West Culburra Residential Development EPBC Act Referral - Supporting Documentation

Prepared for Sealark Pty Limited

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DOCUMENT TRACKING

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Template 2.8.1

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1. Introduction

1.1. Project details

1.1.1. Project title

West Culburra Mixed-use Development project

1.1.2. Project industry type

Residential Development

1.1.3. Project industry sub type

1.1.4. Estimated start and end date for proposed action

Indicatively, late 2024 – 2034.

1.2. Proposed Action Details

1.2.1. Provide an overview of the proposed action, including all proposed activities.

The proposed action is located adjacent to the existing suburb of Culburra Beach and extends westwards into the suburb of Wollumboola. The action area covers 65.85 ha and is comprised of remnant native vegetation and cleared land. The action area is within the catchment of both the Crookhaven River / Curleys Bay and Lake Wollumboola and is located within the Shoalhaven Local Government Area (LGA), approximately 15 km south-east of Nowra (Appendix C, Figure 1, page 91 and Figure 2 page 92).

It is bound by Culburra Road and remnant vegetation to the south and Crookhaven River to the north (Appendix C, Figure 1 page 91). Rural lands form the western boundary, with urban and residential areas adjoining the eastern boundary along Canal Street East. The centre of the action area borders the Culburra Wastewater Treatment Plant on three sides, which is accessed via Strathstone Street. A small portion of the action area also sits south of Culburra Road. The southern boundary of the action area is nearby (separated by Culburra Road) to the Lake Wollumboola BioBank Site which is owned by Sealark Pty Ltd and was registered in 2019 and is proposed to form a future extension to Jervis Bay National Park.

The proposed action is proposing a mixed-use development which indicatively includes the following (Appendix C, Figure 6 page 96):

- Implementation of a Soil and Water Management Plan
- clearing of certain vegetation to facilitate future development including permanent asset protection zones
- relocation of existing services
- construction of new roundabout on Culburra Road, including all lead in/lead out road works
- construction of a footpath and kerb and gutter from the new roundabout on Culburra Rd to the Town Centre
- construction of new internal roads, roundabouts, drainage works, and footpaths

- construction of temporary fire trails and emergency bushfire egress
- construction of utility services (water, sewer electricity, telecommunications)
- construction of permanent water quality measures
- establishment of public reserves including a foreshore reserve, woodland reserve and other open space areas including new playing fields and a club house
- embellishment of public reserves including implementation of vegetation management plans on foreshore reserve and woodland reserve areas;
- subdivision of the action area to create residential allotments, industrial allotments, medium density allotments, integrated housing allotments, commercial allotments and subsequent buildings on those allotments.

To facilitate the mixed-use development, 46.27 ha of native vegetation (in various condition states) and 1.98 ha of cleared land would be affected through vegetation clearing. About 17.26 ha of native vegetation would be retained as part of the proposed action.

1.2.2. Is the project action part of a staged development or related to other actions or proposals in the region? Yes / No

No.

1.2.3. If Yes: Is the proposed action the first stage of a staged development (or a larger project)? Yes / No

Not applicable.

1.2.4. If Yes: Related referral(s)

Not applicable.

1.2.5. Provide information about the staged development (or relevant larger project).

Not applicable.

1.2.6. What Commonwealth or state legislation, planning frameworks or policy documents are relevant to the proposed action, and how are they relevant?

The following pieces of legislation are relevant to the proposed action:

***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)**

The EPBC Act aims to protect Matters of National Environmental Significance (MNES) including wetlands of international importance, threatened species and communities and listed migratory species. An action that may or is likely to have a significant impact on MNES should be referred to the Commonwealth to determine whether it is a Controlled Action that requires approval from the Commonwealth.

MNES have been identified on the site. This report has been prepared consistent with the requirements of the EPBC Act and assesses potential impacts to MNES in the action area.

***Environmental Planning and Assessment Act 1979* (EP&A Act)**

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation that relates to the action area. It provides a framework for the overall environmental

planning and assessment of the proposed action. Various legislative instruments such as the NSW *Biodiversity Conservation Act 2016* (BC Act) (replacing the now repealed *Threatened Species Conservation Act 1995* (TSC Act)), *Water Management Act 2000* (WM Act) and *Rural Fires Act 1997* are integrated with EP&A Act and have been reviewed separately.

Other legislation, policies and guidelines apply to the site, are listed below;

- *Local Government Act 1993* (LG Act)
- *Local Government Amendment (Ecologically Sustainable Development) Act 1997*
- *National Parks and Wildlife Act 1974* (NPW Act)
- *Rural Fires Act 1997* (RF Act)
- *Water Management Act 2000* (WM Act).

The proposed action has a long assessment history at state level under Part 3A of the EP&A Act, which was then transitioned to the status of State Significant Development. An application for a concept approval for West Culburra was submitted as a State Significant Development (SSD3846) application.

This application was exhibited and a determination to refuse the development application was made on 17/10/2018. An appeal was filed in the NSW Land and Environment Court (NSW LEC) against the refusal. The court issued a consent on 1 December 2021 for the West Culburra Concept Proposal, which applies to Part Lot 2 DP 1279350, Lot 3 DP1279350 and Lot 1 DP 1279350. following a significant reduction in the area proposed for development and the establishment of a 100 m buffer off the wetlands along Curleys Bay and the Crookhaven River. The aforementioned lots are the subject of this referral and comprise the action area (LEC No. 2019/78149).

The history of the proposed action at state level is provided below.

The Culburra Beach Action Area is part of a large area zoned for urban development in the early 1990s – see Figure 1 below showing the urban zoned lands. The proposed action is the only section of the urban zoned land that is approved for urban development. Parts of the residential zoned land now form part of the Lake Wollumboola Biobank site.

The site was also included in a broader strategic rezoning proposal, known as The Halloran Trust Planning Proposal, which incorporated all lands owned by Sealark in Culburra Beach, Wollumboola, Callala Bay and Kinghorn (Allen Price and Associates 2014). The original Jervis Bay proposal was contiguous with Jervis Bay National Park linking the three distinct geographic areas subject to various proposed biodiversity certification and conservation measures (Figure 4). While Jervis Bay National Park was included within the original boundary, it was classified as 'Retained Land' i.e. land that is not proposed for development or subject to conservation measures (as part of the biocertification assessment).

Due to ongoing investigations required for the Culburra Beach area, the Halloran Land Trust Planning Proposal was split into two Planning Proposals in June 2018. The split consists of one part covering the Culburra Beach area and the other part covering the Callala Bay and Kinghorn Point area. The reasoning behind the decision to split the Halloran Planning Proposal was twofold. Firstly, Callala Bay and Kinghorn Point weren't subject to a 2-year groundwater investigation, therefore splitting them out would facilitate their progression. Secondly, to improve the community engagement process by

allowing Callala Bay and Culburra Beach to be consulted on separately, thus enabling a more efficient and targeted approach.

1.2.7. Describe any public consultation that has been, is being or will be undertaken regarding the project area, including with Indigenous stakeholders. Attach any completed consultation documentations, if relevant.

State Significant Development Application (SSD 3846)

Public consultation for the proposed action has occurred over numerous occasions between 2012 and 2021 and was completed as part of the exhibition process for the State Significant Development Application (SSD 3846). The State Significant Development Application was submitted to the Department of Planning and Environment for approval. As part of the SSD application, an Environmental Assessment Report (EAR) was prepared. The SSD application was exhibited, which included the Environmental Assessment Report. A summary of the consultation that has been conducted is provided below:

Exhibition of the EAR

The Department of Planning and Environment exhibited the EAR from 26 April – 7 June 2013 through the following means:

- Made it publicly available from 26 April – 7 June 2013:
    - on the Department's website
    - at the Department's information centre in Sydney
    - at the Department's Southern Region Office in Wollongong
    - at Shoalhaven City Centre
- letter notifications for landowners in the vicinity of the site about the exhibition period
- notified relevant state government agencies and Shoalhaven City Council by letter
- advertised the exhibition in the Nowra Shoalhaven News and South Coast Register.

A total of 37 submissions were received and responded to. The DA was then re-exhibited by the Independent Planning Commission (available at https://www.ipcn.nsw.gov.au/projects/2018/06/west-culburra-concept-proposal#). Details regarding the submissions and the responses can be found in Appendix M. Public exhibition was also completed as part of the Land and Environment Court appeal in 2020.

Consultation with indigenous stakeholders

An Aboriginal Cultural Heritage Assessment (ACHA) was completed as part of the rezoning process. Consultation with the indigenous community was completed as part of the ACHA. Consultation was undertaken on numerous occasions with the Registered Aboriginal Parties (RAPs) and through a formal notification in the Shoalhaven and Nowra News on 16 December 2010. The notification was published consistent with Sections 4.1.2 and 4.1.3 of the DECCW Consultation Policy (Dr Johan Kamminga 2020).

Following the refusal of the planning proposal, an addendum letter was prepared that specifically addressed concerns raised about impacts to Aboriginal heritage sites of regional conservation significance and Aboriginal people in relation to the reduced development footprint. A review of the ACHA prepared by South East Archaeology determined that the original assessment met legislative requirements and included appropriate preservation measures for Aboriginal sites adjacent to the development footprint and mitigation measures to minimise indirect impacts.

1.3. Referring Party's Identity

1.3.1. Confirm that you have read and understand this Privacy Policy. This must be checked to proceed

☒ Yes

Privacy Statement:

Personal information means information or an opinion about an identified individual, or an individual who is reasonably identifiable.

By completing and submitting this form, you consent to the collection of all personal information contained in this form. If you are providing the personal information of other individuals in this form, please ensure you have their consent before doing so

The Department of Agriculture, Water and the Environment (the department) collects your personal information (as defined by the Privacy Act 1988) through this platform for the purposes of enabling the department to consider your submission and contact you in relation to your submission. If you fail to provide some or all of the personal information requested on this platform (name and email address), the department will be unable to contact you to seek further information (if required) and subsequently may impact the consideration given to your submission.

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Table 1: Identity of the person referring the action

Question	Answer
Is Referring party an organisation or business? Yes / No	Yes
If Yes: Do they have an existing ABN or CAN? Yes / No	Yes. 87 096 512 088
Organisation name	Eco Logical Australia Pty Ltd
Organisation's Primary Address	PO Box Q108. Sydney NSW 1230

1.4. Identity of Person Proposing to take the Action

The identity of the person proposing to take the action is described in Table 2.

Table 2: Identity of Person Proposing to take the Action

Question	Answer
Are the Person Proposing to take the action details the same as the Referring party details? Yes / No	No
Is Person Proposing to take the action (PPA) an organisation or business? Yes / No	Yes
If Yes: Do they have an existing ABN or CAN? Yes / No	Yes. 81 075 795 587
Organisation name	Sealark Pty Limited
Organisation's Primary Address	1006/97-99 Bathurst Street Sydney, NSW 2000
First name	Matt
Second name	Philpott
Job title	Managing Director – Land and Development
Phone number	0438 888 857
Email	matt@sealark.com.au
Address	GPO Box 2678 Sydney NSW 2000
Are you proposing the action as part of a Joint Venture? Yes / No	No
Are you proposing the action as part of a Trust? Yes / No	Yes
If Yes: Describe the nature of the trust arrangement in relation to the proposed action. Please attach the Trust Deed	Trust deed attached at Appendix N. Please note, Sealark Pty Limited is not a Trust but is owned by Wollumboola Ltd (Trustee for the Halloran Trust) which is a private charitable rust and is registered with SCNC.
Describe the Person proposing the action's history of responsible environmental management including 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 the action	Wollumboola Ltd (Trustee for the Halloran Trust) have committed to the establishment of approximately 2,147 ha in in-perpetuity conservation agreements across south-eastern NSW as part of the former NSW BioBanking Agreement Scheme. Sealark also engages in small scale residential development across south east NSW. During the planning phase of any development, Sealark consider all potential constraints, with a focus on biodiversity values and will make efforts to avoid areas containing high biodiversity value. Ensuring that impacts to biodiversity values are first avoided, then minimised and mitigated, although not forming part of a formal policy, informs decision making at Sealark. There have been no proceedings under Commonwealth, State or Territory law.

1.5. Proposed Designated Proponent details

The proposed designated proponent details are described in Table 3.

Table 3: Identity of the Proposed Designated Proponent

Question	Answer
1.5.1. Are the Proposed designated proponent details the same as the Person proposing to take the Action? Yes / No	Yes.
Is Person Proposing to take the action (PPA) an organisation or business? Yes / No	Yes
If Yes: Do they have an existing ABN or CAN? Yes / No	Yes. 81 075 795 587
Organisation name	Sealark Pty Limited
Organisation's Primary Address	1006/97-99 Bathurst Street Sydney, NSW 2000
First name	Matt
Second name	Philpott
Job title	Managing Director – Land and Development
Phone number	0438 888 857
Email	matt@sealark.com.au
Address	GPO Box 2678 Sydney NSW 2000
Are you proposing the action as part of a Joint Venture? Yes / No	No
Are you proposing the action as part of a Trust? Yes / No	Yes
If Yes: Describe the nature of the trust arrangement in relation to the proposed action. Please attach the Trust Deed	Trust deed attached at Appendix N. Please note, Sealark Pty Limited is not a Trust but is owned by Wollumboola Ltd (Trustee for the Halloran Trust) which is a private charitable rust and is registered with SCNC.
Describe the Person proposing the action's history of responsible environmental management including 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 the action	Wollumboola Ltd (Trustee for the Halloran Trust) have committed to the establishment of approximately 2,147 ha in in-perpetuity conservation agreements across south-eastern NSW as part of the former NSW BioBanking Agreement Scheme. Sealark also engages in small scale residential development across south east NSW. During the planning phase of any development, Sealark consider all potential constraints, with a focus on biodiversity values and will make efforts to avoid areas containing high biodiversity value. Ensuring that impacts to biodiversity values are first avoided, then minimised and mitigated, although not forming part of a formal policy, informs decision making at Sealark. There have been no proceedings under Commonwealth, State or Territory law.

1.6. Summary of Allocation

1.6.1.1. Check this box to confirm these are the correct identity details. ☐

1.7. Payment details

1.7.1. Do you qualify for an exemption from fees under EPBC Regulation 5.23 (1)(a)? Yes / No
No.

1.7.2. If Yes: Select reason for exemption. Small Business / An individual

1.7.3. Has the department issued you with a credit note? Yes / No
No.

1.7.4. If Yes: Provide your credit note number

1.7.5. Have you applied for or been granted a waiver for full or partial fees under Regulation 5.21 or 5.21A? Yes / No
No.

1.7.5.1. If Yes: Provide your waiver document number

1.7.6. Are you going to apply for a waiver of full or partial fees under EPBC Regulation 5.21A? Yes / No
No.

1.7.7. Would you like to add a purchase order number to your invoice? Yes / No
No.

1.7.7.1. If Yes: Enter purchase order number

1.7.8. Who would you like to allocate as the entity responsible for payment? Person proposing to take the action / Proposed designated proponent / Referring party – Third party
Person proposing to take the action.

Location

2.1. Provide your mapping information by uploading files or drawing on the map below

To be completed in the portal.

2.2. What is the address of the proposed action? Note: Address details can be entered in various formats such as: Street address Lot & deposited plan

The proposed action occurs on Lot 1 DP 1279350, Lot 2 DP 1279350 AND Lot 3 DP1279350.

2.3. Where is the primary jurisdiction of the proposed action?

New South Wales.

2.4. Is there a secondary jurisdiction for this proposed action? Yes / No

No.

2.4.1. If Yes: Where is the secondary jurisdiction of the proposed action?

Not applicable.

2.5. What is the tenure of the project area relevant to the project area?

Freehold.

Existing Environment

3.1. Describe the current condition of the project area's environment

The action area is within the Shoalhaven Local Government Area (LGA), approximately 15 km south-east of Nowra and immediately west of the existing urban area of Culburra Beach. The majority of land is currently zoned as a Deferred Matter under the Shoalhaven Local Environmental Plan 2014 (SLEP 2014). Small portions of the action area in the east are zoned B2 Local Centre and IN1 General Industrial. The northern perimeter runs adjacent to the foreshore and is mostly zoned E2 Environmental Conservation. For any areas deferred from the SLEP2014, the zones of the SLEP1985 apply which include mostly 2(c) Residential Living Area and 4(a) Industrial (General) with some small sections of 5(a) Special Use Zone and 5(c) Special Use (Reservation) Zone as per Figure 1 from Note 1.

It is expected in time that Shoalhaven City Council will update the underlying zones to zones that comply the NSW Standard Instrument, in line with the approved concept approval. It is expected the majority of the land would be rezoned to residential, public recreation and infrastructure land use zones (Appendix C, Figure 5 page 95). No changes to the C2 zoned land are proposed. The Biodiversity Certification Assessment Report and subsequent court case included the proposal to rezone the land to facilitate the proposed action.

The land to the west and south of the action area is currently zoned a deferred matter, however large areas of residential zoning exist in this area under the SLEP 1985. Land to the north and north-east is currently zoned C2 – Environmental Conservation with a small area zoned as SP2 – Infrastructure. There is an opportunity to rezone the foreshore areas C2, subject to Shoalhaven City Council approval. The land to the east of the action area is zoned a mix of B2 – Local Centre, R2 – low density residential and B5 – Business Development.

To facilitate access to the action area, existing roads would be used until the roads proposed to connect to Culburra Road are constructed. The action area can currently be accessed via Culburra Road or Strathstone Street. The action area is currently comprised of largely regrowth remnant native vegetation and a small portion of cleared land and is not currently used for any specific purpose. The land was historically partially cleared for agricultural purposes and private native forestry, and the vegetation present is likely to be regrowth between 50 – 60 years old. Despite the previous land clearing, a majority of the native vegetation was in good condition with minimal weed cover. To the best of ELAs knowledge, the action area has not recently been affected by floods, fires (including the 2019/20 summer fires) or other significant natural disasters.

3.2. Describe any existing or proposed uses for the project area

The action area is currently comprised of remnant native vegetation and a small portion of cleared land and is not currently used for any specific purpose. The action area is proposed to be used for residential development and associated infrastructure, including a town centre, open space and conservation.

3.3. Describe any outstanding natural features and/or any other important or unique values that applies to the project area

The action area does not contain any unique or outstanding natural features. The action area fronts on to the Crookhaven River, mangroves and Cans Point. These features are described further in Section 3.9 of this referral (Appendix C, Figure 4 page 94).

3.4. Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area.

The action area is situated adjacent to the Crookhaven River, is low lying and is mostly < 20 m ASL.

3.5. Describe the flora and fauna within the affected area and attach any investigations of surveys if applicable

Targeted survey for threatened flora and fauna species has been conducted over numerous targeted surveys between 1993 and 2022 and are described in Appendix C (Figure 10 page 100 and Figure 11 page 101). Field surveys have identified the following Matters of National Environmental Significance within the action area:

- *Calyptorhynchus lathami* (Glossy Black Cockatoo).

In addition, five threatened fauna species have been identified within lands adjacent to the proposed action area (both to the west in the larger original Biocertification assessment area) and to the south of Culburra Road. During numerous years of targeted survey, these species have not been identified in the action area:

- *Callocephalon fimbriatum* (Gang-gang Cockatoo)
- *Petaurus australis* (Yellow-bellied Glider)
- *Litoria aurea* (Green and Golden Bell Frog)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Petauroides volans* (Greater Glider).

No threatened flora species have been identified in the action area during targeted survey, and none have been previously recorded (BioNet 2022) (Appendix C, Figure 8 page 98 and Figure 9 page 99). In addition to the MNES present, the action area contains native vegetation which is described further in Section 3.6.

3.6. Describe the vegetation (including the status of native vegetation and soil) within the project area.

The action area is comprised of native vegetation that is estimated to be regrowth 50 – 60 years old. This has been determined through the interpretation of historic imagery, previous land uses, relative age of the canopy and very low occurrence of hollow bearing trees across the action area.

Vegetation within the action area includes five Biometric vegetation types (BVT) / Plant Community Types, one of which forms part of threatened ecological communities listed under the EPBC Act (Table 4, Page 19). BVT SR649 swamp sclerophyll forest forms part of Coastal Swamp Oak Forest of New South and South East Queensland, which is listed as endangered under the EPBC Act (Appendix

C, Figure 12 page 102 and Figure 14 page 104). A small area of this community was present within the proposed development footprint, along the proposed boardwalk. A majority of the community is proposed for retention and zoning as C2 – Environmental Conservation.

According to the NSW Mitchell Landscapes, the action area is mapped on the Wandandian Coastal Plains soil landscape with the portions of the action area located along the edge of the Crookhaven River mapped as Seven Mile Barrier landscape. The Wandandian Coastal Plains landscape is characteristic by undulating slopes and wide flat valleys, with yellow and yellow-red deep textured contract soils and harsh clay subsoil. The general elevation is between 20 – 80 m. The Seven Mile Barrier is a quarternary coastal barrier system that is comprised of quartz sand suns at an elevation of 0 – 25 m (DECCW 2002).

Table 4: Biometric vegetation type and associated TECs in the action area

Biometric Vegetation Type (BVT)	Area (ha) in Action Area	Area (ha) in development footprint	EPBC Act listing
SR592 | Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills (Logged/advanced regrowth with scattered old-growth trees) (PCT 1079)	38.95	34.22	N/A
SR592 | Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion (Black She-oak Woodland) (PCT 1079)	7.17	6.54	N/A
SR648 | Swamp Mahogany swamp sclerophyll forest on coastal lowlands (Swamp Forest occurring along broad drainage lines usually dominated by Woollybutt, but also Swamp Mahogany, with a sedge and swamp shrub understorey) (PCT 1231)	1.65	1.09	N/A
SR650 | Swamp Oak swamp forest fringing estuaries (Estuarine fringe forest typically in excellent condition however sometime with some Lantana)	2.21	0.28	N/A
SR649 | Swamp Oak floodplain swamp forest (Older growth Swamp Oak forest sometimes with patches of Lantana) (PCT 1232)	4.27	0.28	Coastal Swamp Oak (Casuarina glauca) Forest of NSW and SE QLD
SR512 | Bangalay - Old-man Banksia open forest on coastal sands (Coastal Sand Forest sometimes with patches of Lantana) (PCT 659)	8.11	3.88	N/A
Cleared (Existing 4WD tracks)	1.99	1.05	N/A
	65.85	**48.27**	

3.7. Describe any Commonwealth heritage places overseas, or other places recognised as having heritage values that apply to the project area.

There are no Commonwealth Heritage places that apply to the project area.

3.8. Describe any Indigenous heritage values that apply to the project area.

An ACHA was prepared by South East Archaeology which assessed the action area and surrounds for any potential Aboriginal heritage sites. No Aboriginal Heritage sites had been previously listed within the investigation area on any heritage registers or planning instruments (Appendix K). There are 18 previously recorded sites (17 middens and one artefact scatter) in the land surrounding the action area. Field survey did not identify any Aboriginal heritage items within the action area during survey. Three sites were identified adjacent to the action area during survey. The three sites were identified as open artefact occurrences (West Culburra 3/A, 4/A and 4/B).

The assessment determined that the reduction in the development footprint, increase to the foreshore setback and survey of the middens to determine precise location further decreased any potential impacts to Aboriginal items adjacent to the action area.

Additional consultation and surveys are currently being completed in relation to the development footprint proposed as part of this referral.

3.9. Describe the hydrology characteristics that apply to the project area and attach any hydrological investigations or surveys if applicable.

The action area is immediately to the north of the Lake Wollumboola Catchment and borders the Crookhaven River to the north. A small portion of the action area is within the Lake Wollumboola Cathcment. The action area does not contain any streams. The action area is within the Shoalhaven / Crookhaven River Catchment which is the sixth largest coastal catchment in NSW, where the floodplain drains into an estuary of water approximately 21 km^2.

The Broughton Creek and Comerang Island floodplains north of the Shoalhaven River and the narrow river floodplain upstream of Nowra to Burrier form the main estuary drainage catchment for the Shoalhaven River estuary. Most of the floodplain and wetlands to the south of the Shoalhaven River drain south-east to the Crookhaven River estuary mainly via the upper river and Crookhaven Creek (MPR 2020).

The waterway of the Shoalhaven Estuary is unusual given that it contains a permanent opening at Crookhaven Heads and an intermittent entrance at Shoalhaven Heads. This has resulted from the construction of the connecting Berrys Canal by landowner Alexander Berry in 1822. Originally, the Shoalhaven estuary had its opening to the Pacific Ocean at Shoalhaven Heads. The construction of Berrys Canal has redirected the discharge into the Crookhaven River and towards Crookhaven Heads, which is more protected from wave action and is permanently open. As a result, Shoalhaven Heads turned into an intermittent opening, which only breaches during large storm events (MPR 2020).

The action area is within 100 m of Curleys Bay and the Crookhaven River which are known to support migratory wader birds. These aquatic features are fringed with estuarine and riverine habitats. These habitats occupy large areas to the north of the action area, and to the east and west along the foreshore. Mangroves and sea-grasses extend upstream along the Crookhaven River for approximately 4 km and approximately 8 km to the north and north east, through Curleys Bay. There are also small patches, and one large patch, of Coastal Saltmarsh to the immediate north of the action area which are present between Mangrove Forest and Swamp Oak Forest.

The extensive mangrove forests and mudflats provide habitat and foraging resources for an array of wetland, wading and migratory species. The Crookhaven and Shoalhaven River estuaries also contain extensive sea-grass beds which can provide important habitat for many fish and other marine fauna. The mangrove forests, mudflats, sea-grass beds and Coastal Saltmarsh adjacent to the action area represent only a very small proportion of those present in the estuary at Culburra Beach.

For more detail on the hydrological characteristics of the action area, refer to Appendix P.

4. Impact and mitigation

Note provided: From the location information you provided in Section 2 we have identified and pre-populated potential Matters of National Environmental Significance (MNES) relevant to your proposed action area.

EPBC Act Section	Controlling provision	Impacted [1]	Reviewed [2]
2	World Heritage	No	Yes
S15B	National Heritage	No	Yes
S16	Ramsar Wetland	No	Yes
S18	**Threatened Species and Endangered Communities**	**Yes**	**Yes**
S20	Migratory Species	No	Yes
S21	Nuclear	No	Yes
S23	Commonwealth Marine Area	No	Yes
S24B	Great Barrier Reef	No	Yes
S24D	Water Resource in relation to large coal mining development or coal seam gas	No	Yes
S26	Commonwealth Land	No	Yes
S27B	Commonwealth heritage places overseas	No	Yes

[1] "Impacted" column is pre-populated with Yes or No once location information has been provided at Section 2.1

[2] "Reviewed" column is automatically ticked once relevant Controlling Provision section has been reviewed (see note 3)

[3] The Review Impact dropdown takes user to the applicable Controlling Provision page to address questions on impacts.

Note: all controlling provisions must be reviewed for impact regardless of pre-populated value

4.1. World Heritage properties impacts

4.1.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. There are no world heritage properties in the action area.

4.1.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

There are no world heritage properties in the action area.

4.1.3. Do you think your proposed action is a controlled action? Yes / No

No.

4.2. National Heritage place impacts

4.2.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. There are no national heritage properties in the action area.

4.2.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

There are no national heritage properties in the action area.

4.3. Ramsar Wetland impacts

4.3.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. There are no RAMSAR wetlands within or adjacent to the action area.

4.3.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No. There are no RAMSAR wetlands within or adjacent to the action area.

The action area is within 100 m of Curleys Bay, the Crookhaven River and the Lake Wollumboola Catchment which, although are not listed as RAMSAR wetlands are known to support migratory wader birds. These aquatic features are fringed with estuarine and riverine habitats. These habitats occupy large areas to the north of the action area, and to the east and west along the foreshore. Mangroves and sea-grasses extend upstream along the Crookhaven River for approximately 4 km and approximately 8 km to the north and north east, through Curleys Bay. There are also small patches, and one large patch, of Coastal Saltmarsh to the immediate north of the action area which are present between Mangrove Forest and Swamp Oak Forest.

The extensive mangrove forests and mudflats provide habitat and foraging resources for an array of wetland, wading and migratory species. The Crookhaven and Shoalhaven River estuaries also contain extensive sea-grass beds which can provide important habitat for many fish and other marine fauna. The mangrove forests, mudflats, sea-grass beds and Coastal Saltmarsh adjacent to the action area represent only a very small proportion of those present in the estuary at Culburra.

4.4. Threatened species and Endangered Communities

4.4.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

Yes. The proposed action would directly impact the following TEC through vegetation removal:

- Coastal Swamp Oak (Casuarina glauca) Forest of the NSW and SE QLD ecological community – endangered

The proposed action would directly impact potential foraging habitat for the following MNES through vegetation removal:

- *Callocephalon fimbriatum* (Gang-gang Cockatoo) - endangered
- *Calyptorhynchus lathami lathami* (South-eastern Glossy Black Cockatoo) - vulnerable

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

The following MNES were not identified in the action area during survey, however a precautionary approach was taken and impacts were assessed:

- *Petauroides volans* (Greater Glider) – endangered
- *Petaurus australis* (Yellow-bellied Glider) - vulnerable
- *Syzygium paniculatum* (Magenta Lilly Pilly) – vulnerable.

The proposed action would result in the direct impacts outlined in Appendix A, Table 5 page 24 and will result from the clearing of native vegetation to facilitate the proposed action.

Table 5: Direct impacts to MNES in the action area

Scientific name	Common name	Presence	Foraging habitat	Breeding habtiat
Coastal Swamp Oak (Casuarina glauca) Forest of the NSW and SE QLD	n/a	Present	Direct impacts to 0.28 ha in the action area, with 3.99 ha proposed for retention	n/a
Callocephalon fimbriatum	Gang-gang Cockatoo	Absent	Present. 38.14 ha of potential foraging habitat in good condition	Absent. No breeding trees identified in the action area during targeted survey. Direct impacts to breeding habitat would not occur.
Calyptorhynchus lathami	Glossy Black Cockatoo	Present (foraging only)	Present. 8.13 ha of preferred foraging habitat in good condition	Absent. No breeding trees identified in the action area during targeted survey. Direct impacts to breeding habitat would not occur.
Petauroides volans	Greater Glider	Not present in the action area. Some BioNet records and field observations from the last 30 years in adjacent lands.	Absent. No historic records for the species, not identified during targeted survey. Action area lacks necessary requirements to represent breeding habitat. About 38.14 ha of marginal foraging habitat would be affected	Absent. No breeding trees identified in the action area during targeted survey. Direct impacts to breeding habitat would not occur.
Petaurus australis	Yellow-bellied Glider	Not present in the action area. Some BioNet records and field	38.14 ha of marginal foraging habitat	Absent. No breeding trees identified in the action area during targeted survey.

Scientific name	Common name	Presence	Foraging habitat	Breeding habtiat
		observations from the last 30 years in adjacent lands.		Direct impacts to breeding habitat would not occur.
Pteropus poliocephalus	Grey-headed Flying-fox	Not present in the action area. BioNet records from the last 30 years in adjacent lands.	46.27 ha of potential foraging habitat in good condition	Absent. No camps in the development footprint. No direct impacts to breeding habitat would occur.
Syzygium paniculatum	Magenta Lilly-Pilly	Not present in the action area. BioNet records from the last 30 years in adjacent lands.	Not present in the action area. Species not identified during targeted survey across the action area.	N/A.

4.4.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No. The proposed action is considered unlikely to be a significant impact to any MNES either known or considered likely to occur in the action area. An assessment for each MNES is provided below.

Coastal Swamp Oak (Casuarina glauca) Forest of the NSW and SE QLD

Impact – do you consider this impact to be significant?

Impact summary

The proposed action would remove 0.28 ha of Coastal Swamp Oak (Casuarina glauca) Forest through vegetation maintenance along an existing track/management trail . About 3.99 ha of this community would be retained within the action area (Appendix A, Figure 16 page 106). The area to be affected by the proposed action forms 7% of the occurrence in the action area. The application of the significant impact criteria determined that the proposed action is unlikely to constitute a significant impact to this MNES (Appendix A, Table 6 page 27).

COMMUNITY DESCRIPTION

The ecological community occurs in coastal catchments, at elevations of < 20 m ASL that are typically found within 30 km of the coast. This distance can vary by catchment; for example, low elevations can occur as far as 40 km inland on the Hawkesbury River, or more than 100 km on the Clarence River (DotEE 2018).

Coastal Swamp Oak Forest typically occurs on unconsolidated sediments, including alluvium deposits, and where soils formed during the Quaternary period as a result of sea-level rise during the Holocene period (Sloss et al., 2007). These are most typically hydrosols, which are saturated with water for long periods of time (typically grey-black clay-loam and/or sandy loam soils). The ecological community can also occur on organosols (peaty soils). The ecological community is typically found where groundwater is saline or brackish, but can occur in areas where groundwater is relatively fresh. It is typically found on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine

fringes where soils are at least occasionally saturated, water-logged or inundated. These are typically associated with low-lying coastal alluvial floodplains and alluvial flats (DotEE 2018).

The canopy layer is dominated by *Casuarina glauca* (Swamp Oak) which forms a relatively uniform upper layer, with height and density dependent on the local environmental conditions. Emergent *Eucalyptus* sp. are also common. In freshwater settings, *Melaleuca* sp. may emerge as a canopy or sub canopy (DotEE 2018).

KEY DIAGNOSTICS AND CONDITION THRESHOLDS

The patch of Coastal Swamp Oak Forest in the action area met the following ley diagnostic characteristics:

- Occurs in the Sydney Basin Bioregion
- Occurs in a coastal catchment <50 m ASL, on a coastal floodplain on a lake margin where the soils are periodically inundated
- Has a forest structure with canopy > 10% cover
- Has a canopy dominated by *Casuarina glauca*.

An assessment against the condition thresholds determined that the community met category B due to:

- Patch size < 5 ha but more than 2 ha
- Groundcover was predominantly native (>60%).

The Coastal Swamp Oak Forest was considered a medium sized patch in high condition (DotEE 2018).

ASSESSMENT AGAINST CRITICAL HABITAT

Consistent with the conservation advice for this community, habitat critical to the survival of the community is defined as patches that are of a reasonable size and best condition (categories A and B). The patch within the action area met category B and therefore is considered habitat critical to the survival of the community.

OCCURRENCE IN THE ACTION AREA

The proposed action area contains 4.27 ha of the ecological community in two patches. The community was positioned close to the Crookhaven River and Curleys Bay. The community was in good condition and contained a canopy dominated by *Casuarina glauca*. The midstorey was sparse and the groundcover was dominated by native species. The community showed signs of degradation from *Lantana camara* (Lantana) infestations, however these were small and isolated (Appendix A, Plate 1 page 27).

Plate 1: Coastal Swamp Oak Forest in the action area

IMPACT ASSESSMENT

The proposed action would remove 0.28 ha of Coastal Swamp Oak (Casuarina glauca) Forest through vegetation maintenance along the existing track Impacts are unlikely to occur to the extent of the 0.28 ha, given that it would be subject to occasional management during the operational phase of the development. A precautionary approach has been taken for the application of the significant impact criteria, and assumed that the entire 0.28 ha would be removed. About 3.99 ha of this community would be retained within the action area. The area to be affected by the proposed action forms 7% of the occurrence in the action area. The application of the significant impact criteria determined that the proposed action is unlikely to constitute a significant impact to this MNES (Appendix A, Table 6 page 27).

Table 6: Application of the significant impact criteria with respect to Coastal Swamp Pak (Casuarina glauca) Forest

Criterion	Assessment
reduce the extent of an ecological community	The proposed action would reduce the extent of the community by a maximum of 0.28 ha. The action would be limited to occasional maintenance of the community which currently occurs along the edge of a cleared track. About 3.99 ha would be retained within the action area. The reduction of the community would be 7% of the current extent of occurrence in the action area
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The proposed action would formalise an already existing track throughout the action area. A maximum of 0.28 ha of the community would be subject to maintenance along the edge of the existing track. Full removal of the 0.28 ha is not expected to occur. Fragmentation would not occur, given that the track is existing. Given that the proposed action would be limited to maintenance, with isolated removal of canopy and shrubs, fragmentation is not expected to occur. The elevated boardwalk would be adjoined by patches of the community

Criterion	Assessment
	proposed for retention which would assist in the maintenance of connectivity throughout the patch and the broader landscape.
adversely affect habitat critical to the survival of an ecological community	The proposed action would remove 0.28 ha of habitat critical to the survival of the community. Actions that could have an adverse impact on the community include vegetation clearing and alteration to hydrology and water flows. With respect to vegetation clearing, the impacts are unlikely to be adverse, given that 3.99 ha of habitat critical to the survival of the community will be retained across the action area. The area to be retained is approximately 93% of the current extent of the community in the action area. With respect to changes of hydrology and water flows, extensive studies and mitigation measures have been implemented to ensure that changes to hydrology are minimised including a 100 m setback from the Crookhaven River and Curleys Bay.
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	This community is reliant on specific hydrological conditions to survive. Extensive studies and mitigation measures have been implemented to ensure that changes to hydrology are minimised including a 100 m setback from the Crookhaven River and Curleys Bay. Alterations to subsurface water flows and groundwater levels are not expected to occur as part of the proposed action.
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 occurrence of the ecological community in the action area is 4.27 ha, of which 0.28 ha is proposed for maintenance and 3.99 ha is proposed for retention. The removal of 0.28 ha of the occurrence of the community would not remove all structural layers, with most remaining intact during the operational phase of the boardwalk. This is unlikely to affect the overall composition of the community, given that impacts would be minor, and 93% of the occurrence would be retained. The area to be retained is of the same composition and structure of the area to be modified. The 3.99 ha to be retained is not proposed to be harvested or regularly burnt, or subject to other activities that could cause a decline in functionally important species.
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, **including, 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**	The occurrence of the ecological community in the action area is 4.27 ha, of which 0.28 ha is proposed for maintenance and 3.99 ha is proposed for retention. The proposed action, although modifying a maximum of 0.28 ha of the community, is unlikely to cause a substantial reduction in the quality or integrity of the occurrence in the action area due to the limited area proposed for removal and mitigation measures that would be implemented to manage any ongoing indirect impacts. The proposed action would not result in the regular mobilisation of fertilisers, herbicides or other chemicals given the proposed use of the footprint as an elevated boardwalk.

Criterion	Assessment
pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	
interfere with the recovery of an ecological community.	The proposed action is unlikely to interfere with the ecological community given that: • The proposed action would modify a maximum of 0.28 ha of the community to formalise an track into an elevated boardwalk • Impacts to the community would be minor and sporadic during the construction and operational phases, and only when required • About 3.99 ha of 93% of the community would be retained within the action area • The proposed action would not fragment or isolate patches of the community • The proposed action is unlikely to cause a substantial reduction in the integrity or composition of the community Therefore, the proposed action is unlikely to constitute a significant impact to this ecological community.

***Callocephalon fimbriatum* (Gang-gang Cockatoo)**

Impact – do you consider this impact to be significant?

Impact summary

The proposed action would remove 38.14 ha of foraging habitat for the Gang-gang Cockatoo through vegetation clearance. The nine (9) hollow bearing trees to be removed are highly unlikely to provide breeding habitat for this species, given the absence of any breeding pairs or individuals identified during targeted survey and lack of hollows at the appropriate density for the Gang-gang Cockatoo. The application of the significant impact criteria determined that the proposed action is unlikely to constitute a significant impact.

SPECIES DESCRIPTION AND ECOLOGY

Gang-gang Cockatoos are endemic to south-eastern Australia. The species is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee (DAWE 2022c). It is adapted to cooler conditions and has always been more common at higher elevations and more southern latitudes.

The population of the Gang-gang Cockatoo has declined in its geographic distribution. Gang-gang Cockatoos primarily occur within the temperate eucalypt forests and woodlands of mainland south-east Australia and is an altitudinal migrant.

During summer months, Gang-gang Cockatoos primarily inhabit mature, wet sclerophyll forests, typically dominated by eucalypts with dense, shrubby acacia, wattle and banksia understory. Where foraging resources are abundant, a higher density of birds may use the area. The species has also been reported in more open eucalypt assemblages, subalpine snow gum woodland, temperate rainforests, and occasionally regenerating forests.

During winter months, Gang-gang Cockatoos tend to range beyond montane forests to inhabit woodland assemblages at lower, drier altitudes and occupy open eucalypt assemblages. Sightings have also been recorded in suburban areas and cities where potential foraging resources are available. The winter and summer habitats can overlap, with some individuals choosing to winter at higher altitudes whilst some remain at lower altitudes during summer.

The Gang-gang Cockatoo feeds in small groups of < 25 individuals, with most foraging occurring in the canopy. Evidence suggests that in areas of good condition habitat, a smaller range of foraging species are utilised, whilst in urban areas a broader range of species are used. The species generally breeds between October and January, however, records exist of breeding events in late August, early September, and March (DAWE 2022c).

The Gang-gang Cockatoo preferences old growth forest and woodland with an abundance of hollow bearing tees for nesting, roosting and loafing. Nesting occurs in hollows on trunks or limbs and occasionally within dead spouts (DAWE 2022c). The literature suggests that the species will nest and roost near water where larger hollow bearing trees are more common. For the purposes of breeding, the Gang-gang Cockatoo requires stands of suitably sized hollow bearing trees, where multiple nests

will be assembled within a few hundred metres of one another and used over different years (DAWE 2022c).

The Gang-gang Cockatoo hollow preferences are specific, with sizing estimated at:

- entrance height of 21.3 cm (minimum entrance height 12 cm)
- hollow chambers generally around 20 cm in floor diameter
- hollow chambers around 50.5 cm deep (range 22– 90 cm)
- hollows around 7.5 m (range 5–9.4 m) above the ground.

TARGETED SURVEY AND HABITAT PRESENCE

Targeted survey for diurnal birds has been conducted over multiple surveys from 1993 to 2022 (Appendix D). The Gang-gang Cockatoo has not been identified in the action area during targeted survey. There is one record for the species from the 1980's in the action area (Appendix C, Figure 18 Page 108. The action area is likely to provide foraging resources for this species, however is not known to support breeding activity. This has been determined through:

- results of numerous targeted surveys (1993 – 2022)
- low abundance of suitable hollow bearing trees across the action area suggesting that;
    - the action area does not have the adequate hollow resources to allow the species to establish multiple nests which is required to facilitate breeding
- majority of records located to the south and west of the action area.

The foraging habitat within the action area is likely utilised as part of a range of foraging resources throughout the locality. Given the low density of hollows and absence of suitable breeding habitat, it is unlikely that the foraging habitat in the action area is relied upon, or a primary source of foraging habitat. It is likely that the surrounding landscape provides more suitable foraging habitat and potential breeding habitat due to the higher presence and abundance of hollow bearing trees and forest.

An assessment of historic records and survey throughout the locality suggests that areas to the west and south of the action area are more frequently used over generations by the Gang-gang Cockatoo. Some survey has been completed across these areas, which identified large, continuous areas of old growth forest with mature *Eucalyptus* sp. which contained suitable breeding hollows at a higher density than the action area.

ASSESSMENT AGAINST CRITICAL HABITAT

According to the conservation advice for the Gang-gang Cockatoo, any foraging habitat that could be used in the breeding and non-breeding season is considered critical habitat (DAWE 2022c). The action area supports foraging habitat for this species and therefore meets the definition of critical habitat.

IMPORTANT POPULATIONS

There are no important populations for this species listed in the conservation advice. Therefore, an assessment was made against the definition of an important population in the significant impact guidelines 1.1. The guidelines define an important population as:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The conservation advice does not list key source populations that are important for breeding or dispersal, or any sub-populations outside of the Sydney Basin. It is likely that any individuals utilising the action area for foraging are part of the larger population of Gang-gang Cockatoos. Given that the action area does not appear to support any breeding activity, it is unlikely to be considered a key source population for breeding. The action area may contribute to a larger network of foraging resources throughout the species range and would be utilised on occasion. Evidence from numerous years of survey would suggest that the action area is not relied upon or used as a frequent foraging resource and therefore may not form a key dispersal area.

The action area does not occur at the edge of the known range for the species and does not fulfill this criterion for consideration of an important population.

The NSW Scientific Committee Review of Current Information would suggest that the individuals which occur in NSW form a population (TSSC 2008). There is limited information on genetic diversity for this species. For the purposes of this assessment, a precautionary approach has been taken and it has been assumed that the action area provides foraging habitat that supports an important population.

IMPACT OF THE 2019 / 2020 BUSHFIRES

Across the species range, the 2019 / 2020 bushfire season is estimated to have affected 28 – 36 % of the species area of occupancy (DAWE 2022c). The conservation advice for this species suggests that the impacts of the bushfires could result in a 10% decrease in overall population size of the Gang-gang Cockatoo. Within a 10 km radius of the action area, the most western edge was affected to some degree by the bushfires (Appendix C, Figure 19 page 109). A vast majority of the habitat within 10 km of the action area remained intact and was unburnt. The impacts of the bushfires may temporarily increase the importance of the foraging habitat in the action area, however surveys conducted after the bushfires did not identify any Gang-gang Cockatoos utilising the action area.

IMPACT ASSESSMENT

The proposed action would remove 38.14 ha of foraging habitat for the Gang-gang Cockatoo through vegetation clearance. The nine (9) hollow bearing trees to be removed are highly unlikely to provide breeding habitat for this species, given the absence of any breeding pairs or individuals identified during targeted survey and lack of hollows at the appropriate density for the Gang-gang Cockatoo. The application of the significant impact criteria determined that the proposed action is unlikely to constitute a significant impact.

Consistent with the definition of ‘population’ in the significant impact guidelines, the Gang-gang Cockatoos that may utilise the action area for foraging would form part of the population that occurs

within the Sydney Basin bioregion. This has been used throughout the application of the significant impact criteria in Appendix A, Table 7 page 33.

Table 7: Application of the significant impact criteria with respect to the Gang-gang Cockatoo

Criterion	Assessment
lead to a long-term decrease in the size of a population	Actions that can lead to a decrease in the size of the population include habitat loss, wildlife, climate change and competition for suitable nesting hollows. The proposed action would remove 38.14 ha of foraging habitat. No breeding habitat would be affected, however the removal of foraging habitat would contribute to habitat loss. The proposed action is unlikely to contribute to competition for nesting hollows, given that the species are not known to utilise the action area for breeding. Over the past 30 years, there has been one record for the Gang-gang Cockatoo within the action area (BioNet 2022). Numerous surveys from 1993 – 2022 have not identified the species within the action area. This would suggest that the action area is a foraging resource that is used on occasion, however would not be relied upon. The distribution of records suggests that habitat to the south and west of the action area provide more suitable habitat, given the numerous records throughout this area. The proposed action would retain 17.26 ha of foraging habitat in the action area, with an additional 9,720 ha to be retained in the broader locality. Therefore, the removal of 38.14 ha of foraging habitat that supports the population is unlikely to lead to a long-term decrease in the size of the population.
reduce the area of occupancy of the species	The current area of occupancy for the Gang-gang Cockatoo is estimated at 30,000 km^2. The development footprint contains 38.14 ha or 0.38 km^2 which equates to 0.001% of the current area of occupancy for this species. The proposed action would reduce the area of occupancy by 0.002%.
fragment an existing population into two or more populations	The action area forms part of the Sydney Basin bioregion population which extends from the Hawkesbury River estuary in the north to Durras on the southern NSW coast. Covering approximately 24,625 km^2, its western boundary is defined by the geological Sydney Basin. The proposed action would remove 38.14 ha of foraging habitat for the Gang-gang Cockatoo. No breeding habitat would be affected. The area of foraging habitat to be removed is not positioned such that its removal would cause two areas of foraging habitat within the region to become isolated. Although some foraging habitat would be removed in the action area, the estimated distance between the retained foraging habitat in the action area and locality would be approximately 450 m. Given the highly mobile nature of this species, the Gang-gang Cockatoo would be able to traverse this distance to access foraging habitat. The proposed action would retain 17.26 ha of potential foraging habitat with an additional 9,720 ha available within a 10 km radius of the action area. The proposed action would not fragment this foraging habitat such that the population would become fragmented.
adversely affect habitat critical to the survival of a species	The proposed action would remove 38.14 ha of habitat critical to the survival of the species. This habitat would be used for foraging purposes only. The proposed action would retain 17.26 ha of habitat critical to the survival of the species, with an additional 9,720 ha of habitat critical to the survival of the species present throughout the locality. Of the area available within the locality, a majority is located within National Parks or BioBank Agreement sites which are subject to in-perpetuity management and retention. These areas also contain historic records for the Gang-gang Cockatoo suggesting that this habitat is used by the species across generations. Therefore, the proposed action is unlikely to adversely affect habitat critical to the survival of the Gang-gang Cockatoo.
disrupt the breeding cycle of a population	The breeding cycle of the Gang-gang Cockatoo is comprised of breeding habitat in the form of suitably sized hollows and at a moderate to high density, in proximity to suitable foraging

Criterion	Assessment
	habitat across its altitudinal migration range. The action area does not contain suitable breeding habitat for this species, with potential foraging habitat present.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Actions that are likely to contribute to the decline of the Gang-gang Cockatoo include habitat loss, fragmentation or alteration and competition for nesting sites. The proposed action would decrease the amount of available foraging habitat by 38.14 ha. The historic records for the area and the results of numerous targeted survey suggests that the action area would be used on an occasional basis and is not relied upon for foraging. There is no evidence of breeding. Historic records suggest that the land to the south and west of the action area provides a more frequently used foraging resource. The proposed action would retain 17.26 ha of foraging habitat, with an additional 9,720 ha available within the locality. Of the habitat available within the locality, a majority is located within National Parks or Biobank sites which are subject to in-perpetuity management and retention. These areas also contain historic records for the species over numerous generations. Therefore, it is unlikely that the removal of 38.14 ha of foraging habitat would result in the species decline.
result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Invasive species such as *Acridotheres tristis* (Common Myna) and *Stumus vulgaris* (Common Myna) can outcompete the Gang-gang Cockatoo for suitable breeding hollows. The abundance of these invasive species is likely to increase in areas of urban and residential development. The proposed action would increase the amount of residential development by 38.14 ha with 17.26 ha of existing native vegetation being retained. Although the proposed action would increase residential development and therefore potential for invasive bird species, the action area does not contain suitable breeding habitat for this species. With respect to increasing competition across the locality, there is an abundance (9,720 ha) of suitable habitat for this species. The reduction in habitat is unlikely to be substantial enough that the invasive species would become established in these areas.
introduce disease that may cause the species to decline, or	Gang-gang Cockatoos are susceptible to Psittacine beak and feather disease (PCD). This disease is naturally occurring within Australia. There are no other diseases that are listed as a threat to the Gang-gang Cockatoo (DAWE 2022c). Given that PCD is a naturally occurring disease, it is not possible for the proposed action to 'introduce' it, however, it could be exacerbated by stressors such as significant habitat loss or heat extremes. The proposed action is unlikely to cause a significant loss in habitat for the reasons outlined above. Heat extremes are outside the scope of this assessment. The proposed action is unlikely to result in the introduction of a disease.
interfere substantially with the recovery of the species.	The proposed action is unlikely to substantially interfere with the recovery of the Gang-gang Cockatoo because: • Numerous survey and historic records across the action area have identified one occurrence of the Gang-gang Cockatoo in the past 30 years • The action area does not contain suitable breeding habitat • The action area contains foraging habitat that would be used on an occasional basis but would not form a primary foraging resource • The removal of 38.14 ha of foraging habitat would not fragment or isolate areas of habitat such that the population would decline • The proposed action would not disrupt the breeding cycle of the population • The proposed action would retain 17.26 ha of foraging habitat in the action area, which would remain connected to other foraging habitat in the locality • The proposed action is unlikely to introduce disease or invasive species to the extent that the population would decline. This assessment has concluded that the proposed action is unlikely to constitute a significant impact to the Gang-gang Cockatoo.

***Calyptorhynchus lathami* (South-eastern Glossy Black Cockatoo)**

Impact – do you consider this impact to be significant?

Impact summary

The proposed action would remove 8.13 ha of preferred foraging habitat for the South-eastern Glossy Black Cockatoo through vegetation clearing, with 0.27 ha to be retained in the action area, with 59.91 ha retained in the locality. No confirmed breeding habitat would be affected. The significant impact criteria was applied with respect to the South-eastern Glossy Black Cockatoo and concluded that the proposed action is unlikely to constitute a significant impact.

SPECIES DESCRIPTION AND ECOLOGY

South-eastern Glossy Black Cockatoos are uncommon but widespread and can be found from Mitchell, Queensland, through eastern NSW to East Gippsland, Victoria (Map 1). Their distribution is continuous through the forested parts of the Great Dividing Range but become scattered inland, as far west as the Riverina (DCCEEW 2022a).

South-eastern Glossy Black Cockatoos feed almost exclusively on the seeds of *Allocasuarina* spp. and *Casuarina* spp., usually relying on one or two species within a region which may contribute to the patchy distribution of the subspecies in parts of its range. This species also display a strong preference for individual feed trees and will not feed on many other proximate trees of the same species. The preferencing of particular trees is linked to feeding reward, with cone size, number and weight of seeds the determining factors (DCCEEW 2022a). In NSW, the South-eastern Glossy Black Cockatoo preferences *Allocasuarina littoralis, Allocasuarina torulosa* with *Allocasuarina inophloia* and *Casuarina equisetifolia* also utilised. To a lesser extent, the species may use *Casuarina cunninghamiana* and *Casuarina glauca* on occasion, however use of these species is limited (DCCEEW 2022a).

South-eastern glossy black cockatoos are hollow nesters, utilising large hollows in both living and dead eucalypt trees with a preference for the following dimensions(DCCEEW 2022a):

- >8 m above ground;
- Located in branches >30 cm in diameter;
- Branch or stem no more than 45o from vertical; and
- Minimum entrance diameter of >15 cm.

Nesting only occurs in very old trees with large hollows that are in close proximity or amongst foraging habitat. The species usually occurs in pairs or in groups of three (made up of a breeding pair and their offspring), in woodlands. The movement patterns and ranging behaviour of the South-eastern Glossy Black Cockatoo are poorly understood, with suggestions that the species will migrate in response to resource availability and / or breeding requirements (DCCEEW 2022a).

TARGETED SURVEY AND HABITAT PRESENCE

Targeted survey for diurnal birds has been conducted over multiple surveys from 1993 to 2022 (Appendix D). The South-eastern Glossy Black Cockatoo has been previously recorded foraging through the action area across numerous dates (Appendix C, Figure 20 page 110):

- Gunninah – targeted survey 2001
- SLR targeted survey 2013
- ELA targeted survey 2021
- ELA targeted survey 2022
- BioNet records (2000's).

Each survey period that has identified the species in the action area has identified foraging only. Targeted survey conducted during the breeding season has not identified the species breeding in the action area. With respect to breeding habitat.

The action area lacks suitable breeding habitat for this species as the specific nesting requirements of the South-eastern Glossy Black Cockatoo are not met. Although the action area contains hollows that are >15 cm diameter, the action area is comprised of regrowth forest, dominated by Eucalypts < 40 years old which lack maturity and does not form an old growth forest. Within the action area, there are distinct patches of *Allocasuarina torulosa* with scattered occurrences of *Allocasuarina littoralis*. These areas are considered primary foraging habitat within the action area due to the high density of *Allocasuarina* sp. The remaining areas of native vegetation across the action area contained low to no occurrences of *Allocasuarina* sp. Although preferred foraging species are present, the low density across the remainder of the action area would suggest that areas lacking dense stands of *Allocasuarina* sp. are not the feed trees that are preferred by this species.

An assessment of historic records and survey throughout the locality suggests that areas to the west and south of the action area are also frequently used over generations by the South-eastern Glossy Black Cockatoo. Some survey has been completed across these areas, which identified large, continuous areas of old growth forest with mature *Eucalyptus* sp. which contained suitable breeding hollows at a higher density than the action area.

ASSESSMENT AGAINST CRITICAL HABITAT

Habitat critical to the survival or important habitats of a species or ecological community refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long-term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community (DCCEEW 2022a).

The action area contains habitat that would be used for foraging and dispersal and therefore, would meet the definition of critical habitat. The action area contains 8.40 ha of preferred foraging habitat and an additional 55.14 ha of marginal habitat that would only be used on occasion due to the sparse distribution of *Allocasuarina* sp. and the tendency for the South-eastern Glossy Black Cockatoo to rely on the same feed trees.

There is 0.27 ha of preferred foraging habitat to be retained within the action area and an additional 59.91 ha that would be retained within the locality. The records for this species suggest that there

could be additional preferred habitat within the Lake Wollumboola Biobank site, however this has not been ground truthed (Appendix A, Figure 20 page 110 and Figure 21 page 111).

IMPORTANT POPULATIONS

No important populations have been identified in the Conservation Advice. Consistent with the significant impact guidelines, the definition of an important population is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range (DCCEEW 2022a).

The action area is not near the limit of the species range. The habitat in the action area may provide key foraging habitat for this species which could contribute to dispersal of the species.

IMPACT OF THE 2019 / 2020 BUSHFIRES

Across the species range, the 2019 / 2020 bushfire season is estimated to have affected 34 % of the species area of occupancy. The conservation advice suggests that this could lead to a 22% decrease in the population over time. Within a 10 km radius of the action area, the most western edge was affected to some degree by the bushfires (Appendix C, Figure 22 page 112). A vast majority of the habitat within 10 km of the action area remained intact and was unburnt. The foraging habitat in the action area may temporarily increase in importance for this species.

IMPACT ASSESSMENT

The proposed action would remove 8.13 ha of preferred foraging habitat for the South-eastern Glossy Black Cockatoo through vegetation clearing, with 0.27 ha to be retained in the action area, with 59.91 ha retained in the locality. No breeding habitat would be affected. The significant impact criteria was applied with respect to the South-eastern Glossy Black Cockatoo and concluded that the proposed action is unlikely to constitute a significant impact.

For the purposes of this assessment, the individuals that utilise the action area are considered to form part of an important population. The locality refers to an area of 10 km around the action area.

Table 8: Application of the significant impact criteria with respect to the South-eastern Glossy Black Cockatoo

Criterion	Assessment
lead to a long-term decrease in the size of an important population of a species	Actions that could lead to a long-term decrease in the size of an important population include habitat loss, degradation and fragmentation and competition for nest hollows. The proposed action would contribute to the loss of foraging habitat by 8.13 ha of preferred foraging habitat and 38.14 ha of marginal foraging habitat with low to no presence of *Allocasuarina* sp. The proposed action would not remove any hollows currently used for breeding. The habitat to be removed would not result in the reduction of available foraging habitat to the extent that the species would decline, given the retention of 59.91 ha of preferred habitat available immediately to the west and south of the action area. The clearing proposed to facilitate the action may increase the prevalence of invasive species such as the Common Myna and Starling which can outcompete the South-eastern Glossy Black Cockatoo for hollows. Increased prevalence would be expected in areas that are urbanised and where potential hollows are limited. Although the proposed action

Criterion	Assessment
	would contribute to urbanisation, 59.91 ha of preferred habitat containing hollows would be retained immediately south and west of the action area, which form part of the Lake Wollumboola Biobank site and would be conserved in-perpetuity. Therefore, the loss of 8.13 ha of preferred habitat is unlikely to lead to a long-term decrease in the population of the species.
reduce the area of occupancy of an important population	The current Area of Occupancy is estimated at 40,000 km^2 for the South-eastern Glossy Black Cockatoo. The proposed action contains 8.13 ha of preferred habitat and an additional 38.14 ha of marginal foraging habitat. The total amount of foraging habitat to be removed in the action area is 46.27 ha which forms 0.001 % of the estimated area of occupancy for this species.
fragment an existing important population into two or more populations	The action area is assumed to support individuals that form part of an important population. The important population is assumed to extend throughout the Sydney Basin Bioregion. The proposed action would remove 8.13 ha of preferred foraging habitat, and 38.14 ha of marginal foraging habitat with low to no *Allocasuarina* sp. present. No known breeding habitat would be affected. The removal of the preferred foraging habitat is not of a scale that would cause fragmentation between foraging areas, or foraging areas from breeding habitat. The proposed action would increase the distance between foraging resources, however by an estimated 600 m which is a distance that these highly mobile species could traverse. The proposed action would retain 0.27 ha of preferred foraging habitat and 59.91 ha of preferred habitat to the south and west of the action area. Therefore, the proposed action would not fragment an existing important population into two or more.
adversely affect habitat critical to the survival of a species	The proposed action contains 63.53 ha of foraging habitat that meets the definition of critical habitat, and is comprised of 8.40 ha of preferred habitat and 55.14 ha of marginal foraging habitat. There is no known breeding habitat present in the action area. Adverse impacts to critical habitat are likely to include significant loss of critical foraging or breeding habitat. Although the proposed action would remove 8.13 ha of preferred foraging habitat, there is 59.91 ha of habitat critical to the survival of the species present within the locality, and an additional 10,074 ha of marginal foraging habitat. Of the habitat available within the locality, a majority is located within National Parks or BioBank Agreement sites which are subject to in-perpetuity management and conservation. These areas also contain historic records for the South-eastern Glossy Black Cockatoo suggesting that this habitat is used by the species across generations. Therefore, the proposed action is unlikely to adversely affect habitat critical to the survival of the South-eastern Glossy Black Cockatoo.
disrupt the breeding cycle of an important population	The breeding cycle of the South-eastern Glossy Black Cockatoo is comprised of breeding habitat in the form of suitably sized hollows and at a moderate to high density, in proximity to preferred foraging habitat. The action area does not contain suitable breeding habitat for this species, with 8.13 ha of preferred foraging habitat present. The removal of 8.13 ha of preferred foraging habitat is unlikely to disrupt the breeding cycle of this species, given the retention of 0.27 ha of preferred habitat in the action area and an additional 59.91 ha within the locality.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Actions that are likely to contribute to the decline of the South-eastern Glossy Black Cockatoo include habitat loss, fragmentation or alteration and competition for nesting sites. The proposed action would decrease the amount of preferred foraging habitat by 8.13 ha. There is no evidence of breeding. Historic records suggest that the land to the south and west of the action area also provide a frequently used foraging resource. The proposed action would retain 0.27 ha of preferred foraging habitat, with an additional 59.91 ha of preferred foraging habitat and 10,074 ha of potential foraging habitat within the locality. Of the habitat available within the locality, a majority is located within National Parks or Biobank sites which are subject to in-perpetuity management and conservation. These areas also contain historic records for the South-eastern Glossy Black Cockatoo over

Criterion	Assessment
	numerous generations. Therefore, it is unlikely that the removal of 8.13 ha of preferred foraging habitat would result in the species decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species such as *Acridotheres tristis* (Common Myna) and *Stumus vulgaris* (Common Myna) can outcompete the South-eastern Glossy Black Cockatoo for suitable breeding hollows. The abundance of these invasive species is likely to increase in areas of urban and residential development. The proposed action would increase the amount of residential development by 46.27 ha with 17.26 ha of existing native vegetation being retained, of which 0.27 ha is preferred habitat. Although the proposed action would increase residential development and therefore potential for invasive bird species, the action area does not contain suitable breeding habitat for the South-eastern Glossy Black Cockatoo. With respect to increasing competition across the locality, there is an abundance (59.91 ha) of preferred habitat and an additional 10,074 ha of potential foraging habitat in the locality for this species. The reduction in habitat is unlikely to be substantial enough that the invasive species would become established in potential habitat for the South-eastern Glossy Black Cockatoo
introduce disease that may cause the species to decline, or	South-eastern Glossy Black Cockatoos are susceptible to Psittacine beak and feather disease (PCD). This disease is naturally occurring within Australia. There are no other diseases that are listed as a threat to the South-eastern Glossy Black Cockatoo (DCCEEW 2022a). Given that PCD is a naturally occurring disease, it is not possible for the proposed action to 'introduce' it, however, it could be exacerbated by stressors such as significant habitat loss or heat extremes. The proposed action is unlikely to cause a significant loss in habitat for the reasons outlined above. Heat extremes are outside the scope of this assessment. The proposed action is unlikely to result in the introduction of a disease.
interfere substantially with the recovery of the species.	The proposed action is unlikely to substantially interfere with the recovery of the south-eastern Glossy Black Cockatoo because: • Numerous survey and historic records across the action area have not identified any breeding pairs or potential breeding hollows in the action area • The action area does not contain suitable breeding habitat • The action area contains 8.13 ha of preferred foraging habitat for this species • The removal of 8.13 ha of preferred foraging habitat and 38.14 ha of marginal foraging habitat would not fragment or isolate areas of habitat such that the population would decline • The proposed action would not disrupt the breeding cycle of the population • The proposed action would retain 0.27 ha of preferred foraging habitat in the action area, and an additional 59.91 ha in the locality which would remain connected to other foraging habitat • The proposed action is unlikely to introduce disease or invasive species to the extent that the population would decline. This assessment has concluded that the proposed action is unlikely to constitute a significant impact to the South-eastern Glossy Black Cockatoo.

***Petaurus australis* (Yellow-bellied Glider)**

Impact – do you consider this impact to be significant?

Impact summary

The proposed action would remove 38.14 ha of marginal foraging habitat for the Yellow-bellied Glider through vegetation clearance. The nine (9) hollow bearing trees to be removed are highly unlikely to provide breeding habitat for this species, given their position in regrowth forest and lacking the preferred maturity for this species. The application of the significant impact criteria with respect to the Yellow-bellied Glider determined that the proposed action is unlikely to constitute a significant impact.

SPECIES DESCRIPTION AND ECOLOGY

The yellow-bellied glider (south-eastern) is found at altitudes ranging from sea level to 1,400 m ASL. Its distribution is widespread but patchy, ranging from South-east QLD to south east SA, predominantly occurring in forests along the eastern coast, from the NSW-Qld border to the NSW-Vic border. In some areas the distribution also extends inland to the western slopes of the Great Dividing Range.

Across the entire range, the subspecies' distribution is highly disjunct due to a combination of biogeographic processes and land clearing which is further exacerbated by the specific habitat requirements. Small social groups occupy large and exclusive home ranges and occur at low densities (0.03-0.14 individuals/ha: Henry & Craig 1984 cited in Woinarski et al. 2014; Goldingay & Kavanagh 1993; Goldingay & Jackson 2004; Woinarski et al. 2014).

The yellow-bellied glider (south-eastern) occurs in eucalypt-dominated woodlands and forests, including both wet and dry sclerophyll forests with abundance highly dependent on habitat suitability, floristic diversity, which is in turn determined by forest age and floristics (Woinarski et al. 2014).

The species shows a preference for large patches of mature old growth forest that provide suitable trees for foraging and shelter with a high proportion of winter-flowering and smooth-barked eucalypts. Smooth-barked eucalypts are important due to the range of foraging substrates (and therefore food resources) they provide, as loose bark hanging in strips from these trees provides shelter for insect prey. Floristic diversity is important to ensure that a year-round food source is available.

The Yellow-bellied Glider is social and lives in family groups of two to six individuals (though usually three to four) of varying age and sex composition, throughout an exclusive home range of approximately 50–65 ha (plausible range 25–85 ha). Home ranges are necessarily large, because the trees used as foraging substrates are dispersed and use of trees can vary. During the day, the species shelters in hollows found in large, old trees, usually >100 DBH. Hollow-bearing trees are a critical habitat feature for the yellow-bellied glider.

TARGETED SURVEY AND HABITAT PRESENCE

Targeted survey for the Yellow-bellied Glider were completed across the action area on numerous occasions from 1993 – 2022. The Yellow-bellied Glider has not been identified in the action area during survey or historically through BioNet records. The species has been identified on land adjacent (to the west) to the action area and south of the action area (south of Culburra Road; Appendix C, Figure 23 page 113).

The action area is considered to form marginal foraging habitat because:

- The action area is comprised of regrowth forest, dominated by Eucalypts < 40 years old and lacking maturity and old growth forest
- The action area contains a very sparse distribution of hollow bearing trees
- Where hollow bearing trees are present, they are < 100 cm DBH.

It is likely that the surrounding landscape in the Biobank site to south and the Jervis Bay National Park provide more suitable foraging habitat and potential breeding habitat due to the higher presence and abundance of hollow bearing trees and forest containing old growth canopy.

ASSESSMENT AGAINST CRITICAL HABITAT

According to the conservation advice, habitat critical to the survival of the Yellow-bellied Glider includes areas containing (DAWE 2022a):

- Large, contiguous areas of floristically diverse forest dominated by winter flowering and smooth-barked Eucalypts with mature living hollow-bearing trees
- Areas identified as refuges under future climate change scenarios
- Short or long-term post fire refuges
- Habitat corridors that facilitate the dispersal of the species between fragmented habitats
- Areas in which some trees have evidence of use for sap extraction.

The action area contains nine (9) canopy species from the Myrtaceae family, of which four are listed as known glider feed trees (CoA 2022), some of which (*Eucalyptus pilularis, Eucalyptus punctata, Eucalyptus longifolia*) are smooth-barked species. The action area does not include mature living hollow bearing trees consistent with the description in the conservation advice (trees with a DBH > 100 cm). This condition is partially met.

The conservation advice does not identify areas of potential habitat for the Yellow-bellied Glider that would be suitable under a future climate change scenario. Without conducting substantial additional studies, determining suitability as a refuge is outside the scope of this assessment.

The 2019 – 2020 bushfires are estimated to have affected 41 % of the known distribution of the species. Surveys were conducted in the Shoalhaven region in May – June 2020. The action area was not burnt during the 2019 – 2020 bushfires. A total of 71 sites were surveyed, 31 of which had previous records for the Yellow-bellied Glider. Of the 31 sites, the species was identified at 10 sites. Site subject to severe fire did not record any Yellow-bellied Gliders post fire.

It is possible that the action area would provide refuge habitat during post fires, however the suitability of the action area to provide long-term habitat is highly unlikely, given the absence of

suitable hollows that would be used for breeding and denning. The presence of another resident population adjacent to the action area may decrease suitability, as the species' home ranges are exclusive.

The action area may provide connectivity throughout the landscape for this species, evidenced by the records within adjacent lands and presence of suitable habitat within the locality.

The action area meets part of the requirements to be considered critical habitat, namely:

- large continuous areas containing floristically diverse forest
- potential to provide temporary post fire refuge habitat
- acts as a habitat corridor.

IMPORTANT POPULATIONS

The conservation advice details the current known important populations. The Shoalhaven region is listed as an important population as a result of the 2019 – 2020 bushfires (DAWE 2022a). Therefore, any individuals that would utilise the action area for foraging or dispersal would form part of the important population.

IMPACT OF THE 2019 / 2020 BUSHFIRES

Across the species range, an estimated habitat reduction has not been provided. The conservation advice refers to increased pressures and loss of foraging and breeding habitat during the 2019 / 2020 bushfire season. Within a 10 km radius of the action area, the most western edge was affected to some degree by the bushfires (Appendix C, Figure 25 page 115). A vast majority of the habitat within 10 km of the action area remained intact and was unburnt. The action area is unlikely to increase in importance for this species, as it does not include the habitat requirements to support foraging or breeding.

IMPACT ASSESSMENT

The proposed action would remove 38.14 ha of marginal foraging habitat for the Yellow-bellied Glider through vegetation clearance. The nine (9) hollow bearing trees to be removed are highly unlikely to provide breeding habitat for this species, given their position in regrowth forest and lacking the preferred maturity for this species. The application of the significant impact criteria with respect to the Yellow-bellied Glider determined that the proposed action is unlikely to constitute a significant impact.

Table 9: Application of the significant impact criteria with respect to the Yellow-bellied Glider

Criterion	Assessment
lead to a long-term decrease in the size of an important population of a species	The proposed action would remove 38.14 ha of marginal foraging and dispersal habitat of an important population. The impacts to the important population would be limited to the reduction in foraging and dispersal habitat. It is unlikely that impacts to breeding habitat would occur. The reduction in habitat represents 0.39 % of the available foraging and dispersal habitat available within the locality. The area to be removed, although reducing the potential foraging and dispersal area is considered marginal habitat and would be used on an occasional basis. This is due to the absence of the species during targeted surveys (conducted periodically from 1993 – 2022), absence of suitable hollow bearing trees used for breeding and denning and absence of foraging evidence (sap marks in suitable trees).

Criterion	Assessment
	The removal of 38.14 ha of marginal foraging habitat is unlikely to lead to a long-term decrease in the size of the important population.
reduce the area of occupancy of an important population	The estimated area of occupancy (AOO) for the Yellow-bellied Glider is 12,724 m^2 (DAWE 2022). The estimates of AOO are based on records over the past 20 years, with the AOO expected to be an underestimate due to lack of data across the species known range (DAWE 2022). The proposed action would reduce the AOO of this species by 0.003 % across its entire range. The reduction in area of occupancy would be limited to foraging and dispersal habitat.
fragment an existing important population into two or more populations	The action area forms part of the Shoalhaven important population which extends throughout the Shoalhaven region. The extent of the important population is not limited to the action area. The proposed action would remove 38.14 ha of potential foraging and dispersal habitat and may reduce connectivity of foraging habitat within the action area. The action area is bordered by the Crookhaven River to the north, residential development to the east and remnant vegetation to the west and south. A reduction in connectivity may occur along the western extent of the action area. The retention of foraging habitat along the boundary of the sewer pumping station and the foreshore would maintain connectivity around the action area and to throughout the surrounding landscape. Although connectivity would be reduced, the proposed action would not fragment areas of foraging habitat or foraging habitat from breeding habitat. 17.26 ha of foraging habitat would be retained within the action area, and an additional 9,613 ha available within the locality, of which a majority forms either national parks or Biobank Agreement sites which contain a high proportion of the historic records for this species.
adversely affect habitat critical to the survival of a species	The action area contains 63.53 ha of habitat critical to the survival of the Yellow-bellied Glider, of which 38.14 ha is proposed for removal and 17.26 ha is proposed for retention. The critical habitat within the action area is marginal, would form foraging habitat used on occasions and would not support breeding. The Yellow-bellied Glider has not been historically recorded in the action area (both in BioNet and during targeted survey from 1993 – 2003), with activity documented to the west and south of the action area. The Yellow-bellied Glider is known to be territorial, with denning individuals occupying exclusive home ranges. Given the absence of historic records, absence of suitable breeding habitat and territorial nature of the species, the removal of 38.14 ha of marginal foraging and dispersal habitat would not adversely affect habitat critical to the survival of the species.
disrupt the breeding cycle of an important population	The action area contains 63.53 ha of marginal foraging habitat for the Yellow-bellied Glider. Breeding and denning habitat in the form of mature hollow bearing trees in old growth remnant woodland is not present in the action area. The action area would not be used for breeding purposes. An interpretation of the historic records (BioNet 2022) suggests that the species is utilising areas to the west and south of the action area for foraging and potentially breeding habitat. Potential for these areas to support breeding habitat is supported by surveys of the Lake Wollumboola BioBank site which identified numerous living, old growth trees with hollows amongst old growth forest. The removal of 38.14 ha of marginal foraging habitat is unlikely to disrupt the breeding cycle of an important population. Given the absence of the species in the action area (evidenced by historic records and targeted surveys since 1993) and absence of breeding habitat, the action area is unlikely to be relied upon by the Yellow-bellied Glider.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that	The proposed action would decrease the availability of marginal foraging habitat for the Yellow-bellied Glider by 38.14 ha. The proposed action would retain 17.26 ha of marginal foraging habitat within the action area. The action area would not provide breeding habitat for the Yellow-bellied Glider due to the absence of suitable hollows and old growth forest. About 17.26 ha of marginal foraging habitat would be retained, with an additional 9,613 ha

Criterion	Assessment
the species is likely to decline	of foraging and potential breeding habitat available within the locality in the Jervis Bay National Park and the Lake Wollumboola Biobank site. The area of marginal foraging habitat to be removed comprises 0.004 % of the habitat available within the region. The areas of habitat in Jervis Bay National Park and the Lake Wollumboola Biobank site also contain historic records for the species, from 1990 onwards. This would suggest that the habitat to the west and south of the action area is preferred habitat for the Yellow-bellied Glider. Therefore, the proposed action would not remove 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	Threats to the Yellow-bellied Glider include climate change, altered fire regimes, clearing and fragmentation of habitat and timber harvesting. Invasive species have been recorded preying on the Yellow-bellied Glider, however there is not enough evidence to determine whether predation is impacting the species on a population level (DAWE 2022).
introduce disease that may cause the species to decline, or	*Phytophthora cinnamomi* may impact the Yellow-bellied Glider through the reduction in suitable foraging habitat throughout the species range. However, there is limited evidence to determine the scale of impact to the Yellow-bellied Glider.
interfere substantially with the recovery of the species.	The proposed action would remove 38.14 ha of marginal foraging habitat for the Yellow-bellied Glider. The action area would not provide suitable breeding habitat for this species due to the lack of suitable hollow bearing trees and old growth forest. The action area also lacks historic records, with no species historically identified in BioNet or during targeted surveys, which have occurred since 1993. The proposed action would retain 17.26 ha of marginal habitat, with 9,613 ha available within the locality of which a majority forms part of National Parks and Biobank sites which would be conserved in-perpetuity. An assessment of the historic records for this species suggests that the national parks and Biobank sites are preferred habitat for the Yellow-bellied Glider. The proposed action, although reducing connectivity of habitat would not isolate or fragment areas of foraging habitat, or foraging or breeding habitat for this species. Therefore, the proposed action would not substantially interfere with the recovery of the species. This assessment has concluded that the proposed action is unlikely to constitute a significant impact to the Yellow-bellied Glider.

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

Impact – do you consider this impact to be significant?

Impact summary

The proposed action would remove 46.27 ha of potential foraging habitat through vegetation clearing. No breeding habitat in the form of camps would be affected. The significant impact criteria was applied with respect to the Grey-headed Flying-fox and concluded that the proposed action is unlikely to result in a significant impact to this species (Appendix A, Table 10 page 47).

SPECIES HABITAT AND ECOLOGY

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* sp.*, Corymbia* sp.*, Angophora* sp.*, Melaleuca* sp.*, Banksia* sp. and *Ficus* sp. and will migrate in response to flowering events and the availability of food. This species 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).

TARGETED SURVEY AND SPECIES PRESENCE

Targeted survey for Grey-headed Flying-fox has not been completed across the action area. There are records for the species adjacent to the action area. No camps have been previously recorded in the action area and none were incidentally observed during survey. The action area is likely to provide foraging habitat for the Grey-headed Flying-fox in the form of winter flowering Eucalypts and other flowering and fruiting native species.

There are no records for this species within the action area, however there are numerous records for the species within 10 km of the action area (Appendix A, Figure 26 page 116). Camps within a 20 km radius (DCCEEW, 2022b) of the action area include (Appendix A, Figure 27 page 117):

- Comerong Island, Nowra – 2,500 – 9,999 individuals last counted in mid-2016 (approx. 4 km from the action area)

- Bomaderry Creek - 2,500 – 9,999 individuals last counted in mid-2020 (approx. 16 km from the action area)
- Berry – 500 – 2,499 individuals last counted in mid-2021 (approx. 18 km from the action area).

Individuals occupying these camps may utilise the foraging habitat in the action area as part of a mosaic of foraging resources throughout the locality.

ASSESSMENT AGAINST CRITICAL HABITAT

The draft National Recovery Plan for the Grey-headed Flying-fox defines habitat critical to the survival of the species as natural habitat that is patches which (DAWE 2021):

- 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 crebra,* both of which were identified in the action area (DAWE 2021).

Individuals occupying these camps may utilise the foraging habitat in the action area as part of a mosaic of foraging resources throughout the locality.

The action area contains 46.27 ha of potential foraging habitat for this species (Appendix C, Figure 26 page 116). About 46.27 ha would be directly affected in the action area, with 17.26 ha proposed for retention in the action area. No camps were identified in the action area during survey and none have been historically recorded (DCCEEW 2022b). The vegetation adjoining the action area extends west and south into the Jervis Bay National Park, Lake Wollumboola Biobank site and private land and is >10,000 ha of continuous vegetation. This large adjoining vegetation patch comprises potential foraging habitat that is within a 20 km radius of the action area (Appendix C, Figure 27 page 117).

IMPORTANT POPULATIONS

The Draft National Recovery Plan for the Grey-headed Flying-fox does not contain a definition for an important population. Therefore, the action area has been assessed against the definition used in the significant impact criteria. The definition for an important population includes:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Grey-headed Flying-fox are one large, interbreeding population. Therefore, any individuals are important for breeding, dispersal and maintaining genetic diversity. The potential foraging habitat in the action area would support the important population.

IMPACT OF THE 2019 / 2020 BUSHFIRES

Across the species range, an estimated habitat reduction as a result of the 2019 / 2020 bushfires has not been provided, however it is expected that the fires would have reduced the foraging habitat available and directly affected some camps. This is likely to have increased the importance of unaffected camps and foraging habitat within the species range. It is likely that the foraging habitat available within the action area has increased in importance for this species. This species has the ability to forage widely and migrates the eastern coast of Australia suggesting that there could be numerous other foraging sites that were utilised during the bushfires. Within a 10 km radius of the action area, the most western edge was affected to some degree by the bushfires (Appendix C, Figure 28 page 118). A vast majority of the habitat within 10 km of the action area remained intact and was unburnt.

IMPACT ASSESSMENT

The proposed action would remove 46.27 ha of potential foraging habitat through vegetation clearing. No breeding habitat in the form of camps would be affected. The significant impact criteria was applied with respect to the Grey-headed Flying-fox and concluded that the proposed action is unlikely to result in a significant impact to this species (Appendix A, Table 10 page 47).

Table 10: 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	No. 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. No known camps would be affected. Actions that could lead to a long-term decrease in the Grey-headed Flying-fox population relevant to the proposed action include habitat loss and electrocution on powerlines. The proposed action would remove 46.27 ha of potential foraging habitat for the Grey-headed Flying-fox which would contribute to habitat loss. It is anticipated that the electrical wires would be buried underground. 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 (DAWE 2021)). The species are known to utilise a range of foraging resources within their nightly foraging distance including vegetation in urban areas. It is likely that the foraging habitat in the action area forms part of a range of foraging resources for this species and would not be solely relied upon. The proposed action would retain 17.26 ha of potential foraging habitat, with an additional 10,328 ha available within the locality. Of the habitat available within the locality a majority is present within the Jervis Bay National Park or the Lake Wollumboola Biobank site, which are both subject to in-perpetuity management and conservation. Although the proposed development would result in habitat loss, it is unlikely to lead to a 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 reduce the area of occupancy by 46.27 ha through the removal of potential foraging habitat. No known camps would be affected. The impact is unlikely to be significant given that 17.26 ha would be retained with an additional 10,328 ha available within the locality. Of the habitat available within the locality a majority is present within the Jervis Bay National Park or the Lake Wollumboola Biobank site, which are both subject to in-perpetuity management and conservation. Considering the species foraging habits and the utilisation of numerous foraging resources throughout the foraging range, the reduction is unlikely to be significant.

Criterion	Assessment
fragment an existing important population into two or more populations	No. 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. Despite no Grey-headed Flying Fox being observed during survey, this is a highly mobile species that has been recorded within 600m of the action area and that has a camp within approximately 5 km of the action area. The 46.27 ha of foraging habitat to be removed is not of a scale that would fragment two areas of foraging habitat or foraging habitat from breeding habitat that the species would not be able to traverse. The proposed action would not fragment an existing population into two or more.
adversely affect habitat critical to the survival of a species	The action area contains 63.53 ha of potential foraging habitat which meets the definition of critical habitat. Of this habitat, 46.27 ha is proposed for removal and 17.26 ha is proposed for retention. Actions that would adversely affect habitat critical to the survival of the species includes loss of foraging habitat, disturbance to camps and impacts of climate change. Loss of foraging habitat is relevant to this proposal. the Grey-headed Flying-fox is highly mobile and utilises a range of foraging resources within 20 km of camps. The foraging habitat in the action area forms part of a wider network of resources that extend beyond the action area into the locality. Of the resources within the locality, (estimated at 10,328 ha) the area of foraging habitat in the action area is 0.45 %. A majority of the foraging resources within the locality are present in National Parks or Biobank sites and are subject to in-perpetuity management and conservation. Therefore, although the proposed action will remove 46.27 ha of habitat critical to the survival of the species, it is unlikely to result in an adverse impact given the retention of habitat in the action area and availability of resources throughout the locality.
disrupt the breeding cycle of an important population	No roosting habitat in the form of camps would be removed or disturbed for the Grey-headed Flying-fox. The removal of 46.27 ha of potential foraging habitat is not being fragmented from a camp or causing isolation of foraging resources or camps throughout the species range. In addition, 17.26 ha of potential foraging habitat would be retained with 10,268 ha available within the locality. A majority of this habitat is within the foraging range of any individuals occupying camps within a 20 km radius of the action area.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No. 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 highly unlikely to be at such an extent that the Grey-headed Flying-fox would decline. The foraging habitat is not directly contiguous with known camps for this species. This species has a large foraging range. There is approximately 10,328 ha within the locality and 17.26 ha retained within the action area. The resources within the action area would likely form a mosaic of foraging resources and would not be solely relied upon 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	No. 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 limited 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 46.27 ha of foraging

Criterion	Assessment
	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 proposed action is unlikely to interfere with the recovery of the species given: • no camps would be affected • the proposed action would remove 46.27 ha of potential habitat • about 17.26 ha of foraging habitat would be retained within the action area • about 10,328 ha of potential foraging habitat is available within the locality, a majority of which is present in National Parks and Biobank sites which are conserved and managed in-perpetuity • the proposed action would not isolate or fragment areas of breeding habitat, or areas of breeding habitat from foraging habitat • the breeding cycle for this species is unlikely to be disrupted. This assessment has concluded that the proposed action is unlikely to constitute a significant impact to the Grey-headed Flying-fox.

***Petauroides volans* (Greater Glider)**

Impact – do you consider this impact to be significant?

Impact summary

The proposed action would remove 38.14 ha of native vegetation that does not form potential habitat for the Greater Glider. A precautionary approach has been taken, and despite the absence of this species or potential habitat in the action area, the significant impact criteria has been applied. The assessment concluded that the proposed action is unlikely to constitute a significant impact.

SPECIES HABITAT AND ECOLOGY

The Greater Glider (southern and central) occurs in eastern Australia, where it has a broad distribution from around Proserpine in QLD, south through NSW and the ACT, to Wombat State Forest in central VIC. It occurs across an elevational range of 0−1,200 m above sea level (a.s.l) except in the ACT, where the species is only known from the Lower Cotter Catchment and Namadgi National Park (DCCEEW 2022b). The species formerly occurred in Booderee National Park but appears to have been extirpated from that location in the mid-late 2000s. The species has undergone a reduction in its extent across its known range. This has occurred in areas that have been disturbed and suffered habitat loss and areas where habitat remains intact and undisturbed (DCCEEW 2022b).

The Greater Glider (southern and central) is largely restricted to eucalypt forests and woodlands of eastern Australia. It is typically found in highest abundance in taller, montane, moist eucalypt forests on fertile soils, with relatively old trees and abundant hollows. The species can also occurs in drier habitats in south-eastern QLD. Evidence suggests that the distribution of the species can be patchy even in areas of continuous habitat and that only a proportion of forest in potential habitat areas are suitable for the species. This is largely a factor of structural attributes and complexity, quality and abundance of den trees (DCCEEW 2022b).

During the day the Greater Glider shelters in tree hollows, with a particular preference for large hollows (diameter >10 cm) in large, old trees. Both live and standing dead trees are used for denning, however the species prefers to use live hollow-bearing trees when adequate numbers are available with multiple dens are used by an individual. The probability of occurrence for this species is positively correlated with the availability of hollows. Surveys in Grafton / Casino did not find the species in areas where there were < 6 suitable hollows per hectare (DCCEEW 2022b).

The Greater Glider is mostly folivorous, with a diet comprising eucalypt leaves supplemented by buds and flowers and feeds on a restricted range of *Eucalyptus* spp. but prefers forest with a diverse range of species to allow feeding adaptability.

Home ranges are typically relatively small (1–4 ha), however are larger (up to 19 ha) in forests on less fertile sites and in more open woodlands (DCCEEW 2022b). Males generally have a larger home range than females, and male home ranges do not overlap. The density of individuals over a home range can vary significantly, with densities estimated from 0.6 to 2.8 individuals per ha (DCCEEW 2022b).

TARGETED SURVEY AND SPECIES PRESENCE

Survey effort for Greater Glider has been conducted across the action area and surrounding landscape from 1993 – 2022. The species has not been identified in the action area during any targeted survey (Appendix C, Figure 29 page 119). There are no historic records for this species within the action area, with the closest record 4 km south of the action area near Jervis Bay National Park (Appendix C, Figure 30 page 120).

The action area is highly unlikely to support a Greater Glider population or provide potential foraging or denning habitat for the species because the action area does not contain the key requirements to provide suitable habitat, being:

- abundance of mature hollow bearing trees at the appropriate density
- mature forest or woodland with a diverse range of foraging species
- evidence of species presence over the past 30 years.

The action area is comprised of regrowth woodland that is approximately 40 years old. The hollow bearing tree density is 10 hollow bearing trees across 46 ha of development footprint, which equates to 0.23 hollows per hectare. This is significantly lower than the estimated required hollow density to support denning. Given the absence of suitable hollow bearing tree densities, the native vegetation present is unlikely to be used for foraging purposes. The Greater Glider has a small home range, and the species would require both denning and foraging habitat to be present within the home range for an area to represent potential habitat.

An assessment of historic records and results of targeted survey across the locality shows that the species is present in areas to the south and west of the action area (Appendix C, Figure 30 page 120). It is assumed that the species within these areas would have an estimated home range of 19 ha due to the location in low fertile forest. A home range of 19 ha measured from the record closest to the action area falls 3 km short of the southern boundary of the action area. This demonstrates that the home range for the closest known individuals does not overlap with the action area.

Therefore, the action area is unlikely to provide foraging or denning habitat for the Greater Glider.

ASSESSMENT OF CRITICAL HABITAT

The definition for critical habitat depending on forest type is:

- large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in a particular region; and
- smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonization; and
- cool microclimate forest/woodland areas (e.g. protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); and
- areas identified as refuges under future climate changes scenarios; and
- short-term or long-term post-fire refuges (i.e. unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.

The conservation advice states the following with respect to critical habitat:

…habitat which meets any one of the criteria above is considered habitat critical to the survival of Greater Glider, irrespective of the current abundance or density of greater gliders or the perceived quality of the site. Forest areas currently unoccupied by the greater glider (southern and central) may still represent habitat critical to survival, if the recruitment of hollow-bearing trees as the forest ages could allow the species to colonise these areas and ensure persistence of a subpopulation.

Consistent with the clause above, despite the absence of the species in the action area and lack of suitable habitat, there is potential that over time the action area could form potential habitat. Therefore, the action area is considered habitat critical to the survival of the Greater Glider.

IMPORTANT POPULATIONS

Consistent with the Conservation Advice, all populations of the Greater Glider are important for the conservation of the species across its range. The action area does not currently support any Greater Gliders and does not contain potential Greater Glider habitat. Therefore, the action area does not currently support an important population.

IMPACT OF THE 2019 / 2020 BUSHFIRES

Across the species range, an estimated habitat reduction has not been provided. The conservation advice refers to increased pressures and loss of foraging and breeding habitat during the 2019 / 2020 bushfire season. Within a 10 km radius of the action area, the most western edge was affected to some degree by the bushfires (Appendix C, Figure 31 page 121). A vast majority of the habitat within 10 km of the action area remained intact and was unburnt. The action area is unlikely to increase in importance for this species, as it does not include the habitat requirements to support foraging or breeding.

IMPACT ASSESSMENT

The proposed action would remove 46.27 ha of native vegetation that does not form potential habitat for the Greater Glider. A precautionary approach has been taken, and despite the absence of this species or potential habitat in the action area, the significant impact criteria has been applied. The assessment concluded that the proposed action is unlikely to constitute a significant impact.

For the purposes of the assessment, critical habitat and important population has been determined consistent with the conservation advice (DCCEEW 2022b). The locality has been used to refer to a 10 km radius around the action area.

Table 11: Significant impact assessment on *Petauroides volans* (Greater Glider)

Criterion	Question	Response
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
1)	**lead to a long-term decrease in the size of a population of a species**	The action area currently does not support any Greater Gliders or Greater Glider habitat., and therefore does not support a population. The proposed action would not lead to a long-term decrease in an important population.
2)	**reduce the area of occupancy of a population**	The proposed action would remove 38.14 ha of native vegetation in the action area. The native vegetation to be removed does not currently provide habitat for the Greater Glider and does not support

Criterion	Question	Response
		a population. Therefore, the proposed action would not reduce the area of an important population.
3)	**fragment an existing population into two or more populations**	The action area does not provide habitat for a population. An analysis of historic records and targeted survey results suggest that an important population is present to the south and west of the action area. The potential home ranges of individuals to the south and west do not overlap with the action area. Therefore, the removal of 38.14 ha of native vegetation would not fragment a population into two or more.
4)	**adversely affect habitat critical to the survival of a species**	Despite the absence of the Greater Glider in the action area, and the absence of potential habitat, the action area still meets the definition for critical habitat. This is defined by the fact that it may provide potential foraging and breeding habitat in the future. The proposed action would remove 38.14 ha of habitat critical to the survival of the Greater Glider. This critical habitat is not currently utilised by the species and does not contain potential foraging or breeding habitat for the species. The proposed action would retain 17.26 ha of habitat critical to the survival of the species, with an additional 9,720 ha of habitat critical to the survival of the species in the locality. Portions of the 9,720 ha present in the locality currently provides foraging and potential breeding habitat for the Greater Glider. A majority of this habitat is within National Parks or Biobank sites which are subject to in-perpetuity management and conservation. In this context, the removal of 38.14 ha of habitat critical to the survival of the Greater Glider, noting it does not currently provide habitat, is unlikely to adversely affect the survival of the species.
5)	**disrupt the breeding cycle of a population**	The proposed action does not currently support a population or contain foraging or breeding habitat for this species. Therefore, the removal of 38.14 ha of native vegetation would not disrupt the breeding cycle of an important population.
6)	**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 contains 38.14 ha of native vegetation which does not support breeding or foraging features for the Greater Glider. Areas to the south and west of the action area contain historic records over multiple generations for the Greater Glider. These areas of habitat are part of a large continuous patch > 9,720 ha in size, of which parts are subject to in-perpetuity conservation measures in National Parks and Biobank sites. The removal of 38.14 ha of native vegetation that currently does not provide habitat for this species would not cause the species to decline.
7)	**result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**	Given the absence of the species in the action area, the proposed action would not result in an invasive species becoming established in the Greater Glider's habitat.

Criterion	Question	Response
8)	**introduce disease that may cause the species to decline, or**	Given the absence of the species in the action area, the proposed action would not introduce a disease that could cause the species to decline.
9)	**interfere substantially with the recovery of the species.**	The proposed action is unlikely to substantially interfere with the recovery of the Greater Glider given that: • the Greater Glider has not been identified in the action area historically, or during targeted survey • the action area does not support foraging or breeding habitat • the closest record for the Greater Glider is 4 km to the south of the action area. The home range for this species does not overlap with the action area • the action area does not support an important population of the species. This assessment has concluded that the proposed action is unlikely to constitute a significant impact to the Greater Glider.

Syzygium paniculatum (Magenta Lilly Pilly)

SPECIES ECOLOGY AND DISTRIBUTION

Based upon available information, the known total population of Magenta Lilly Pilly was estimated to be approximately 1,200 plants distributed along a 400 km stretch of coastal NSW between Upper Lansdowne in the north to Conjola National Park in the south (OEH 2012). The species occurs naturally in the Jervis, Sydney Cataract, Pittwater and Wyong subregions of the Sydney Basin Bioregion, and in the Karuah-Manning and Macleay-Hastings subregions of the NSW North Coast Bioregion. Occurrences of Magenta Lilly Pilly are disjunct (OEH 2012). The five metapopulations are:

1. Jervis Bay
2. Coalcliff
3. Botany Bay
4. Central Coast
5. Karuah-Manning.

These metapopulations consist of 44 known subpopulations. The Jervis Bay and Central Coast metapopulations support the largest number of individuals and subpopulations. There are 12 and 24 recorded subpopulations in these metapopulations respectively (OEH 2012).

Most Jervis Bay subpopulations occur in littoral rainforest or depauperate subtropical rainforest. On Beecroft Peninsula the vegetation is characterised by dominants such as Small-leaved Fig (*Ficus obliqua*), Red Olive Plum (*Elaeodendron australe*), Plum Pine (*Podocarpus elatus*) and Lilly Pilly. Some sites on Beecroft Peninsula are dominated by Magenta Lilly Pilly, which occurs with the abovementioned overstorey species. At St Georges Basin, Magenta Lilly Pilly codominates with Cheese Tree (*Glochidion ferdinandi*) and Lilly Pilly beneath emergent Blackbutt (*Eucalyptus pilularis*) and Bangalay (*E. botryoides*), with an understorey including Cabbage Palm (*Livistona australis*), Muttonwood (*Myrsine variabilis*) and Scentless Rosewood (*Synoum glandulosum*) (OEH 2012).

Table 12: Breakdown of the Jervis Bay Metapopulation of *Syzygium paniculatum*

Metapopulation	Subpopulation	Local government area	General location	Tenure
Jervis Bay	1	Commonwealth	East St Georges Basin	Booderee NP
	2	Commonwealth	St Georges Head	Booderee NP
	3	Shoalhaven	Tomerong Creek	Council/private
	4	Commonwealth	Duck Hole	Department of Defence
	5	Commonwealth	Target Beach	Department of Defence
	6	Commonwealth	Dart Point	Department of Defence
	7	Commonwealth	Honeymoon Bay	Department of Defence
	8	Shoalhaven	Long Beach North	Council
	9	Shoalhaven	Long Beach South	Council
	10	Shoalhaven	Cabbage Tree	Council
	11	Shoalhaven	Abrahams Bosom	Crown reserve
	12	Shoalhaven	Conjola NP	Conjola NP

Magenta Lilly Pilly has been reported to occur on sandy soil or stabilised sand dunes in coastal areas, in littoral rainforest on sand or subtropical rainforest on sandy soil derived from sandstone in littoral

or subtropical rainforest on sandy soils or stabilised Quaternary sand dunes, or in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea. The species has been recorded growing mainly on flat to gently sloping sites on floodplains, creek banks, perched sand dunes, in swales of hind dunes, and on old dunal ridges. It has also been less commonly recorded on steep sites in gullies, such as in Bouddi National Park and at Green Point Foreshore Reserve (OEH 2012).

TARGETED SURVEY AND SPECIES PRESENCE

Targeted survey for *Syzygium paniculatum* was conducted across the action area on numerous survey periods. The species has not been identified in the action area. The closest record to the action area is to the south of Culburra Road and is one individual that has been identified by BioNet and Cumberland Ecology (Appendix C, Figure 32 page 122). Across the broader locality, the records are located at Kinghorne Point and in coastal areas (Appendix C, Figure 33 page 123).

A majority of the Jervis Bay subpopulation is mostly located in littoral rainforest or depauperate subtropical rainforest are not present in the action area. The broader description for the species occurrence also references littoral or subtropical rainforest on sandy soils. The vegetation types in the action area is predominantly comprised of forested wetlands and shrubby open forest (Appendix C, Figure 12 page 102). The vegetation types in the development footprint do not correspond with the vegetation types that the species has been observed in in the Jervis Bay subpopulation.

Based on the absence of the species in the action area and absence of suitable vegetation types, the action area is not considered habitat for this species. No further impact assessment is required.

4.4.3. Do you think your proposed action is a controlled action? Yes/ No

No, for the reasons outlined and discussed in Section 4.4.1 and 4.4.2.

4.4.4. Please describe any avoidance or mitigation measures proposed for this action and attach any supporting documentation for these avoidance and mitigation measures.

The action area forms part of a larger parcel of land that has been subject to strategic assessment under NSW planning legislation and the subsequent lodging of a planning proposal and development application for a Part 3A / transition to SSD. The DA was refused by the NSW Department of Planning in 2018 and an appeal was filed in the NSW Land and Environment Court against the refusal. During the court process, significant reductions to the development footprint were made; reducing the footprint from 91.65 ha in 2017 to the current 46.27 ha in 2022, removing large parts of the development that fell within the Lake Wollumboola Catchment, including a significant setback (100-150m) from the Crookhaven River) to reduce indirect impacts to migratory water birds and water quality, dedication of foreshore land for public protection.

This conservation measure is a 100 m setback from the Crookhaven River and Curleys Bay. The establishment of the 100 m setback is proposed to be zoned C2 – Environmental Conservation. The outcomes of the zoning is further described in Section 4.4.5. The establishment of the conservation area will avoid a majority of the TEC – Coastal Swamp Oak Floodplain Forest in the action area. The proposed action would retain 3.99 ha which comprises approximately 93 % of the TEC in the action area. In addition, the 17.26 ha of native vegetation to be conserved in the C2 zoned land provides potential foraging habitat for the Gang-gang Cockatoo and Grey-headed Flying-fox, and marginal foraging habitat for the South-eastern Glossy Black Cockatoo and Yellow-bellied Glider.

The establishment of the conservation area has maintained connectivity with the surrounding landscape, to both aquatic and terrestrial habitats.

4.4.5. Please describe any proposed offsets and attach any supporting documentation relevant to these measures

The impact assessments provided in Section 4.4 of this referral have concluded that the proposed action is unlikely to constitute a significant impact to any MNES. No residual significant impact is expected. Although there is no anticipated residual significant impact, details on a proposed offset are presented below. The proposed offset strategy includes both onsite retention and offsite conservation measures consistent with the Biobanking Assessment Methodology (BBAM).

Proposed retention measures in the action area

The action area covers 65.85 ha of which 47.96 is proposed for development and 17.26 ha is proposed for retention. It is proposed that the retained land within the action area will be secured by transferring the land to Shoalhaven City Council to be managed in accordance with a Plan of Management adopted under the *Local Government Act 1993* (LG Act). The land is proposed to be classified as community land under the LG Act, and categorised as a 'natural area' with an adopted plan of management under Division 2 of Part 2 of Chapter 6 of that Act primarily for nature conservation.

Proposed conservation measures outside of the action area

These conservation measures will also be secured off-site within the adjoining Lake Wollumboola Biobank Site (BA364). The Lake Woolumboola biobank site was registered in February 2019 and is owned by Sealark Pty Limited. Condition C19 of the LEC consent requires the proponent to retire 2,839 Biobank credits to offset the impacts to native vegetation and threatened species habitat across the action area. The credits must be retired prior to the commencement of construction (Appendix J).

4.5. Migratory Species

4.5.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

Surveys for avifauna have been conducted across the action area and the surrounding landscape on numerous occasions, from 1997 – 2013. Surveys have identified the following threatened migratory species along the foreshore of the action area and surrounding landscape:

- *Calidris tenuirostris* (Great Knot) - critically endangered, migratory and marine
- *Sterna albifrons* (Little Tern) – marine and migratory

The BioNet records also show records for the following migratory species within 1 km of the action area (Appendix C, Figure 8 page 98):

- *Numenius madagascariensis* (Eastern Curlew) - critically endangered, migratory and marine
- *Calidris ferruginea* (Curlew Sandpiper) – critically endangered, migratory and marine

Detailed assessment of how migratory species were using the wetland was conducted as part of Marine Pollution Research between 2019 – 2020 (Appendix O). Marine Pollution Research (MPR) between 2019 and 2020 confirmed that use of Curleys Bay by shore, wading and fishing birds is limited. MPR (2020) attributed this to the proximity of mangroves to the mudflats, stating that "*the low utilisation of the SE and SW Bay mud flats by wading and shore birds can be related back to the relatively narrow width of the intertidal mud flats immediately offshore from mature mangrove trees around 5 to 6 m high*." MPR (2020) concluded that more suitable habitat was available for shore and wading birds at Lake Wollumboola and Comerong Island rather than Curleys Bay.

Additional data available from, *Birds of Shoalhaven City* (Shoalhaven City Council 2019); *Bird Life Australia – Lake Wollumbolla Fact Sheet 2021* and *Presenting the Birds of Lake Wollumboola 2014* have identified the Crookhaven River, Curley's Bay and Lake Wollumboola as important habitat for migratory waders, sea birds and shorebirds, including the Black Swan, Chestnut Teal, Little Tern, ducks, pelicans and spoonbills. The Lake Wollumboola Protection Association has recorded 104 species through this period, mainly aquatic species, many of which are migratory species listed under the EPBC Act.

Impacts on migratory species was identified and assessed by SLR Consulting Australia (2013) in accordance with the Director-Generals requirements issued under the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) and concluded the following:

> "*The proposed development of the subject site for the Culburra West Project will doubtless remove some resources for at least individuals of some threatened species…*
>
> *The significant habitats and ecosystems associated with the Crookhaven River estuarine environment (particularly sea-grass beds, mangrove forests and coastal saltmarsh communities) are all located outside the proposed development footprint. In addition, these estuarine ecosystem and habitats are protected from the Culburra West Project site both by the intervening 100m plus vegetated buffer along the Crookhaven River foreshore and the comprehensive water quality and water volume treatment management regime which has been incorporated into the Project."*

ELA concurs with this conclusion regarding the significance of impacts to local populations of aquatic bird life. Further, the **amended application** (assessed as the action area in this referral) has taken into consideration the comment raised in the Department of Planning and Environment's Assessment Report for SSD 3846 (June 2018) and the Statement of Reasons prepared by the IPC resulting in a proposal that has a significantly reduced footprint (47.34 ha compared to the original refused Concept Plan of 102.23 ha), removal of all impacts to the foreshore area including viewing platforms and associated clearing, resulting in minimum buffers of 100-150m to sensitive waterfront areas, dedication of large tracks of foreshore land to the public for active and passive uses, modified stormwater treatment that achieves neutral or beneficial effect, thus reducing any potential impacts further.

Aquatic and additional terrestrial habitat for bird species could be indirectly impacted by the proposed development. The outer perimeter of the proposed footprint is largely comprised of perimeter roads and APZs. In effect, these areas will provide a buffer between the development lands and retained areas buffering the Crookhaven River and Curleys Bay environs, thereby mitigating

and buffering any indirect impacts such as increased weeds, run-off, changed noise and light conditions. Indirect impacts to aquatic bird habitat would also be mitigated through the proposed setback between the development and Curleys Bay (minimum 100 m) / Lake Wollumboola (500 m) and the preparation/implementation of a Construction Environmental Management Plan and Vegetation Management Plan for the foreshore area as outlined in Section 17.2 Environmental Management Measures of SLR (2013) and re-stated in Allen Price & Scarratts 2020. The provision of these buffer areas addresses Director-General's Environmental Assessment Requirement 9.2.v.

As indicated above, as part of its review of the application, the then OEH stated that it "*is satisfied that the development is unlikely to have a significantly [sic] impact on threatened species and their habitats*" and that "*the projects biodiversity issues had been adequately assessed in accordance with the NSW Framework for Biodiversity Assessment …..*".Therefore, no significant impact criteria has been applied with respect to migratory species.

4.5.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No.

4.6. Nuclear action impacts

4.6.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. The action is not a nuclear action.

4.6.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No. The action is not a nuclear action.

4.7. Commonwealth Marine Area impacts

4.7.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. The action is not in a Commonwealth Marine Area.

4.7.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No. The action is not in a Commonwealth Marine Area.

4.8. Great Barrier Reef impacts

4.8.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. The action does not involve impacts to the Great Barrier Reef.

4.8.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No. The action does not involve impacts to the Great Barrier Reef.

4.8.3. Please describe any proposed offsets and attach any supporting documentation relevant to these measures

4.9. Coal seam gas or large coal mining development impacts

4.9.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. The proposed action does not involve gas or large coal mining developments.

4.9.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No. The proposed action does not involve gas or large coal mining developments.

4.10. Commonwealth Land impacts

4.10.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. There is no Commonwealth Land in or adjacent to the action area.

4.10.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No. There is no Commonwealth Land in or adjacent to the action area.

4.11. Commonwealth heritage places overseas impacts

4.11.1. Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? Yes / No

No. There are no Commonwealth Heritage places overseas in the action area.

4.11.2. Do you consider this likely direct and/or indirect impact to be a Significant Impact? Yes / No

No. There are no Commonwealth Heritage places overseas in the action area.

4.12. Impact Summary

Based on information provided in Section 4.1, a table will display showing each controlling provision and whether the impact is significant or not significant. To make any changes to this section, you will need to update content provided in Section 4.1

4.13. Alternatives

4.13.1. Do you have any possible alternatives for your proposed action to be considered as part of your referral? Yes / No

No.

4.13.2. Considered alternatives

4.13.2.1. Do you have any other alternative actions, including not taking the action, that you have considered but are not proposing as part of this referral? Yes / No

Yes.

4.13.2.2. If Yes: Describe the details of this possible alternative that you have considered but are not proposing If No: Proceed to Section 5.

References

Please fill out the table below with all references used.

Reference	Link	Sensitive information? ☐Yes ☐ No	Relevant page nos.	Document date	Description	Level of confidence ☐Low or uncertain, ☐Medium, ☐High	Why low or uncertain
Avifauna studies at West Culburra (ELA 2021)	Appendix O	No	All	2021	Summary of all avi-fauna studies conducted at West Culburra	High	N/A
BioNet Atlas of NSW Wildlife (BioNet 2022)	https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx	No	Online data set.	Live – updated regularly. Checked in 2022.	Records for flora and fauna across NSW.	Medium to high.	Records must be scrutinised as some individuals are mis-identifications and there can be errors in accuracy.
Culburra 18 Hole Golf Course, Long Bow Point Culburra (Insites 2011)	Appendix I	No	All	2017	Impact Assessment	High	new threatened species records have been identified since the

Reference	Link	Sensitive information? ☐Yes ☐ No	Relevant page nos.	Document date	Description	Level of confidence ☐Low or uncertain, ☐Medium, ☐High	Why low or uncertain
							publication date.
Culburra Golf Course – Long Bow Point Part Lots 5 and 6 in DP 1065111 Species Impact Statemen (Gunninah 2015)	Appendix H	No	All	2017	Impact Assessment	High	new threatened species records have been identified since the publication date.
Culburra Golf Course SIS Addendum Report, Cumberland Ecology 2017	Appendix G	No	All	2017	Impact Assessment	High	N/A
Culburra West Urban Development Project, Culburra Beach SLR 2013	Appendix F	No	All	2013	Impact Assessment	High	Document is 10 years old, new threatened species records have been identified since the publication date.
DAWE 2022a Conservation Advice for Petaurus australis australis (Yellow-bellied glider (south-eastern))	http://www.environment.gov.au/biodiversity/threatened/species/pubs/87600-conservation-advice-02032022.pdf	No	All	2 March 2022	Conservation advice for the Yellow-	High	N/A

Reference	Link	Sensitive information? ☐Yes ☐ No	Relevant page nos.	Document date	Description	Level of confidence ☐Low or uncertain, ☐Medium, ☐High	Why low or uncertain
					bellied Glider		
DAWE 2022a Conservation Advice for Petaurus australis australis (Yellow-bellied glider (south-eastern))	.environment.gov.au/biodiversity/threatened/species/pubs/87600-conservation-advice-02032022.pdf	No	All	2 March 2022	Conservation advice for the Yellow-bellied Glider	High	N/A
DAWE 2022c Conservation Advice for Callocephalon fimbriatum (Gang-gang Cockatoo)	http://www.environment.gov.au/biodiversity/threatened/species/pubs/768-conservation-advice-02032022.pdf	No	All	2 March 2022	Conservation advice for the Gang-gang Cokcatoo	High	Some new breeding sites found. Medium –– high
DAWE 2022c Conservation Advice for Callocephalon fimbriatum (Gang-gang Cockatoo)	.environment.gov.au/biodiversity/threatened/species/pubs/768-conservation-advice-02032022.pdf	No	All	2 March 2022	Conservation advice for the Gang-gang Cokcatoo	High	Some new breeding sites found. Medium - high
DCCEEW 2022a Conservation Advice for Calyptorhynchus lathami lathami (South-eastern Glossy Black Cockatoo)	http://www.environment.gov.au/biodiversity/threatened/species/pubs/67036-conservation-advice-10082022.pdf	No	Entire document	2022	Conservation advice for the South-eastern Glossy Black Cockatoo	High	Nil
DCCEEW 2022a Conservation Advice for Calyptorhynchus lathami lathami (South-eastern Glossy Black Cockatoo)	.environment.gov.au/biodiversity/threatened/species/pubs/67036-conservation-advice-10082022.pdf	No	Entire document	2022	Conservation advice for the South-eastern	High	Nil

Reference	Link	Sensitive information? ☐Yes ☐ No	Relevant page nos.	Document date	Description	Level of confidence ☐Low or uncertain, ☐Medium, ☐High	Why low or uncertain
					Glossy Black Cockatoo		
DCCEEW 2022b Conservation Advice for Petauroides volans (greater glider (southern and central))	http://www.environment.gov.au/biodiversity/threatened/species/pubs/254-conservation-advice-05072022.pdf	No	Entire document	2022	Conservation advice on the Greater Glider	High	Nil
DCCEEW 2022b Conservation Advice for Petauroides volans (greater glider (southern and central))	.environment.gov.au/biodiversity/threatened/species/pubs/254-conservation-advice-05072022.pdf	No	Entire document	2022	Conservation advice on the Greater Glider	High	Nil
Descriptions for NSW (Mitchell) Landscapes Version 2	https://www.environment.nsw.gov.au/resources/conservation/landscapesdescriptions.pdf	No	All	2002	NSW landscape profiles	High	N/A
Descriptions for NSW (Mitchell) Landscapes Version 2	https://www.environment.nsw.gov.au/resources/conservation/landscapesdescriptions.pdf	No	All	2002	NSW landscape profiles	High	N/A
DotEE 2018. Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	http://www.environment.gov.au/biodiversity/threatened/communities/pubs/141-conservation-advice.pdf	No	Entire document	2022	Conservation Advice for Coastal Swamp Oak Forest	High	Nil
DotEE 2018. Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales	.environment.gov.au/biodiversity/threatened/communities/pubs/141-conservation-advice.pdf	No	Entire document	2022	Conservation Advice for Coastal	High	Nil

Reference	Link	Sensitive information? ☐Yes ☐ No	Relevant page nos.	Document date	Description	Level of confidence ☐Low or uncertain, ☐Medium, ☐High	Why low or uncertain
and South East Queensland ecological community					Swamp Oak Forest		
Land and Environment Court Consent LEC No. 2019/78149	Appendix J	No	All	2019	Land and Environment Court decision	High	N/A
OEH 2012. *National Recovery Plan Magenta Lilly Pilly* Syzygium paniculatum.	https://www.dcceew.gov.au/environment/biodiversity/threatened/recovery-plans/national-recovery-plan-magenta-lilly-pilly-syzygium-paniculatum	No	Entire document	2012	Recovery plan for Magenta Lilly Pilly	High	Was prepared in 2012 so some information on population numbers of extent may be outdated.
OEH 2012. *National Recovery Plan Magenta Lilly Pilly* Syzygium paniculatum.	.dcceew.gov.au/environment/biodiversity/threatened/recovery-plans/national-recovery-plan-magenta-lilly-pilly-syzygium-paniculatum	No	Entire document	2012	Recovery plan for Magenta Lilly Pilly	High	Was prepared in 2012 so some information on population numbers of extent may be outdated.
Proposed Mixed-use Subdivision at West Culburra, Shoalhaven City,	Appendix XL	Yes	All	May 2012	ACHA	HIgh	N/A

Reference	Link	Sensitive information? ☐Yes ☐ No	Relevant page nos.	Document date	Description	Level of confidence ☐Low or uncertain, ☐Medium, ☐High	Why low or uncertain
South Coast of NSW: Aboriginal Cultural Heritage Assessment							
Proposed Mixed-use Subdivision at West Culburra, Shoalhaven City, South Coast of NSW: Aboriginal Cultural Heritage Assessment	Appendix X	Yes	All	May 2012	ACHA	HIgh	N/A
Reference	Link	Sensitive information? ☐Yes ☐ No	Relevant page nos.	Document date	Description	Level of confidence ☐Low or uncertain ☐Medium ☐High	Why low or uncertain
Revised West Culburra Beach Concept Plan – Aquatic Ecology Assessment Report (MPR 2020).	Appendix P	No	All	2020	Aquatic ecology assessment report	High	N/A
Sealark Supplementary Report to Aboriginal Cultural Heritage Assessment	Appendix XK	Yes	All	14 April 2020	ACHA supplementary report	High	N/A
Sealark Supplementary Report to Aboriginal Cultural Heritage Assessment	Appendix X	Yes	All	14 April 2020	ACHA supplementary report	High	N/A
Shoalhaven City Coucil, 2014. Shoalhaven Local Environmental Plan (SLEP 2014).	https://legislation.nsw.gov.au/view/html/inforce/current/epi-2014-0179	No	Entire document	2014	Shoalhaven Local Environmental Plan	High	Nil.
State Significant Development Assessment: West Culburra	Appendix M	No	All	2020	Environmental Impact	HIgh	N/A

Reference	Link	Sensitive information? ☐Yes ☐ No	Relevant page nos.	Document date	Description	Level of confidence ☐Low or uncertain, ☐Medium, ☐High	Why low or uncertain
Concept Proposal SSD 3846 (Allan Price and Scarratts Pty Ltd 2020)					Statement submitted with SSD		
TSSC 2008. Gang-gang Cockatoo Callocephalon fimbriatum Review of Current Information in NSW December 2008	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/sc-gang-gang-cockatoo-callocephalon-fimbriatum-review-report.pdf?la=en&hash=3FEF6865BF9A0194895BCA82D57CA00BE76F71C2	No	Entire document	2008	Current information (as of 2008) for the Gang-gang Cockatoo	Medium	Information would be outdated, as the review was compiled > 10 years ago.
TSSC 2008. Gang-gang Cockatoo Callocephalon fimbriatum Review of Current Information in NSW December 2008	.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/sc-gang-gang-cockatoo-callocephalon-fimbriatum-review-report.pdf?la=en&hash=3FEF6865BF9A0194895BCA82D57CA00BE76F71C2	No	Entire document	2008	Current information (as of 2008) for the Gang-gang Cockatoo	Medium	Information would be outdated, as the review was compiled > 10 years ago.

5.1. Declarations

All declarations will be made in the portal.

Appendix A EPBC Act Referral Supporting Documentation (ELA 2022)

Appendix B MNES Likelihood of occurrence assessment

Attachment 2 EPBC Threatened species likelihood tables and assessment of threatened species

The table below lists the threatened species known or considered likely to occur within the action area based on previous surveys, Atlas, EPBC Act Protected Matters Search and/or expert opinion. The 'Likelihood' and 'Justification' columns justifies the culled list of candidate species for further assessment and the 'Additional survey required' indicates whether additional survey was completed to inform this referral.

Five categories for likelihood of occurrence of species are used in this report and are defined below. Assessment of likelihood was based on species' locality records, presence or absence of suitable habitat features within the action area, results of previous studies, on site field surveys and professional judgement.

Known/yes – the species is known to occur within suitable habitat within the action area or surrounding landscape.

likely – a medium to high probability that a species occupies or uses habitat within the action area.

potential – suitable habitat for a species occurs within the action area, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur.

Unlikely – a very low to low probability that a species occupies or uses habitat within the action area.

no – habitat within the ACTION AREA and in the immediate vicinity is unsuitable for the species, or, in the case of plants, the species was not located during searches of the ACTION AREA.

EPBC Act Status

CE = Critically Endangered species, population or ecological community.

E = Endangered species or ecological community

V = Vulnerable species or ecological community.

Threatened flora

Scientific name	Common name	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Caladenia tessellata	Thick-lipped Spider orchid	V	PMST	Associated with open woodlands and heath, typically occurring in treeless areas or very open areas, which are often rocky and where there are only skeletal soils. It does not occur in forested habitats. Plants may lay dormant for 10-20 years, only flowering for one to two years following a mid-late summer fire. Outside this period, it is highly unlikely that any plants will flower and thus that there will be any above ground biomass of the species.	Unlikely	The action area does not contain suitable habitat for this species i.e. open woodland or heath habitat. Previous targeted surveys by local orchid experts (2015) and September 2022 have not recorded this species	No	No
Calochilus pulchellus	Pretty Beard Orchid	E	PMST	. It is known from the Sydney Basin Bioregion, where a total of less than 30 adult plants have been recorded in three sites over a range of 40 km on the South Coast of NSW, at altitudes from 20-560 m above sea level. All currently known sites are within the Shoalhaven Local Government Area. Occurrence in small, widely separated colonies is not unusual in the genus. The cryptic nature of the species, with a single leaf above ground for only a few months and a flowering stem lasting a few days or a week, makes detection difficult for most of the year. It is likely that additional scattered individuals and	Potential	Previous surveys in the action area have not recorded this species within the action area, despite more than 20 years of surveys. Updated targeted surveys undertaken in December 2021 whilst nearby reference sites were flowering (see Figure 5). No individuals recorded	No	No

Scientific name	Common name	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
				small colonies exist within the area of occurrence.				
Corunastylis vernalis	East Lynne Midge-orchid	V	PMST	This species is known from a narrow distribution in dry sclerophyll forest and woodlands from south of Batemans Bay to north of Ulladulla. Grows in shrubby forests on well drained clay-loam between 30-100m altitude (Jones 2006).	Unlikely	The distribution for this species does not occur within the Action area. there are no bionet records for this species within a 30 km radius of the action area.	No	No
Cryptostylis hunteriana	Leafless Tongue Orchid	V	PMST	Cryptostylis hunteriana is known from a range of vegetation communities including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. Subulata*) and the Tartan Tongue Orchid (*C. erecta*). Coastal Plains Scribbly Gum Woodland and Coastal Plains Smoothed-barked Apple Woodland is potential habitat on the Central Coast. Flowers between November and February, although may not flower regularly (OEH 2015).	Potential	Previous surveys in the action area have not recorded this species within the action area, despite more than 20 years of surveys. Updated targeted surveys undertaken in December 2021 whilst nearby reference sites were flowering (see Figure 5). No individuals recorded	No	No

Scientific name	Common name	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Cynanchum elegans	White-flowered Wax Plant	E	PMST	*Cynanchum elegans* is a climber or twiner with a variable form, and flowers between August and May, peaking in November. It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest. The species has also been found in littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia subsp. integrifolia* coastal scrub; *Eucalyptus tereticornis* open forest/ woodland; *Corymbia maculata* open forest/woodland; and *Melaleuca armillaris* scrub to open scrub.	Unlikely	The action area does not contain suitable habitat for this species. Previous targeted surveys have not recorded this species.	No	No
Genoplesium baueri	Bauer's Midge Orchid	E	BioNet, PMST	Known from coastal areas from northern Sydney south to the Nowra district. Previous records from the Hunter Valley and Nelson Bay are now thought to be erroneous. Grows in shrubby woodland in open forest on shallow sandy soils (OEH 2015).	Potential	Targeted surveys conducted by local orchid expert Alan Stephenson in 2015 has concluded that the action area does not contain suitable habitat for this species	No	No
Melaleuca biconvexa	Biconvex Paperbark	V	PMST	*Melaleuca biconvexa* occurs in coastal districts and adjacent tablelands from Jervis Bay north to the Port Macquarie district. It grows in damp places often near streams.	Potential	Potential habitat present, however, this is a conspicuous species and has not been recorded during previous surveys.	No	No

Scientific name	Common name	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Pimelea spicata	Spiked Rice-flower	E	PMST	This species is associated with clay soils. In the coastal Illawarra region this species is associated with Coast Banksia open woodland especially on coastal headlands and hilltops. Prefers vegetation communities dominated by Eucalyptus tereticornis and E. eugenioides, with a groundcover dominated by *Themeda australis*.	Unlikely	The vegetation description for this species does not fit with the vegetation recorded within the action area. There are no BioNet records for this species within a 5km radius of the action area.	No	No
Pomaderris brunnea	Rufous Pomaderris	V	PMST	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria.	No	The geographic distribution for this species does not overlap with the action area.	No	No
Prasophyllum affine	Jervis Bay Leek Orchid	E	BioNet, PMST	This species is known from three sites – Kinghorne Point, Wowly Gully near Callala Bay and near Vincentia township. Grows on poorly drained clay soils that support low heathland and sedgeland communities.	Unlikely	This species was surveyed for in November 2022 and was not identified in the action area during survey.	No	No
Prostanthera densa	Villous Mint-bush	V	BioNet, PMST	Generally, grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	Unlikely	This species is highly conspicuous and has not been recorded in action area despite extensive flora surveys.	No	No
Pterostylis gibbosa	Illawarra Greenhood	E	PMST	Near Nowra, open forest of Spotted Gum, Forest Red Gum and Grey	Potential	Targeted surveys of action area were undertaken in September 2022. The	No.	No

Scientific name	Common name	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
				Ironbark i.e. a transition forest between grassy woodlands and lowland sclerophyll woodlands.		species was confirmed to be flowering at Worrigee during the surveys. No individuals were recorded despite intensive surveys. There are no Bionet records for this species within a 5km radius of action area.		
Rhizanthella slateri	Eastern Australian Underground Orchid	E	PMST	The habitat requirements of this species are poorly understood. It may occur in variable habitats forests and woodlands. This species completes its entire life cycle underground. It is known from ten locations in NSW, closest is a population recorded near Nowra .	Potential	Targeted surveys of action area were undertaken in September 2022. The species was confirmed to be flowering at Worrigee during the surveys. No individuals were recorded despite intensive surveys. There are no Bionet records for this species within a 5km radius of action area.	No.	No
Rhodamnia rubescens	Scrub Turpentine	CE	PMST	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Unlikely	The vegetation types in the action area are not consistent with typical habitat for this species. There are no records within 5 km of the action area.	No	No
Rhodomyrtus psidioides	Native Guava	CE	PMST	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in	No.	Geographic distribution for this species does not overlap with the action area	No	No

Scientific name	Common name	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
				Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW.				
Syzygium paniculatum	**Magenta Lilly Pilly**	**V**	**BioNet, PMST**	**Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.**	**Potential**	**This species is highly conspicuous and has been recorded by ELA during 2016 near the action area.** **It has not been recorded in the action area despite extensive surveys**	**No**	**No – recorded in adjacent land.** **Assessed on precautionary principle.**
Thesium australe								

E = Endangered V = Vulnerable. CE = Critically Endangered

Threatened Fauna

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Amphibian							
Litoria aurea	Green and Golden Bell Frog	V	Amongst emergent aquatic or riparian vegetation and amongst vegetation, fallen timber adjacent to and within 500m of breeding habitat, including grassland, cropland and modified pastures.	Potential	Not identified during multiple survey in recent years in potential habitat within action area, including surveys undertaken by ELA during summer of 2016 and SLR surveys. Potential breeding habitats within action area is limited to two small farm dams. Previously recorded from 2001 BioNet record within the conservation zone along southern boundary	ELA conducted targeted surveys for GGBF in 2021 and 2022 and did not record this species	No. Despite targeted surveys this species has not been recorded with the action area
Heleioporus australiacus	Giant Burrowing Frog	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest. Associated with semi-permanent to ephemeral sand or rock based streams, where the soil is soft and sandy so that burrows can be constructed.	Unlikely	The action area does not contain suitable habitat or resources for this species. There are no BioNet records within a 5 km radius of the action area.	No	No
Litoria littlejohnii	Littlejohn's Tree Frog	V	Littlejohn's Tree Frog occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude (OEH 2019b).	No	The action area does not contain suitable habitat or resources suitable habitat for this species. There are no BioNet records within a 5 km radius of the action area.	No	No
Diurnal Birds							
Anthochaera phrygia	Regent Honeyeater	E & M	Associated with temperate eucalypt woodland and open forest including forest edges,	Potential	Surveys were not conducted for this species. Assumed potential	No	No

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
			wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised. The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes. As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (OEH 2019b.		foraging habitat and non-breeding habitat. An Expert report has been prepared	Not within mapped important areas under BAM	
Apus pacificus	Fork-tailed Swift	M	Habitat includes riparian woodland. Swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted wetland / shorebirds surveys along Crookhaven River.	No
Ardea ibis	Cattle Egret	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted wetland / shorebirds surveys along Crookhaven River.	No

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Ardenna pacificus	Wedge-tailed Shearwater	M	Islands, offshore habitats	Unlikely	No. This species relies on offshore habitat which is not present in the action area	No	No
Ardenna tenuirostris	Short-tailed Shearwater	M	Islands, offshore habitats	Unlikely	No. This species relies on offshore habitat which is not present in the action area	No	No
Arenaria interpres	Ruddy Turnstone	M	Frequents beaches along the coast of NSW. Flies from Siberia or Alaska to Australia in August – September each year	Unlikely	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted targeted survey in 2016 for this species within 100m of Crookhaven River	No. Potential habitat for this species will not be impacted.
Botaurus poiciloptilus	Australasian Bittern	-	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats. Reedbeds, swamps, streams, estuaries.	Potential	Potential habitat present adjacent to Crookhaven River. This species is a candidate species for targeted surveys.	ELA conducted targeted survey in 2016 for this species within 100m of Crookhaven River	No. Potential habitat for this species will not be impacted.
Calidris acuminata	Sharp-tailed Sandpiper	M	Shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted targeted survey in 2016 within 100m of Crookhaven River	No. Potential habitat for this species will not be impacted.
Calidris canutus	Red Knot	E; M	Red Knots are widespread around the Australian coast, less in the south and with few inland records. Small numbers visit Tasmania and off-shore islands. It is widespread but scattered in New Zealand. They breed in North America, Russia, Greenland and Spitsbergen.	Unlikely	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted targeted survey in 2016 for this species within 100m of Crookhaven River	No. Potential habitat for this species will not be impacted.

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
			Red Knots are a non-breeding visitor to most continents.				
Calidris alba	Sanderling	M	This species occurs on coasts, with open sandy beaches or rocky platforms where there is active wave wash. They are rarely inland of sandy shores	Unlikely	No. This species relies on rocky platforms and sandy beaches which are not present in the action area.	No	No. Potential habitat for this species will not be impacted.
Calidris ferruginea	Curlew Sandpiper	CE; M	Intertidal mudflats of estuaries, lagoons, mangrove channels; around lakes, dams, floodwaters, flooded saltbush surrounds of inland lakes.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted targeted survey in 2016 for this species within 100m of Crookhaven River	No. Potential habitat for this species will not be impacted.
Calidris melanotos	Pectoral Sandpiper	M	Shallow fresh to saline wetlands, including coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted targeted survey in 2016 within 100m of Crookhaven River	No. Potential habitat for this species will not be impacted.
Calidris ruficollis	Red-necked Stint	M	Tidal mudflats, saltmarshes, sandy and shelly beaches, saline and freshwater wetlands, saltfields, sewage ponds.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted targeted survey in 2016 within 100m of Crookhaven River	No. Potential habitat for this species will not be impacted.
Calidris tenuirostris	Great Knot	CE	Breeds in north-east Siberia and migrates to coastal areas around Australia, particularly in Northern Territory and Queensland. Prefers sheltered coastal habitat and intertidal mudflats including estuaries	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	ELA conducted targeted survey in 2016 within 100m of Crookhaven River	No. Potential habitat for this species will not be impacted.
Callocephalon fimbriatum	**Gang-gang Cockatoo**	**E**	**During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands. In winter they occur at lower altitudes in drier**	**Known**	**Yes, recorded near the action area at Longbow Point by Gunninah 2013 and Cumberland Ecology**	**Yes**	**No**

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
			more open forests and woodlands, particularly box-ironbark assemblages. They sometimes inhabit woodland, farms and suburbs in autumn/winter (OEH 2019b).		**2017, although habitat in the action area is largely unsuitable (regrowth forest with few suitable hollows)**		**Not recorded during 2022 surveys**
Calyptorhynchus lathami	**Glossy Black-Cockatoo**	**V**	**Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils. Intact drier forest types with less rugged landscapes are preferred. Nests in large trees with large hollows.**	**Known**	**Yes recorded near the action area at Longbow Point by Gunninah 2013 and Cumberland Ecology 2017, although habitat in the action area is largely unsuitable (regrowth forest with few suitable hollows)**	**Yes**	**Yes, incidentally recorded foraging in the action area**
Charadrius leschenaultii	Greater Sand Plover	V	Almost entirely restricted to coastal areas in NSW, mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	Potential	This species has been recorded from BioNet records within a 5km radius of the action area. there is potential habitat within the conservation area of the action area.	Yes. ELA conducted bird targeted for surveys bird wetland species	No. Potential habitat for this species will not be impacted.
Charadrius mongolus	Lesser Sand-plover	E	Almost entirely coastal in NSW, using sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats, sandy beaches, coral reefs and rock platforms.	Potential	This species has been recorded from BioNet records within a 5km radius of the action area. there is potential habitat within the conservation area of the action area.	Yes. ELA conducted bird targeted for surveys bird wetland species	No. Potential habitat for this species will not be impacted.
Chlidonias leucopterus	White-winged Black Tern	M	Large coastal and inland wetlands, saltfields, tidal estuaries, lagoons, grassy swamps, and sewage ponds.	Potential	This species has been recorded from BioNet records within a 5km radius of the action area. there is potential habitat within the conservation area of the action area	Yes. ELA conducted bird targeted for surveys bird wetland species	No. Potential habitat for this species will not be impacted.

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Dasyornis brachypterus	Eastern Bristlebird	E	Habitat is characterised by dense, low vegetation and includes sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest, as well as open woodland with a heathy understorey. In northern NSW occurs in open forest with tussocky grass understorey. All of these vegetation types are fire prone, aside from the rainforest habitat as utilised by the northern population as fire refuge. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously.	Unlikely	The action area does not contain suitable heath habitat or resources for this species. There are no bionet records within a 5 km radius of the action area.	No	No
Egretta sacra	Eastern Reef Egret	M	Beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs.	Potential	This species has been recorded from BioNet records within a 5km radius of the action area. there is potential habitat within the conservation area of the action area.	Yes. ELA conducted bird targeted surveys for wetland bird species	No. Potential habitat for this species will not be impacted.
Gallinago hardwickii	Latham's Snipe	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover. Occupies a variety of vegetation around wetlands including wetland grasses and open wooded swamps.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	No	No

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Haliaeetus leucogaster	White-bellied Sea Eagle	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No. There are no recorded breeding sites for this species within the action area in 2016 or 2022.
Hirundapus caudacutus	White throated Needletail	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas. Has been observed roosting in dense foliage of canopy trees and may seek refuge in tree hollows in inclement weather.	Potential	This species has been recorded form BioNet records within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No, not recorded during recent ELA 2016 surveys.
Hydroprogne caspia	Caspian Tern	M	Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms	Unlikely	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No
Lathamus discolor	Swift Parrot	CE	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts. Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C.*	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
			gummifera), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (OEH 2019b).				
Limicola falcinellus	Broad-billed Sandpiper	M	Sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs.	Potential	Suitable habitat present within the foreshores of Crookhaven River.	Yes. ELA conducted targeted surveys for this species within the action area	No. Potential habitat for this species will not be impacted.
Limosa lapponica baueri	Bar-tailed Godwit	V	Intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons, bays, seagrass beds, saltmarsh, sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. Rarely inland wetlands, paddocks and airstrips.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No. Potential habitat for this species will not be impacted.
Limosa lapponica mensbieri	Northern Siberian Bar-tailed Godwit	CE	Non-breeding migratory species to Australia. Forages along edge of tidal estuaries and harbors in sheltered waters including sandy, mud substrates.	Unlikely	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No. Potential habitat for this species will not be impacted.
Limosa limosa	Black-tailed Godwit	M	Usually sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found around muddy lakes and swamps.	Unlikely	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No
Lophoictinia isura	Square-tailed Kite	-	Found in a variety of timbered habitats including dry woodlands and open forests.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird	No

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
			Shows a particular preference for timbered watercourses (OEH 2019b).			surveys for migratory bird species.	
Numenius madagascariensis	Eastern Curlew	CE; M	Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms.	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No
Numenius minutus	Little Curlew	M	Foraging habitat includes grasslands with saltmarshes, mudflats or sandflats	Potential foraging (non-breeding) habitat present	One historic BioNet record form 1983 within a 5 km radius of the action area	Yes. ELA conducted targeted surveys for this species within the action area	No. Potential habitat for this species will not be impacted.
Numenius phaeopus	Whimbrel	M	Estuaries, mangroves, tidal flats, coral cays, Exposed reefs, flooded paddocks, sewage ponds, grasslands, sports fields, lawns.	Potential	Previously recorded from one BioNet record within action area. Not likely to occur due to presence of suitable habitat	No	No.
Pandion cristatus	Eastern Osprey	-Ma	Associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde and Tidemann 1986). Osprey may nest on the ground, on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown.	Potential	No nesting habitat is likely to be impacted. No records of nests within action area despite numerous surveys for this species and other species including SRL 2013 and ELAs recent survey 2021/22. No impact to foraging habitat.	No	No
Pluvialis fulva	Pacific Golden Plover	M	Estuaries, mudflats, saltmarshes, mangroves, rocky reefs, inland swamps, ocean shores,	Potential	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird	No.

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
			paddocks, sewage ponds, ploughed land, airfields, playing fields.			surveys for migratory bird species.	
Pterodroma leucoptera leucoptera	Gould's Petrel	E	The breeding sites of Gould's Petrel are restricted to two islands at the entrance to Port Stephens on the mid-North Coast of New South Wales. Non-breeding habitat includes sub-Antarctic waters between Macquarie Island and Tasmania.	Unlikely	No suitable marine habitat recorded within the action area	No	No
Rostratula australis	Australian Painted Snipe	E	Swamps, dams and nearby marshy areas	Unlikely	No. Suitable habitat not present in the action area or adjacent ands.	No	No
Thinornis rubricollis	Hooded Plover	V	Prefers sandy ocean beaches which are broad and flat with wave wash. Occasionally found in tidal bays and estuaries, rock platforms, rocky or sand-covered reefs, and small beaches in lines of cliffs. Also use near-coastal saline and freshwater lakes and lagoons.	Unlikely	No. Suitable habitat not present in the action area.	No	No. Potential habitat for this species will not be impacted.
Tringa nebularia	Common Greenshank	M	Terrestrial wetlands (swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans, saltflats, sewage farms and saltworks dams, inundated rice crops and bores) and sheltered coastal habitats (mudflats, saltmarsh, mangroves, embayments, harbours, river estuaries, deltas, lagoons, tidal pools, rock-flats and rock platforms).	Potential.	Presence of potential foraging / wading habitat adjacent to, however not within the action area	Yes. ELA conducted targeted bird surveys for migratory bird species.	No. Potential habitat for this species will not be impacted.
Xenus cinereus	Terek Sandpiper	M	Mudbanks and sandbanks near mangroves, rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.	Unlikely	No. Potential habitat not present in the action area.	No	No. Potential habitat for this species will not be impacted.

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Mammals (non-flying)							
Dasyurus maculatus maculatus	Spotted-tailed Quoll (SE mainland population)	E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (OEH 2019b).	Potential.	Marginal habitat present within the action area.	Survey completed in 2015 – 2017 and 2021 – 2022.	No
Isoodon obesulus	Southern Brown Bandicoot	E	This species is associated with heath, coastal scrub, heathy forests, shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (OEH 2019b).	Unlikely	Previous surveys have not recorded this species. There are no BioNet records for this species within a 5 km radius of the action area.	No. ELA did not consider this a species requiring survey. Records in BioNet are an error	No
Petauroides volans	**Greater Glider**	**E**	**This species is restricted to eucalypt forests and woodlands where it forages on eucalyptus leaves and flowers. It prefers areas of un-logged vegetation.**	**Known in locality**	**Yes recorded near the action area at Longbow Point by Gunninah 2013 and Cumberland Ecology 2017, although habitat in the action area is largely unsuitable (regrowth forest with few suitable hollows)**	**Yes**	**No** **Not recorded by remote cameras and spotlighting in 2022**
Petaurus australis	**Yellow-bellied Glider**	**V**	**This species is restricted to tall mature forests, preferring productive tall open sclerophyll forests with a mosaic of tree species including some that flower in winter (Environment Australia 2000, OEH 2019b). Large hollows**	**Known in locality**	**Yes recorded near the action area at Longbow Point by Gunninah 2013 and Cumberland Ecology 2017, although habitat in the action area is largely unsuitable**	**Yes**	**No** **Not recorded by remote cameras and spotlighting in 2022**

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
			within mature trees are required for shelter, nesting and breeding.		**(regrowth forest with few suitable hollows)**		
Phascolarctos cinereus	Koala	V	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70%, with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis* (OEH 2019b)	Unlikely	Previous surveys were conducted within the action area did not record this species.	ELA has conducted a review of habitat and literature and determined that this species is unlikely to occur.	No
Pseudomys novaehollandiae	New Holland Mouse	V	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (OEH 2019b).	Unlikely	Previous surveys have not detected this species in the action area. surveys were conducted using pitfall traps and hair tubes in 2015 – 2017.	No	No
Mammal (flying)							
Chalinolobus dwyeri	Large-eared Pied Bat	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces.	Unlikely	Foraging habitat present. There are no habitat breeding features recorded within the action area. This species was predicted from PMST. There are no BioNet records for this species.	Yes. This species did not require targeted surveys as there are no sandstone cliffs within 2 km of the action area.	No. Not recorded during echolocation surveys

Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
			Found in well-timbered areas containing gullies (OEH 2019b).				
Pteropus poliocephalus	**Grey-headed Flying-Fox**	**V**	**Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (OEH 2019b).**	**No breeding habitat**	**No existing camps identified or previously recorded in the action area.**	**No**	**No**

Appendix C Figures

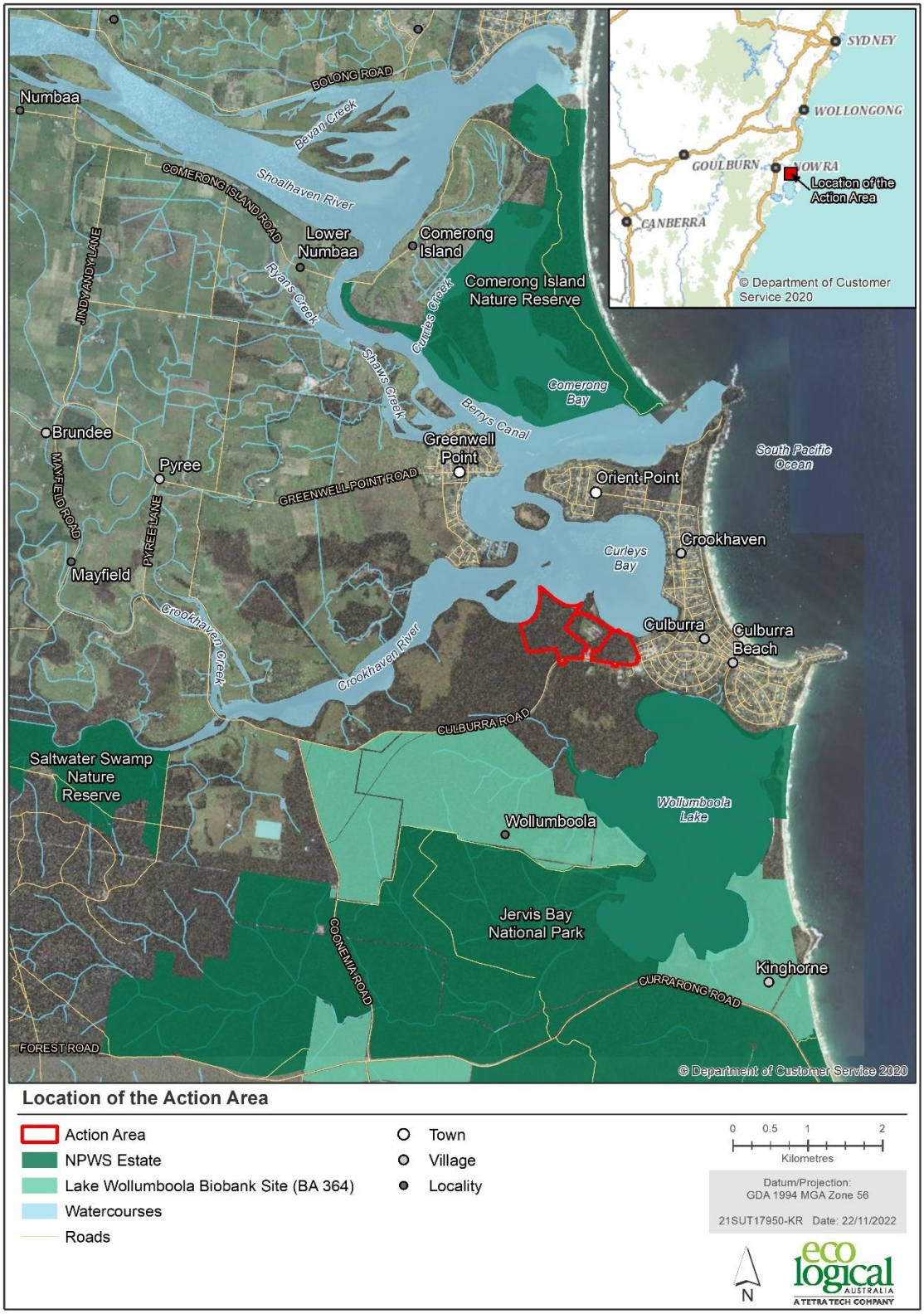

Figure 1: Location of the action area

Figure 2: Co-ordinates for the action area

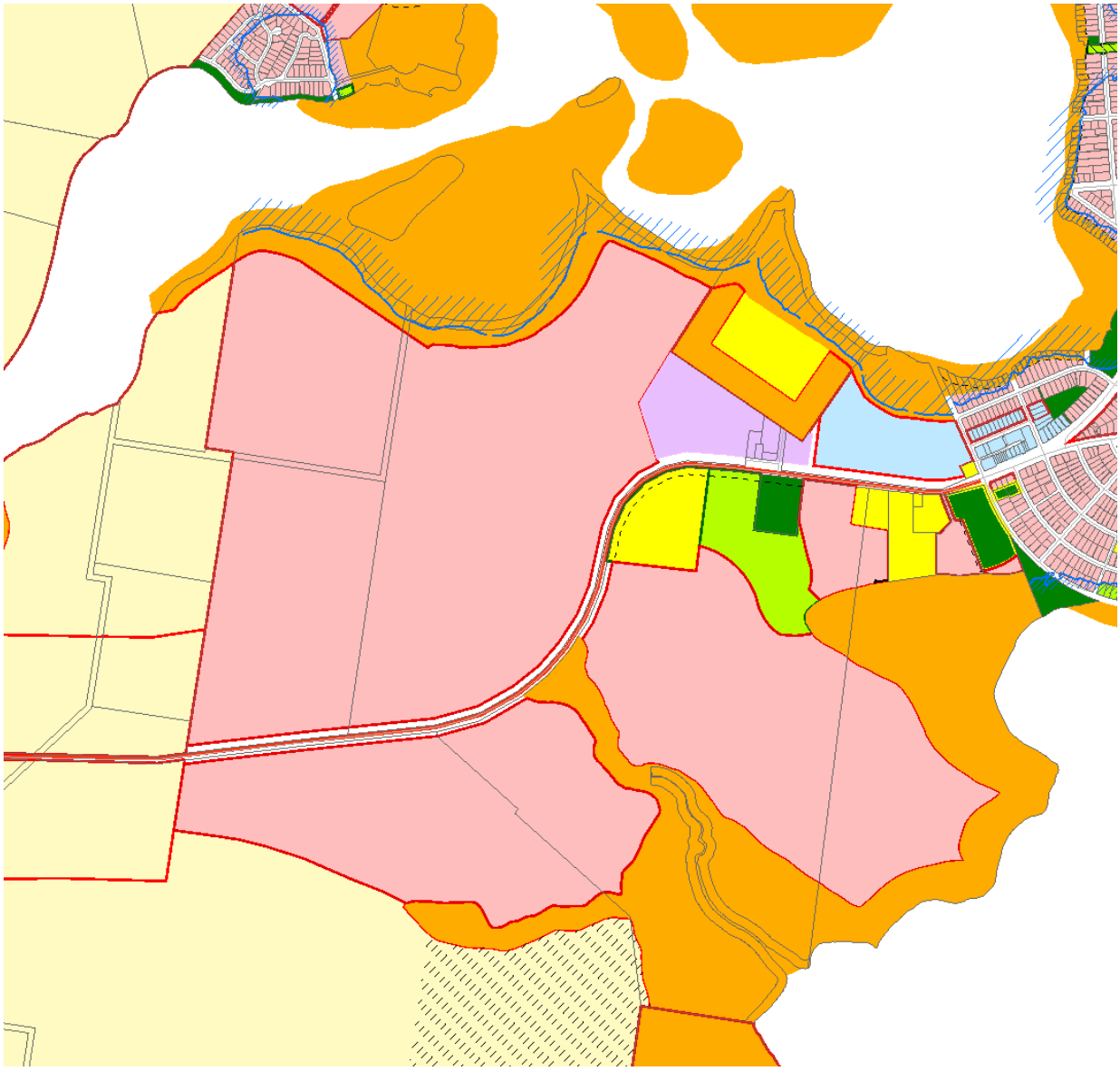

Figure 3:Culburra Beach 1990's rezoning in relation to the action area

Figure 4: Location of the action area in relation to conservation areas

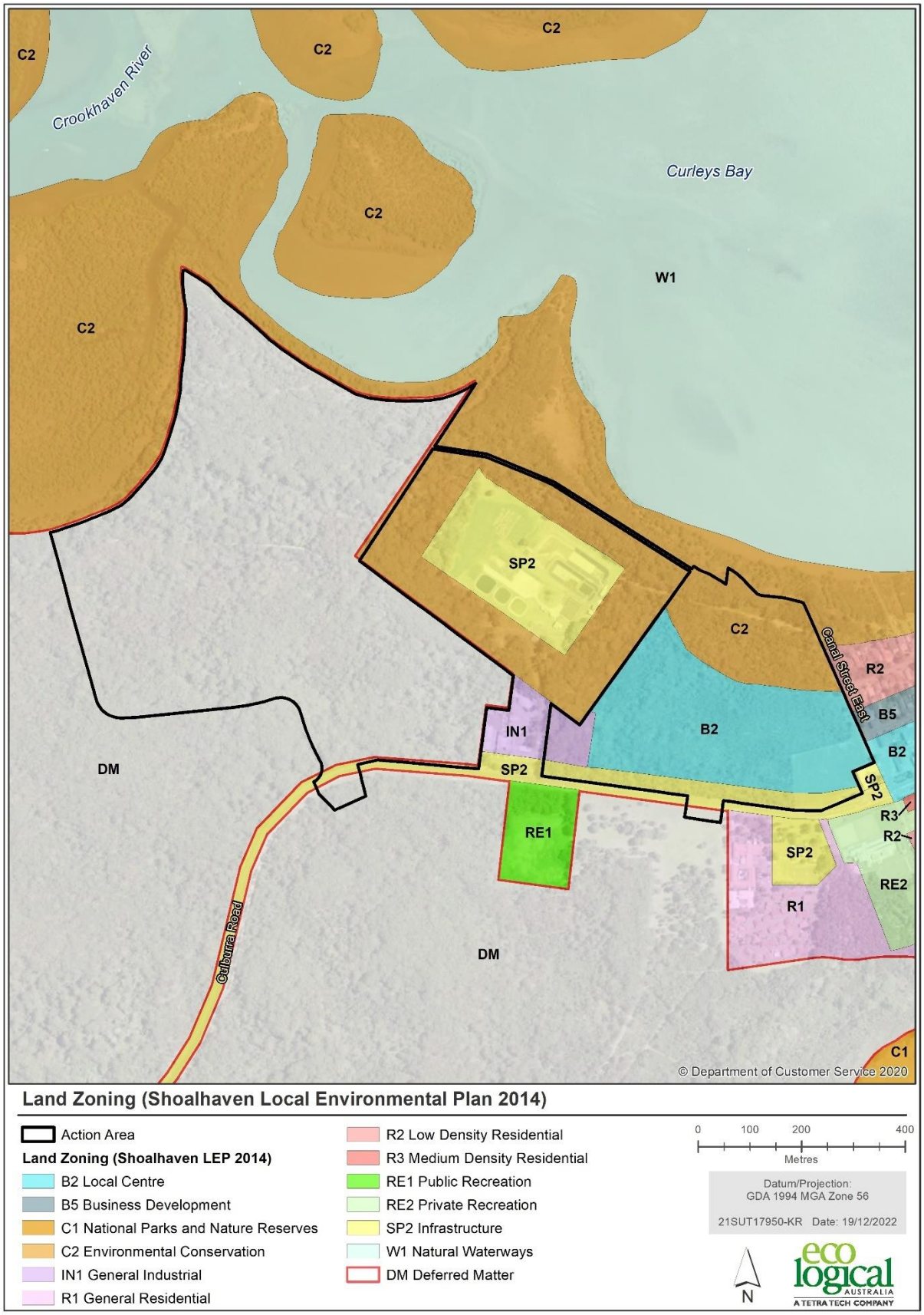

Figure 5: Current land zoning across the action area

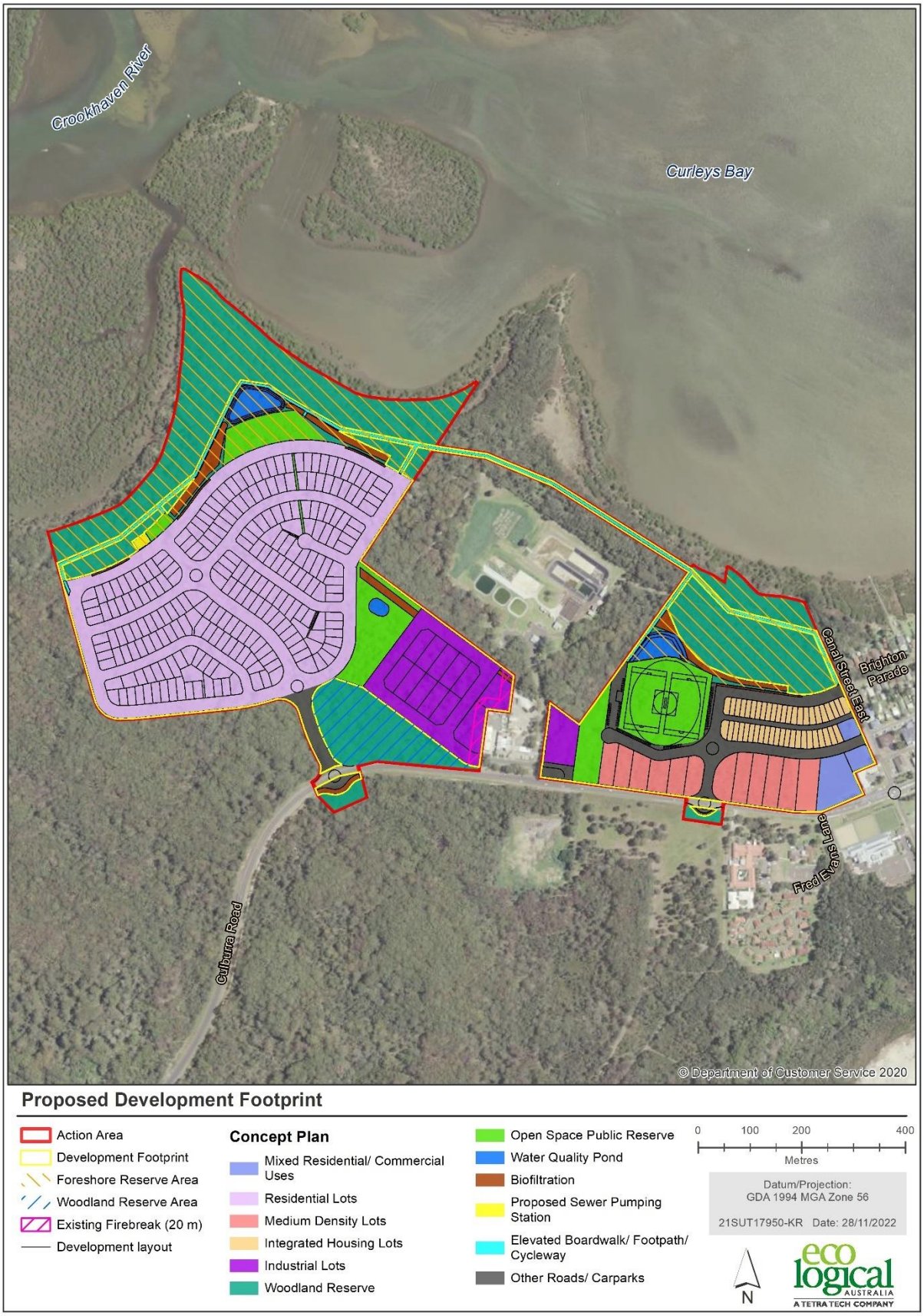

Figure 6: Proposed development, retention and conservation areas in the action area

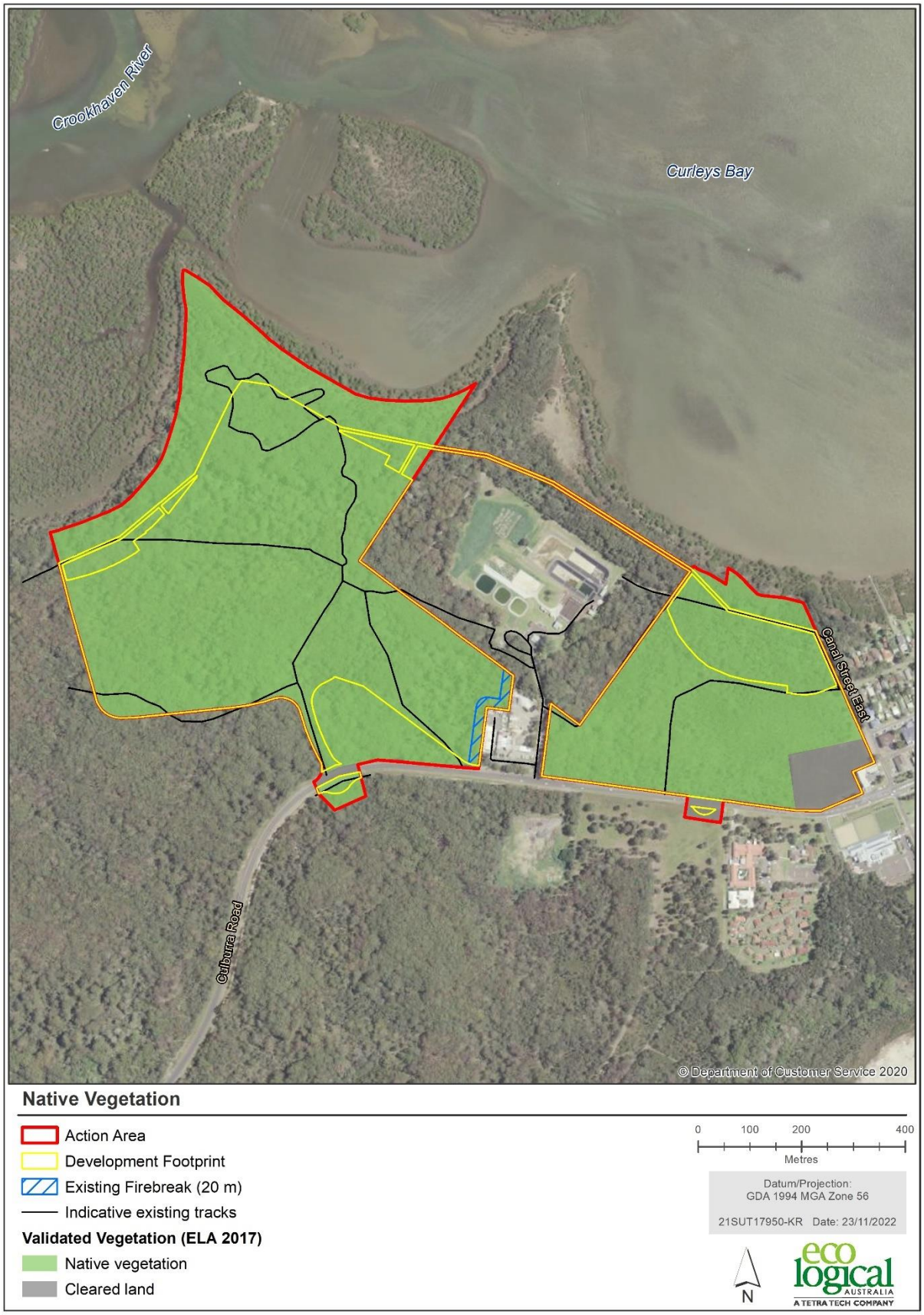

Figure 7: Extent of native vegetation in the action area

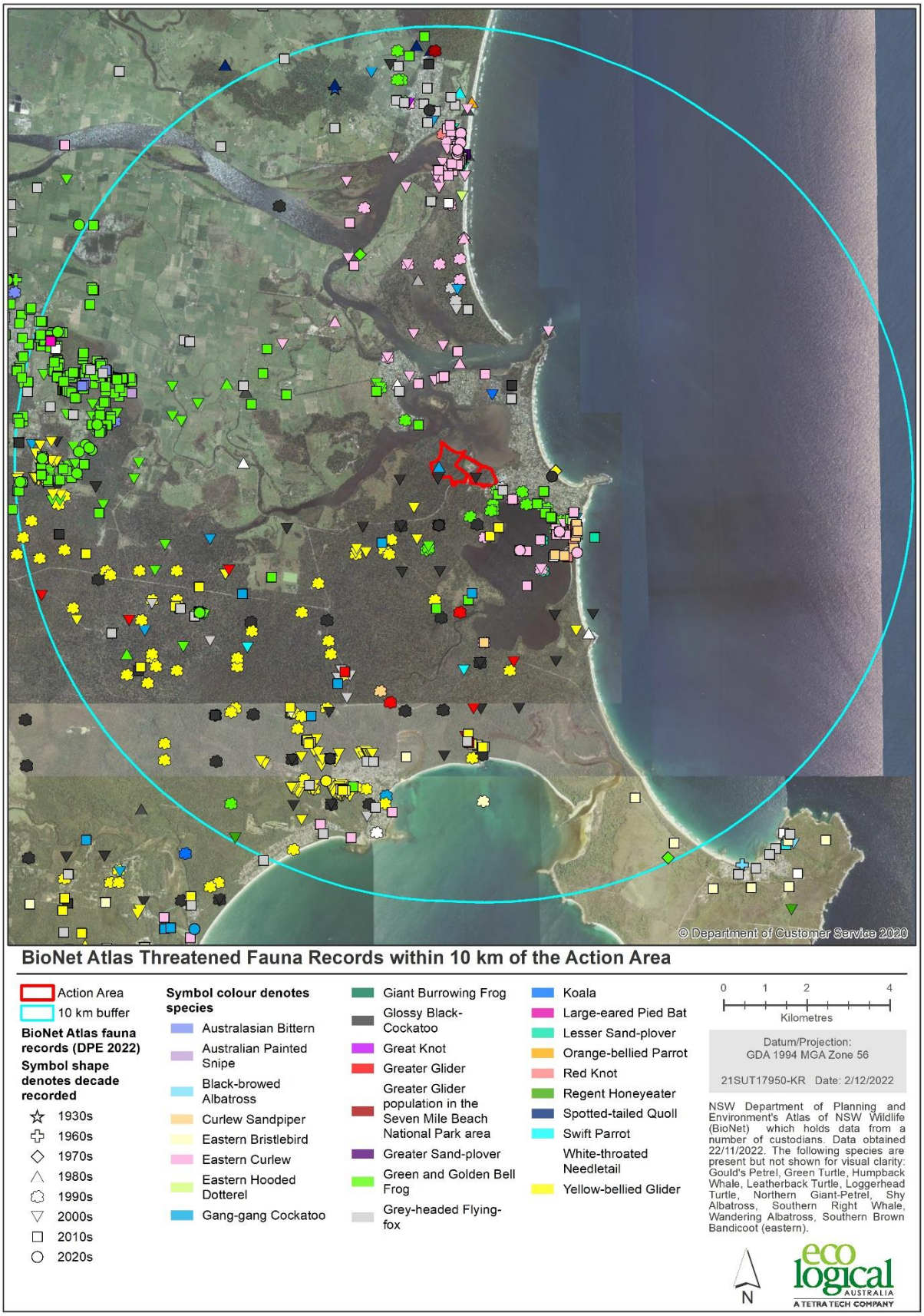

Figure 8: Threatened fauna records within 10 km of the action area

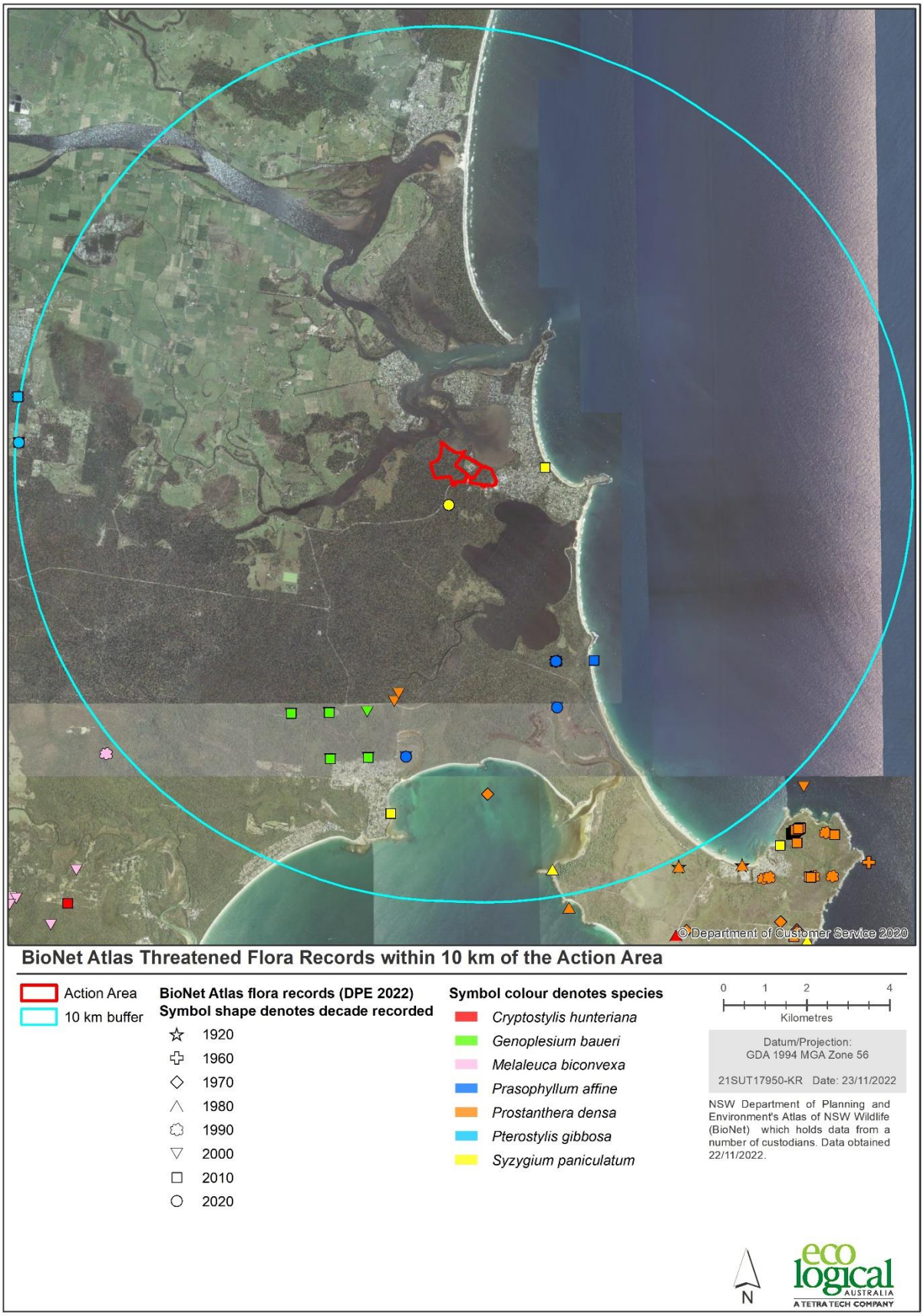

Figure 9: Threatened flora records within 10 km of the action area

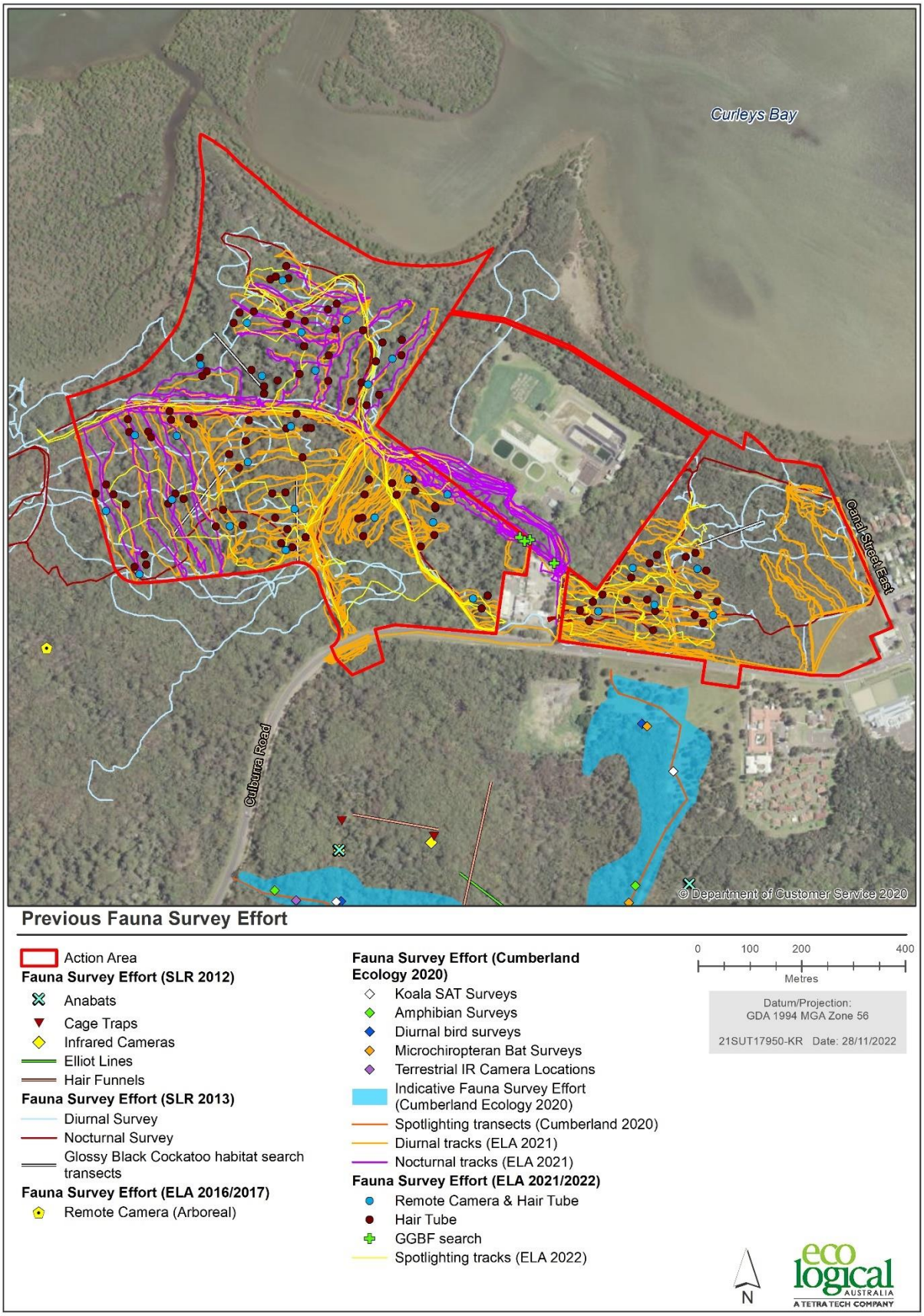

Figure 10: Fauna survey effort across the action area

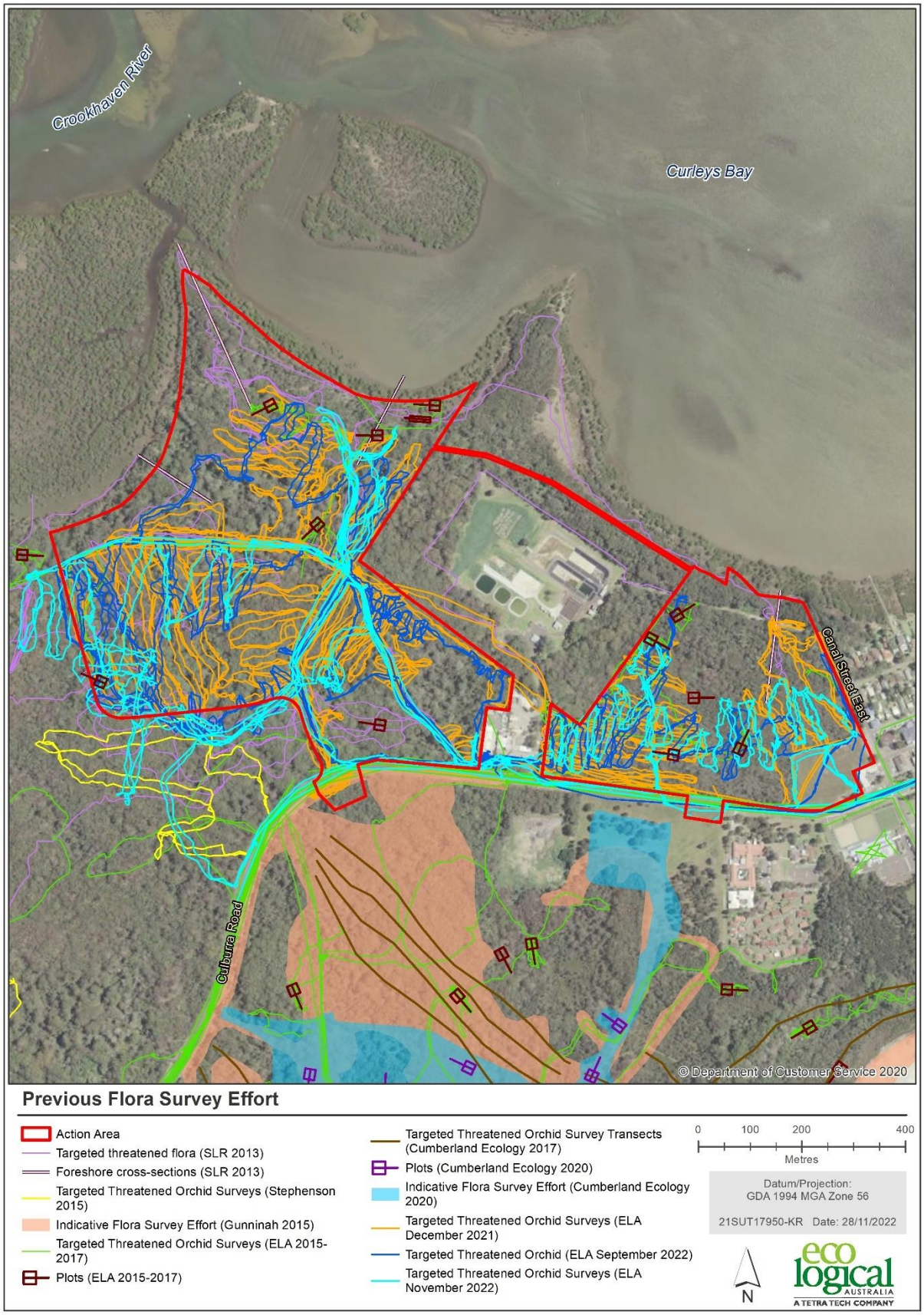

Figure 11: Flora survey effort across the action area

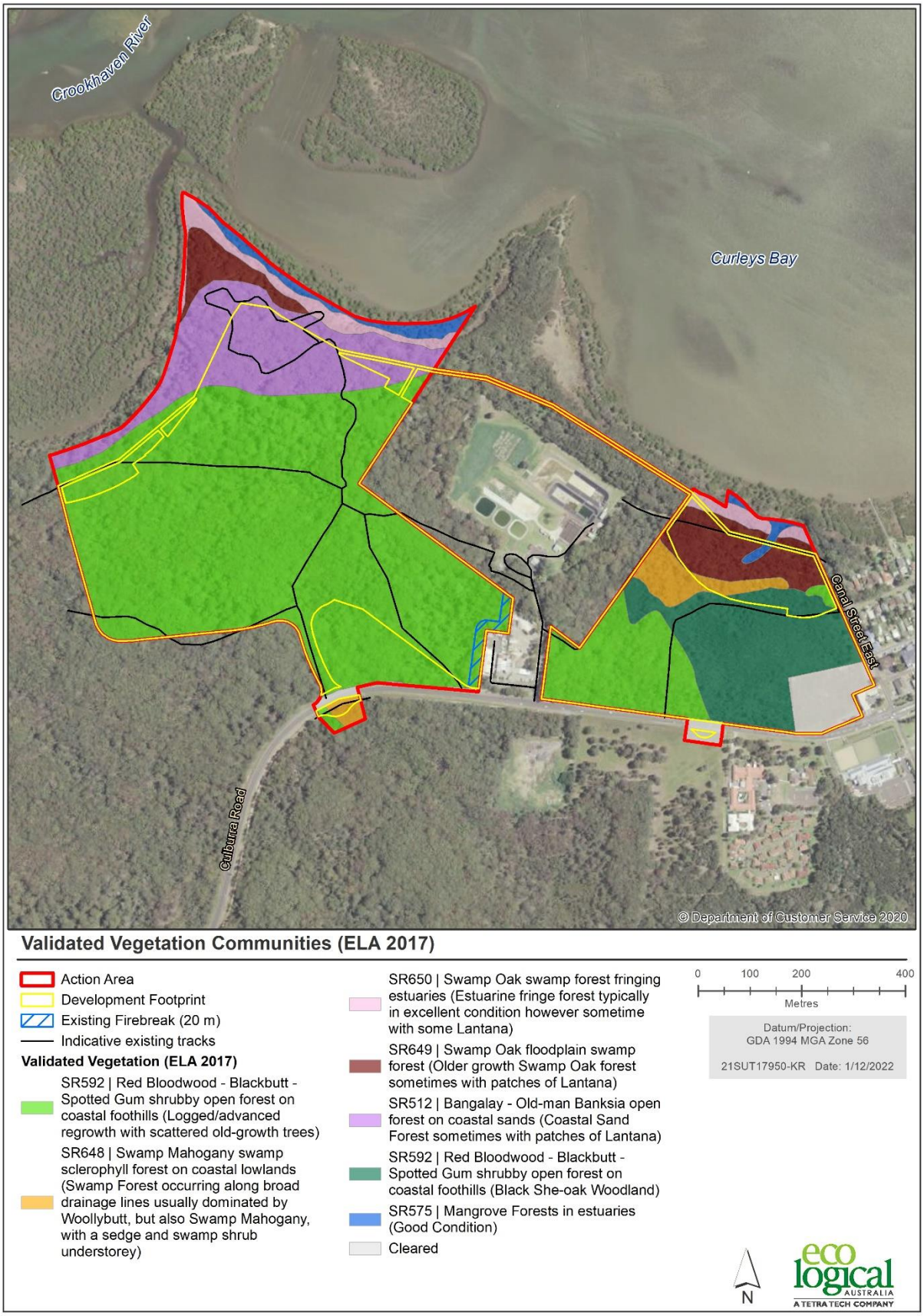

Figure 12: Validated vegetation across the action area

Figure 13: Hollow bearing trees in the action area

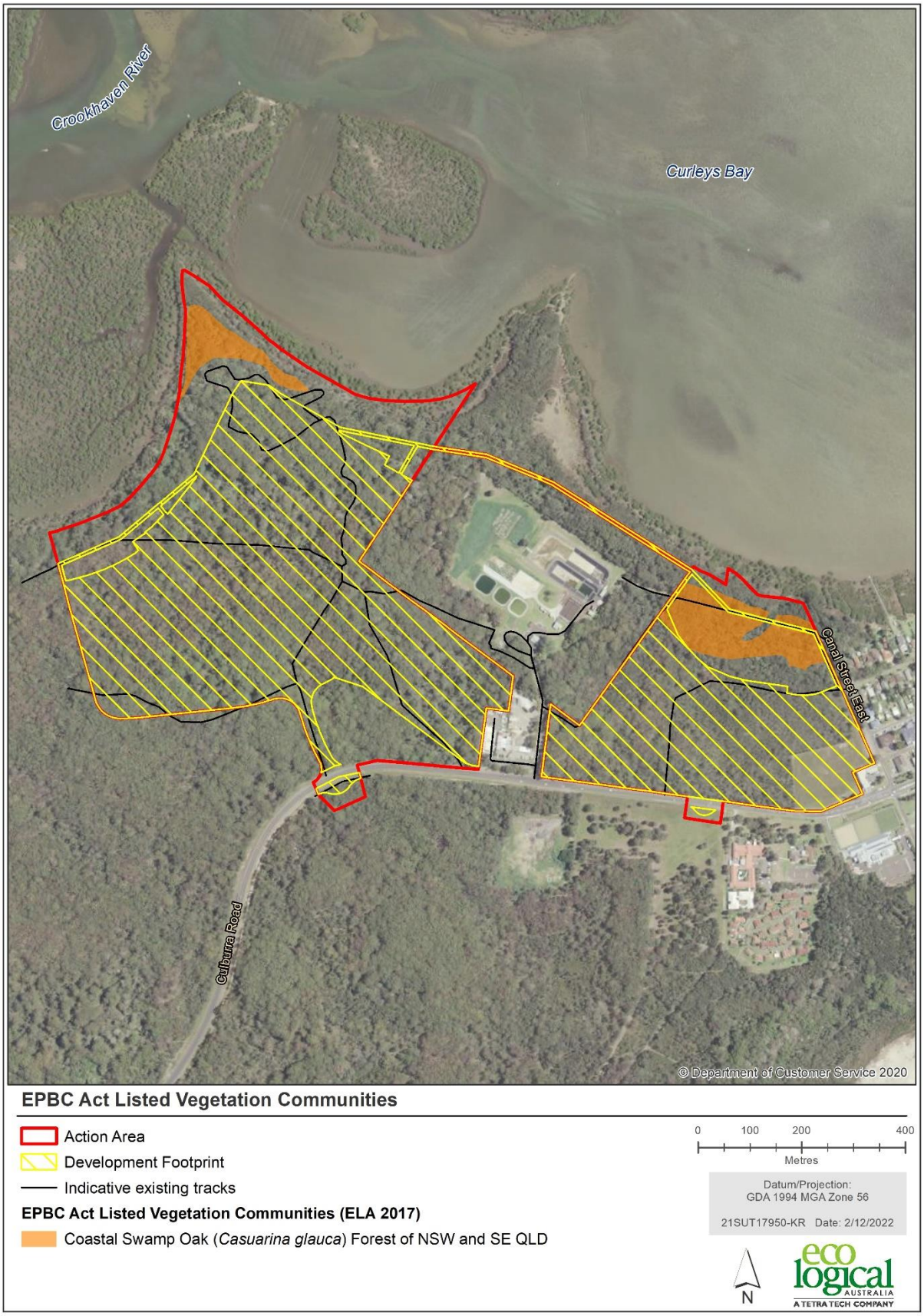

Figure 14: Field validated threatened ecological communities

Figure 15: Targeted survey effort results and BioNet records for threatened flora and fauna in the action area and surrounds

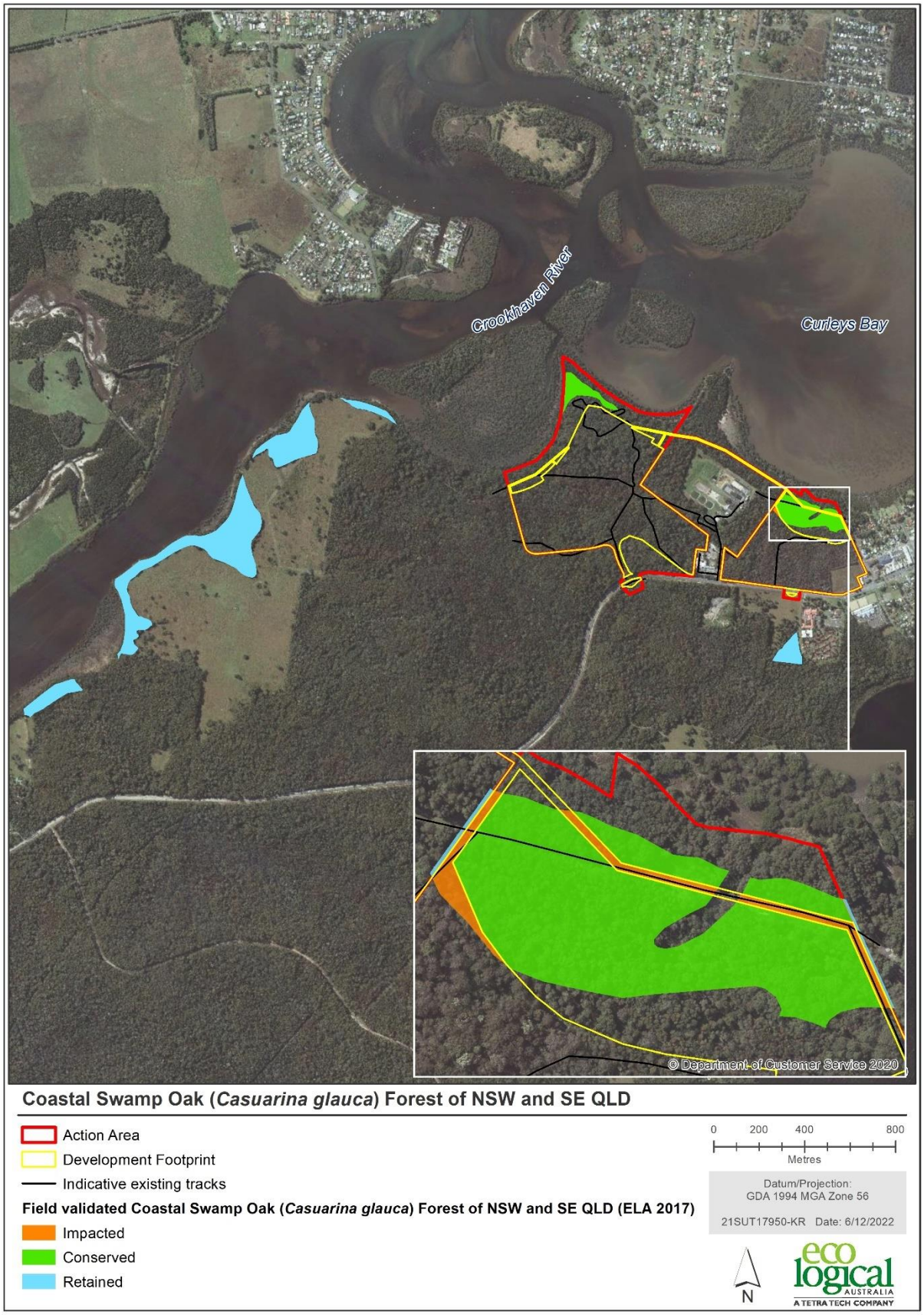

Figure 16: Proposed impact and conservation areas for Coastal Swamp Oak (Casuarina glauca) Forest

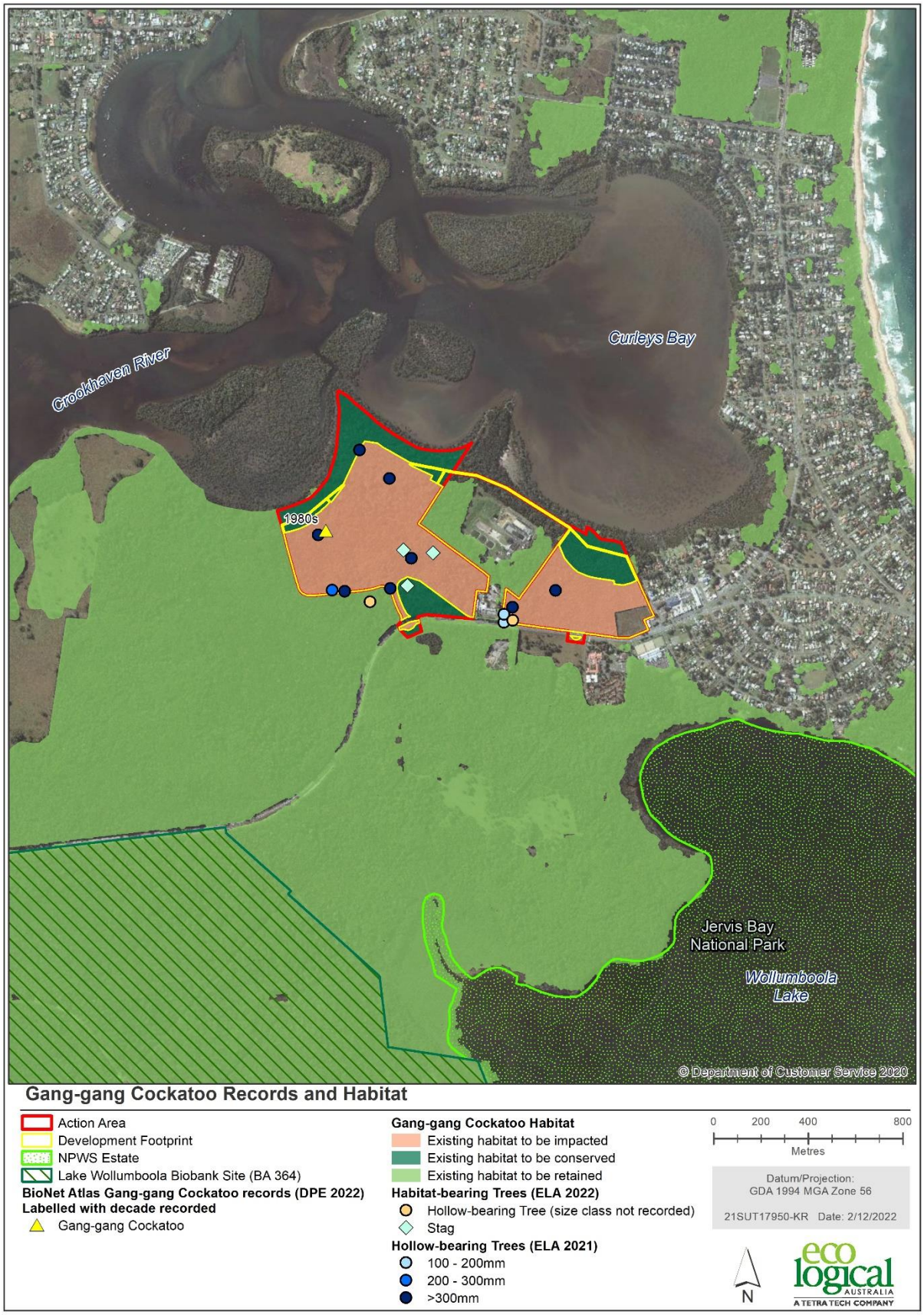

Figure 17: Gang-gang Cockatoo records and habitat in the action area

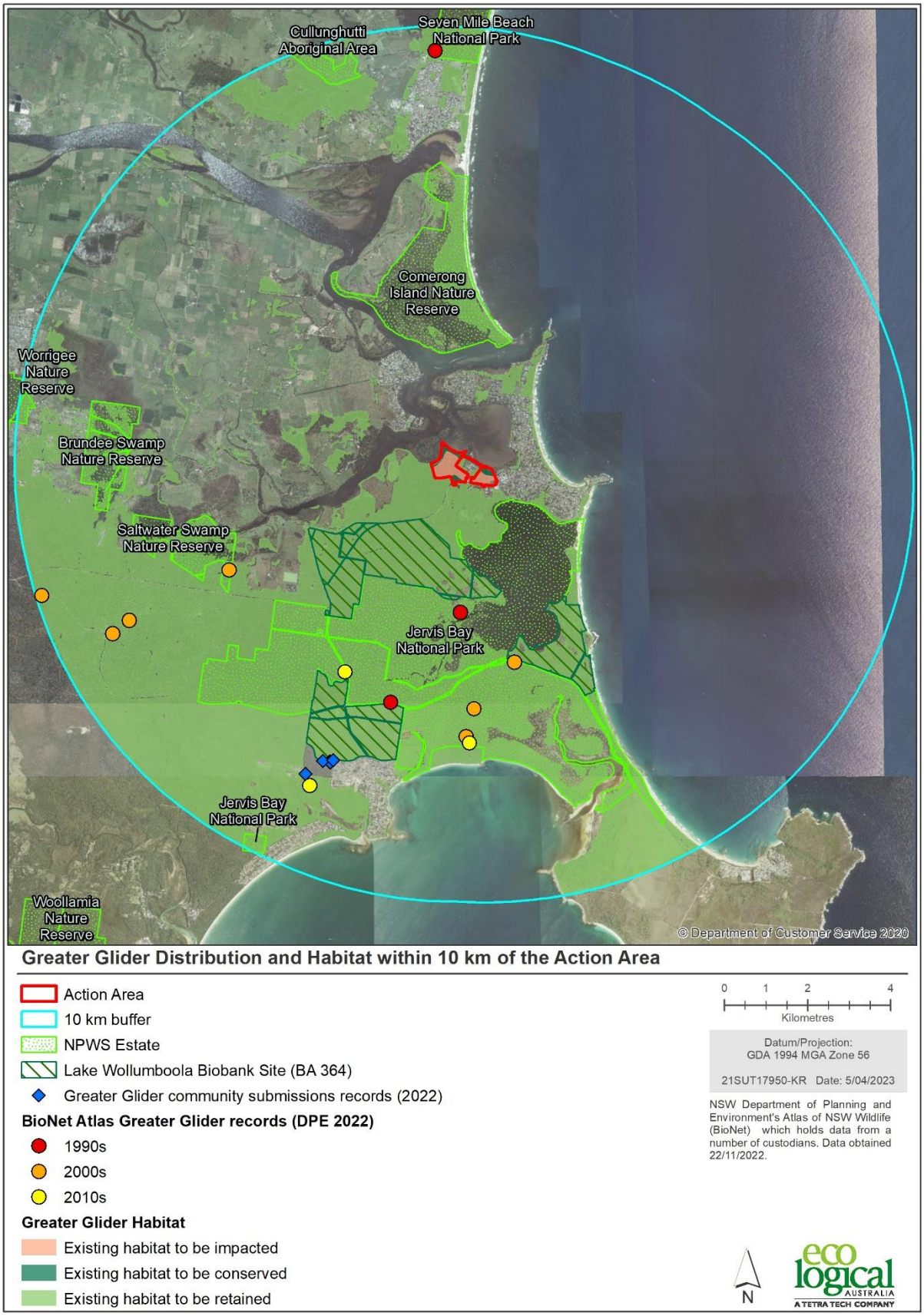

Figure 18: Gang-gang Cockatoo records and habitat within 10 km of the action area

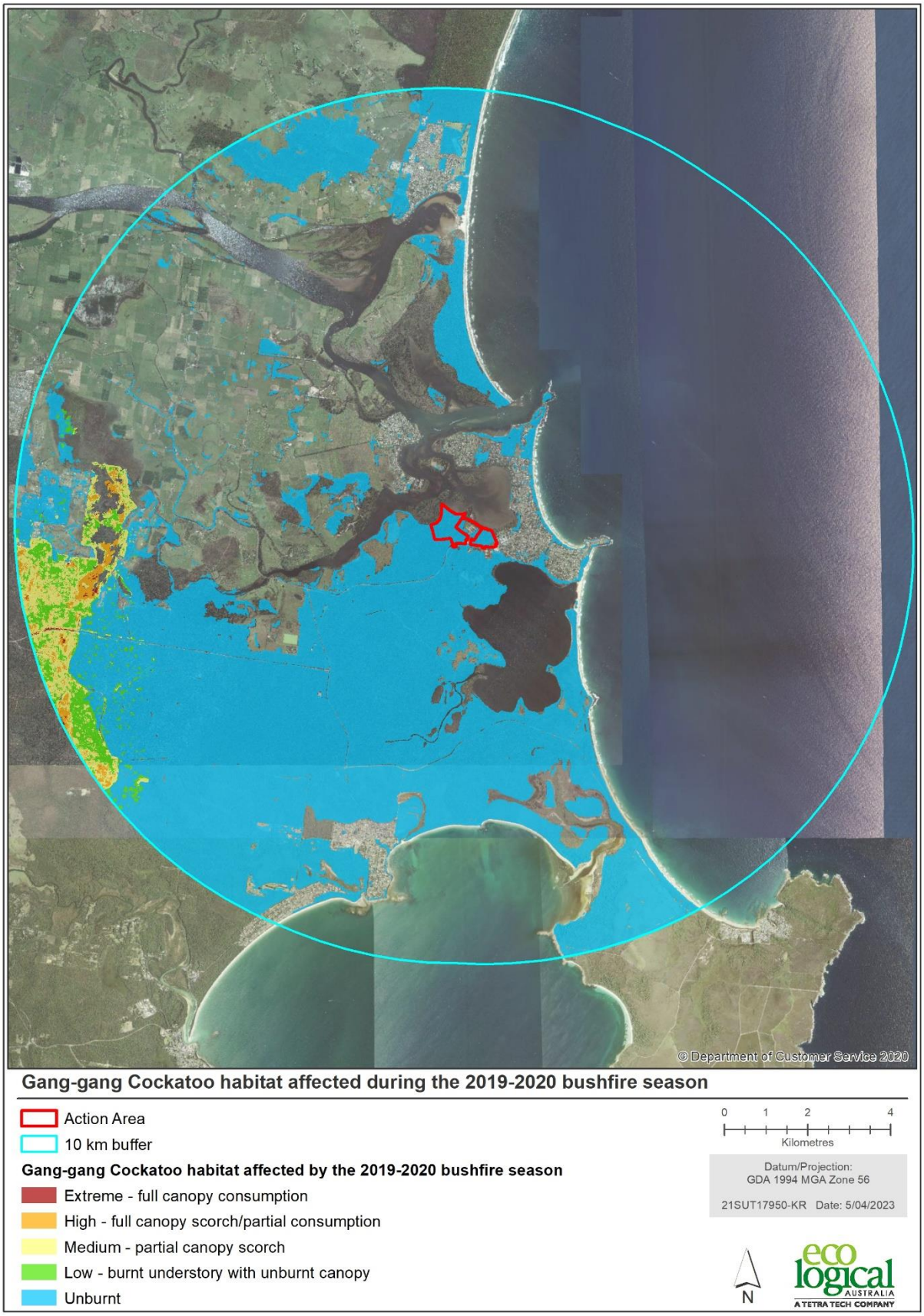

Figure 19: Impacts of the 2019 – 2020 bushfires on potential Gang-gang Cockatoo habitat within 10 km of the action area

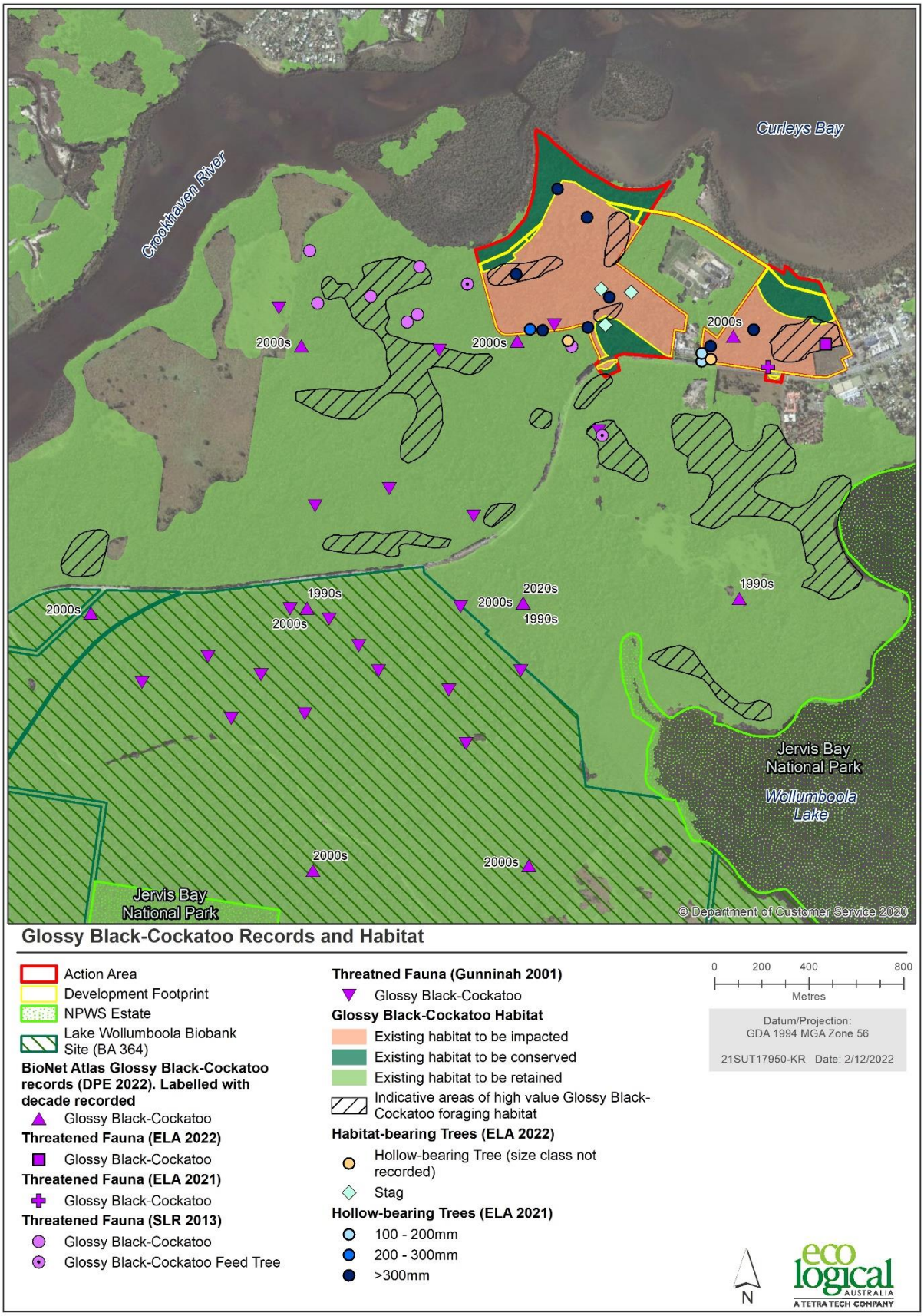

Figure 20: Glossy Black-cockatoo records and habitat in the action area

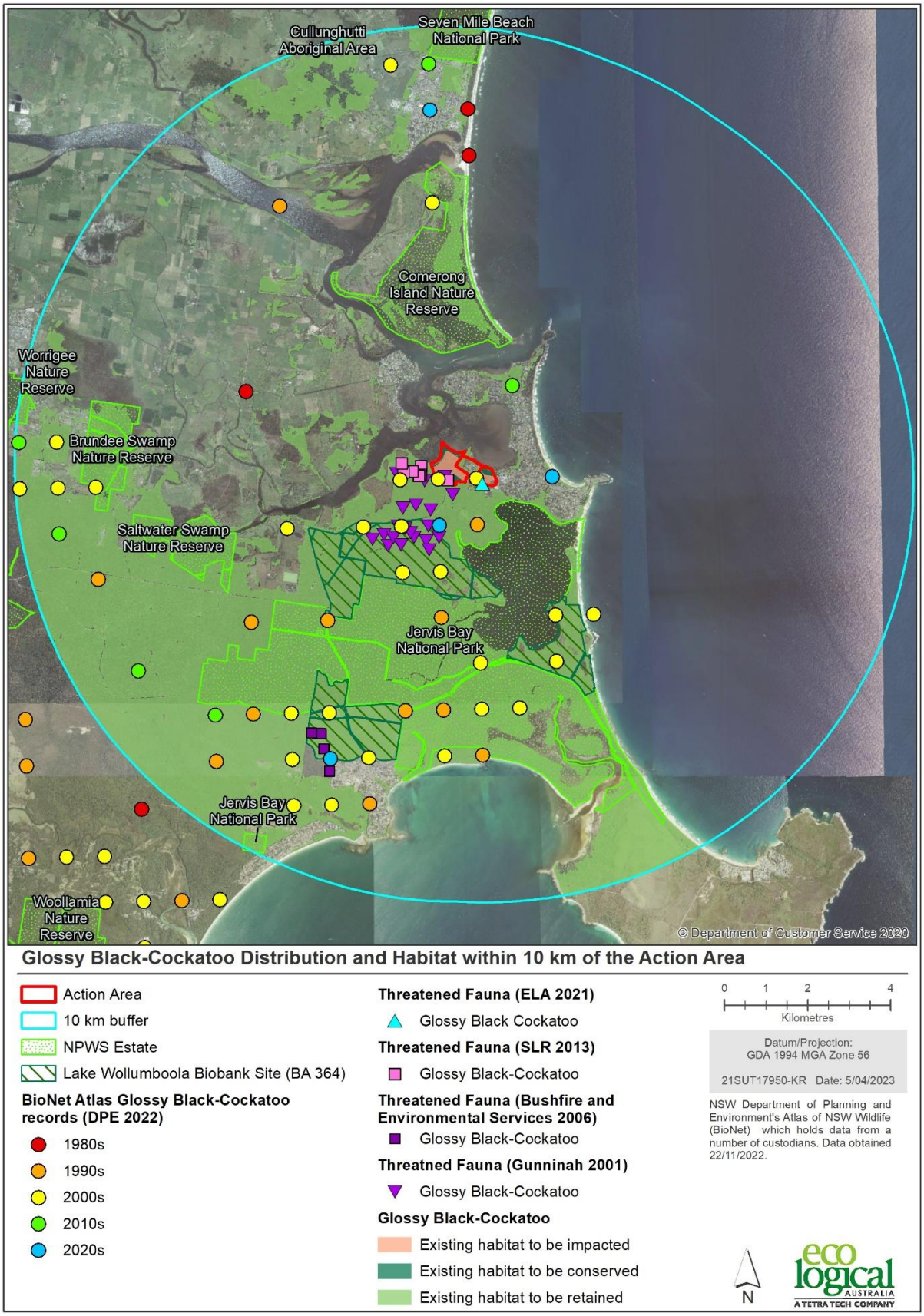

Figure 21: Glossy Black-cockatoo distribution and habitat within 10 km of the action area

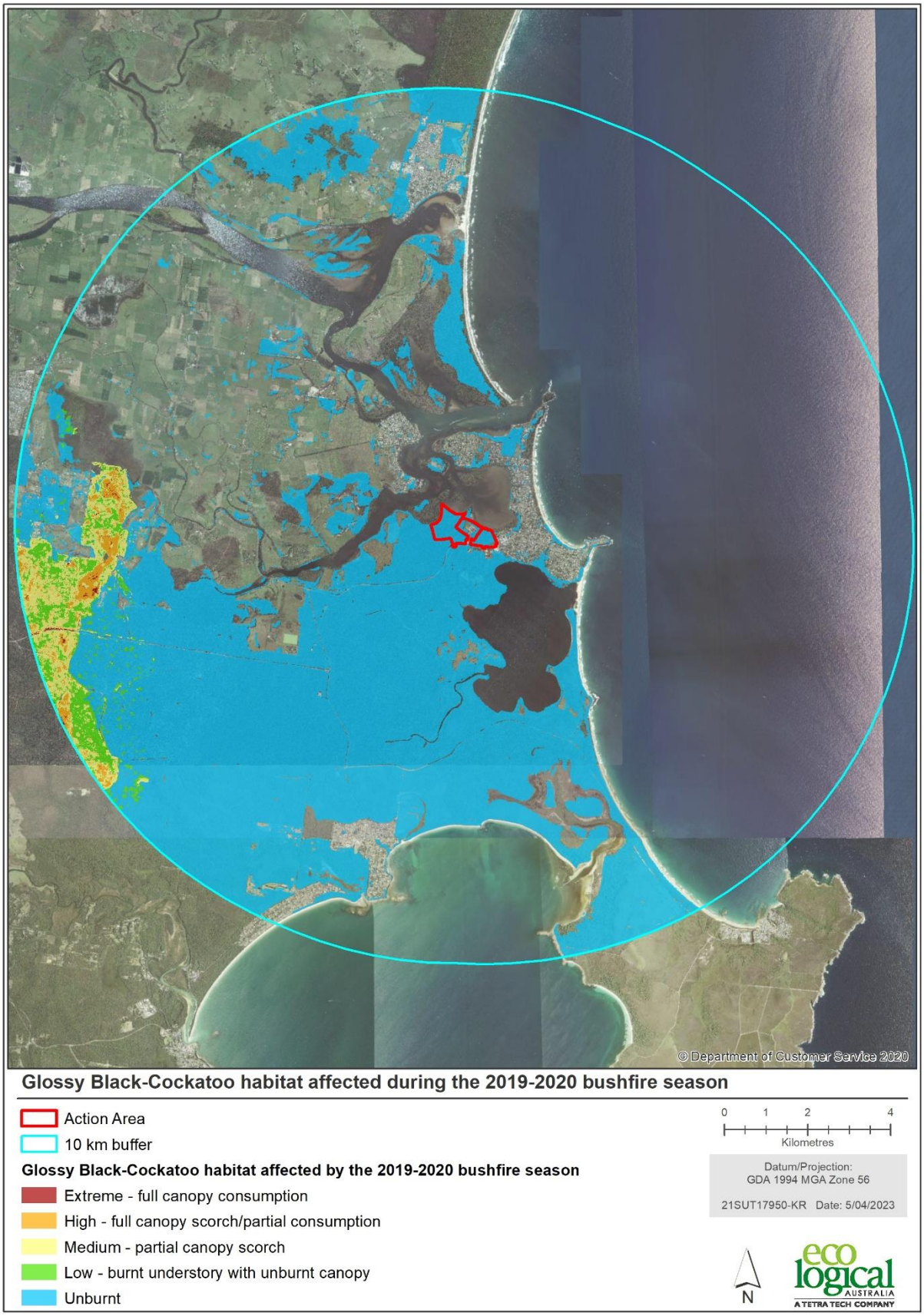

Figure 22: Glossy Black-cockatoo habitat affected by the 2019 – 2020 bushfires within 10 km of the action area

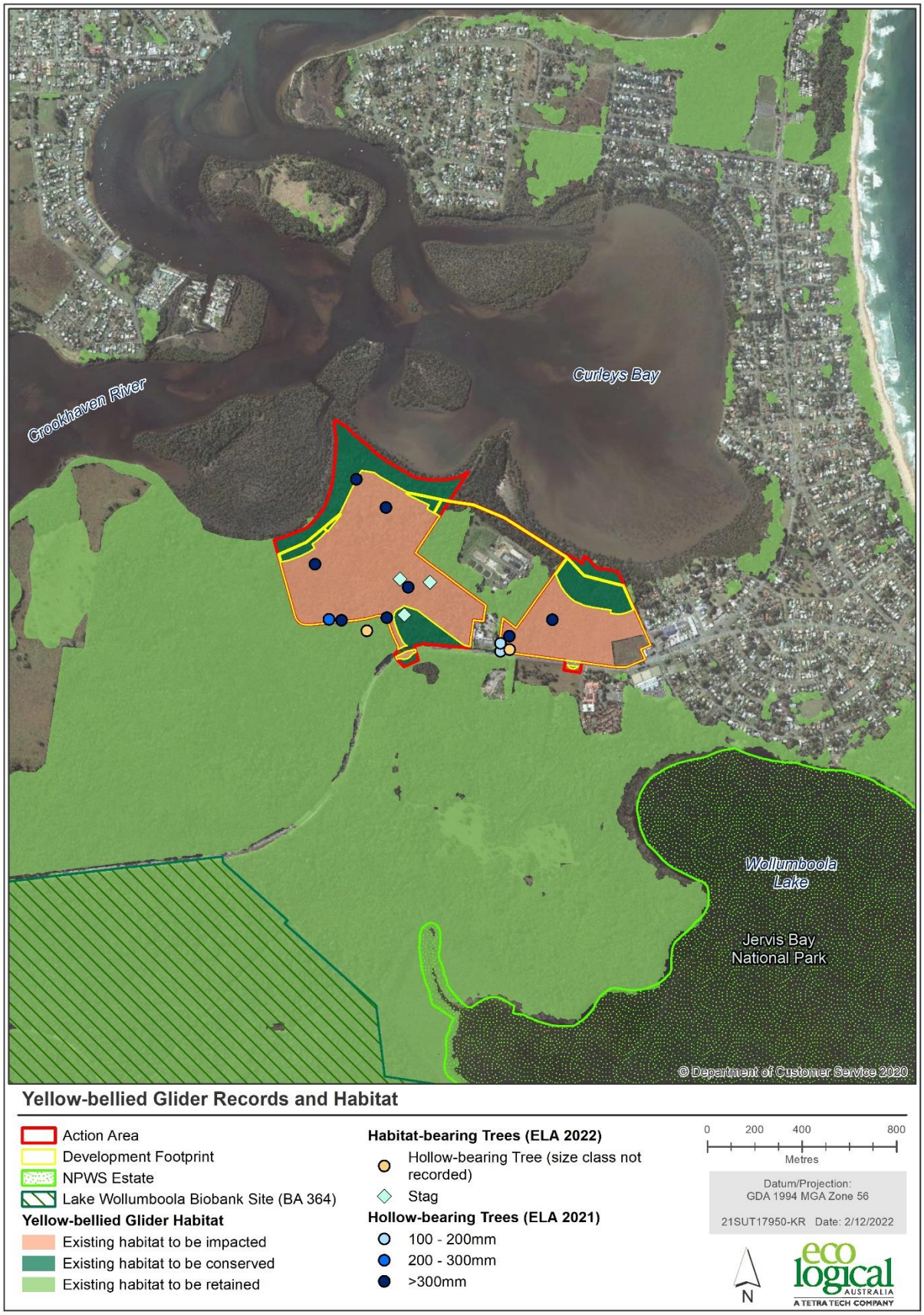

Figure 23: Yellow-bellied Glider records and habitat in the action area

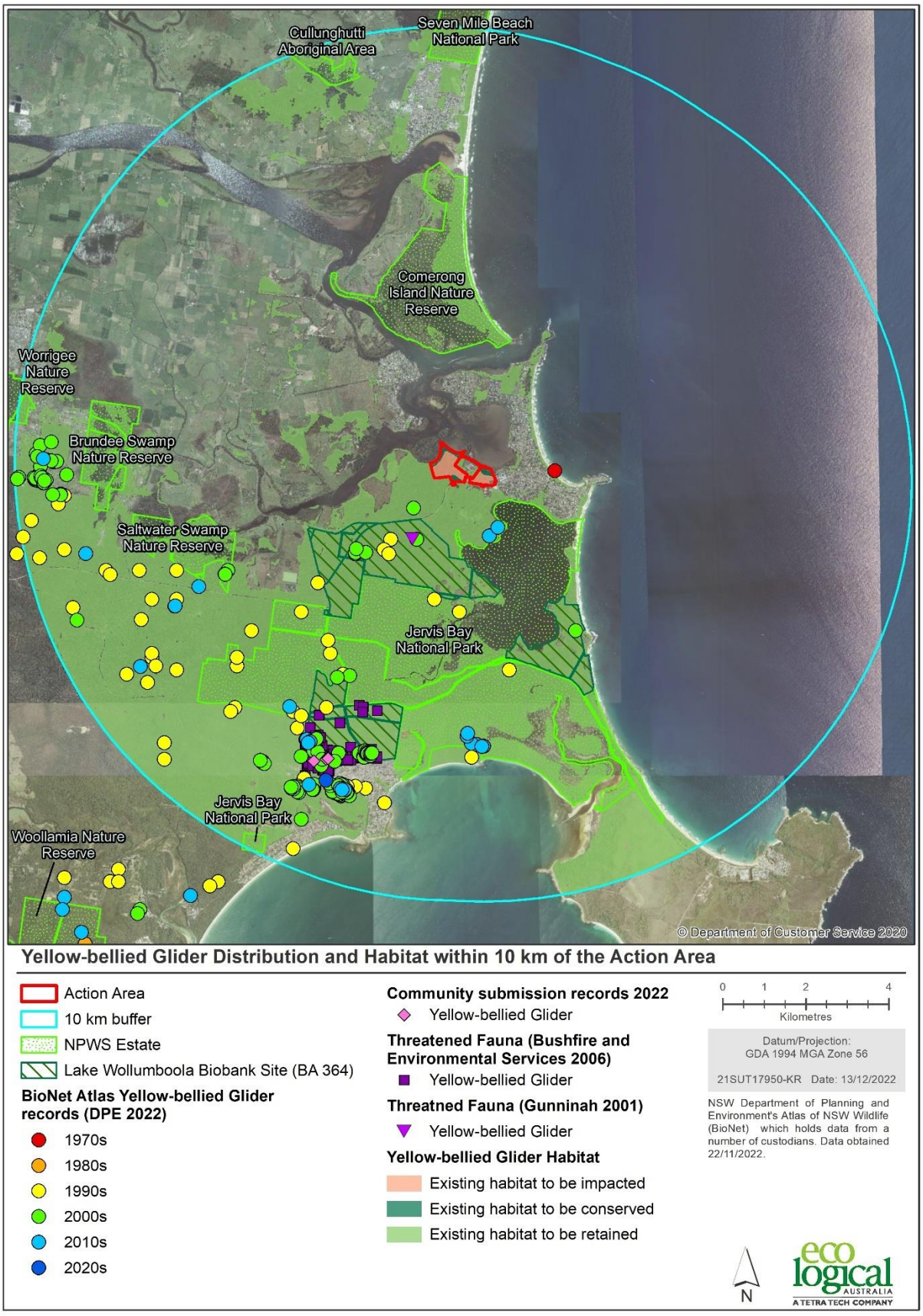

Figure 24: Yellow-bellied Glider distribution and habitat within 10 km of the action area

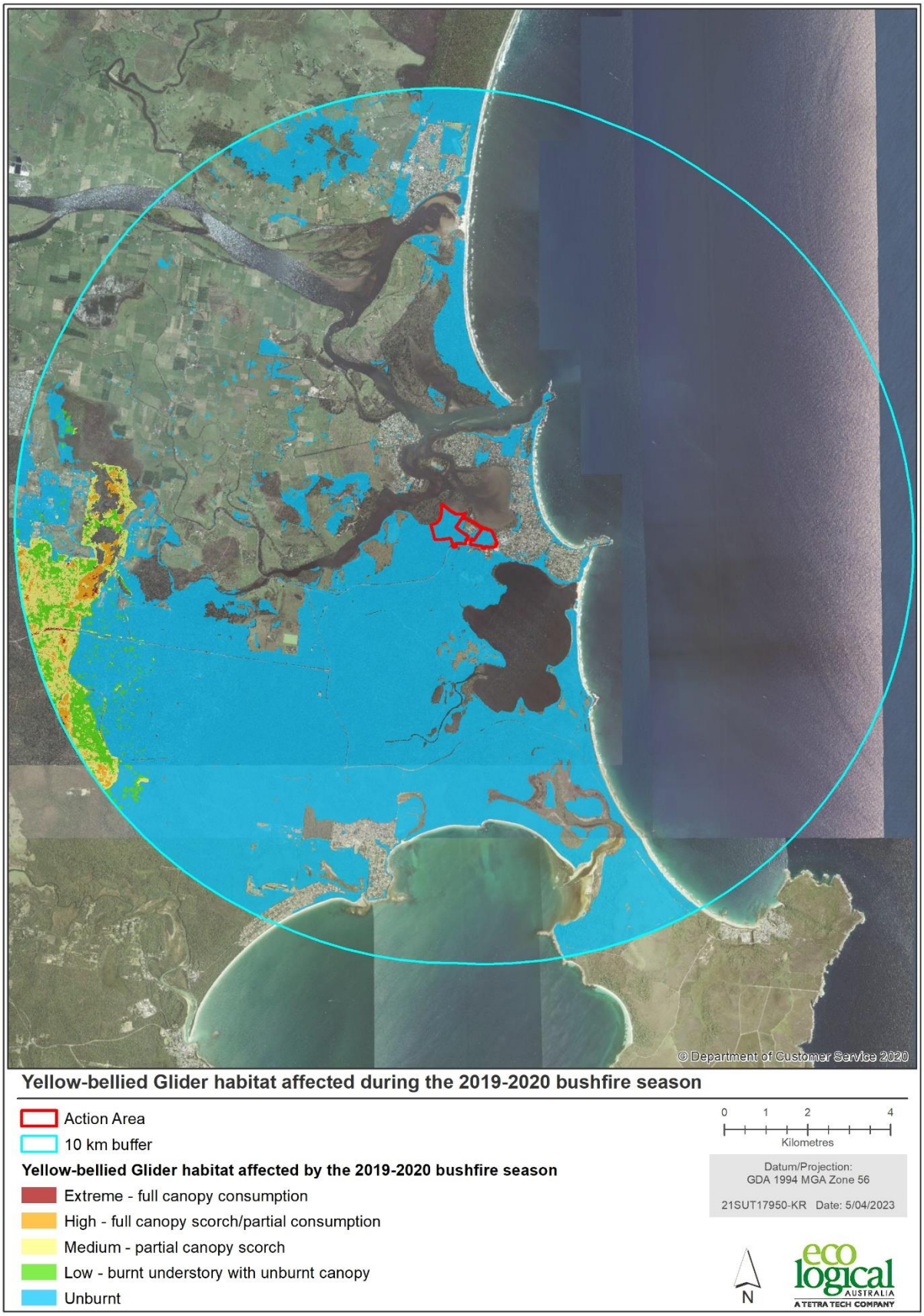

Figure 25: Yellow-bellied Glider habitat affected by the 2019 – 2020 bushfires within 10 km of the action area

Figure 26: Grey-headed Flying-fox records and habitat in the action area

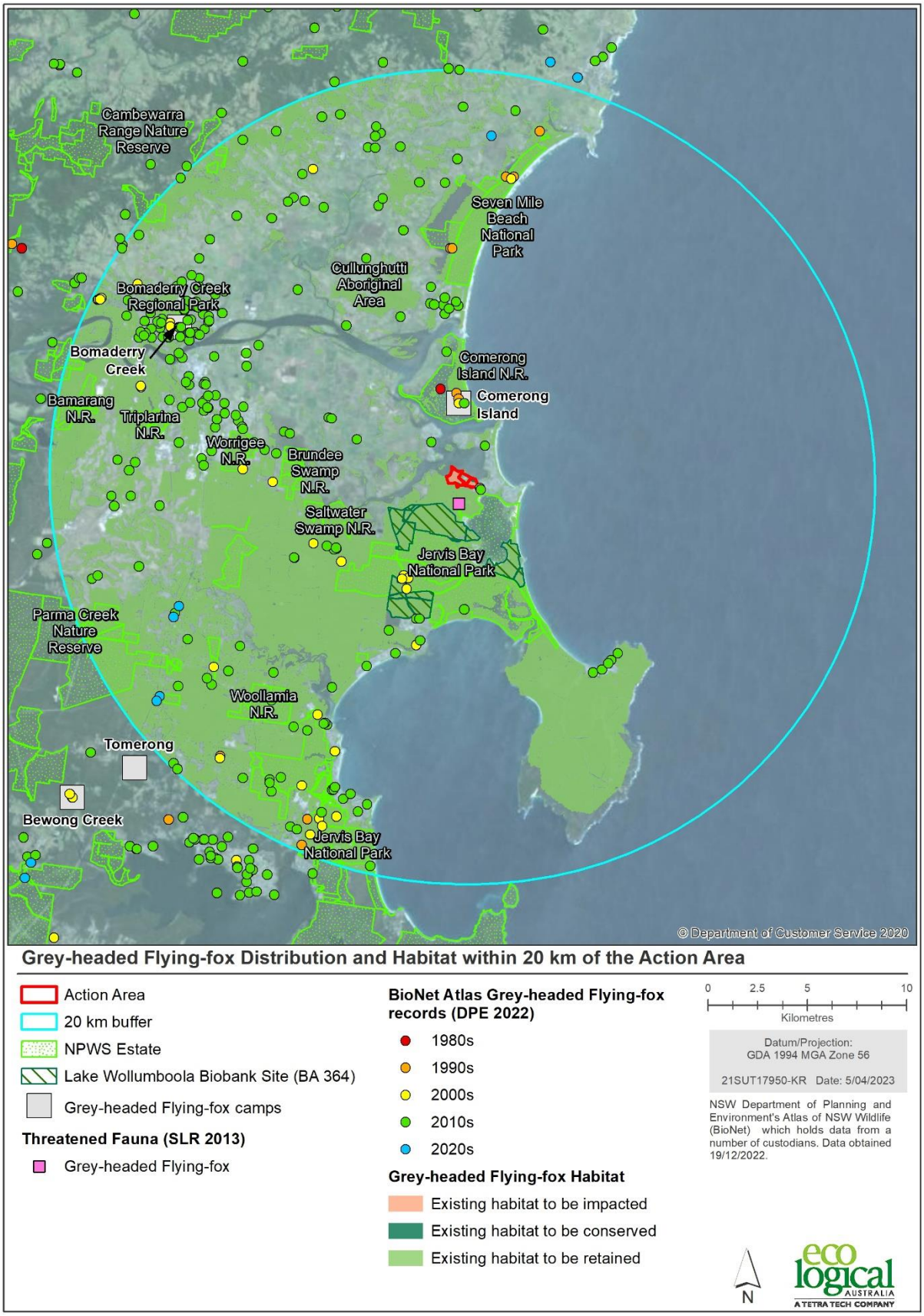

Figure 27: Grey-headed Flying-fox distribution and habitat within 20 km of the action area

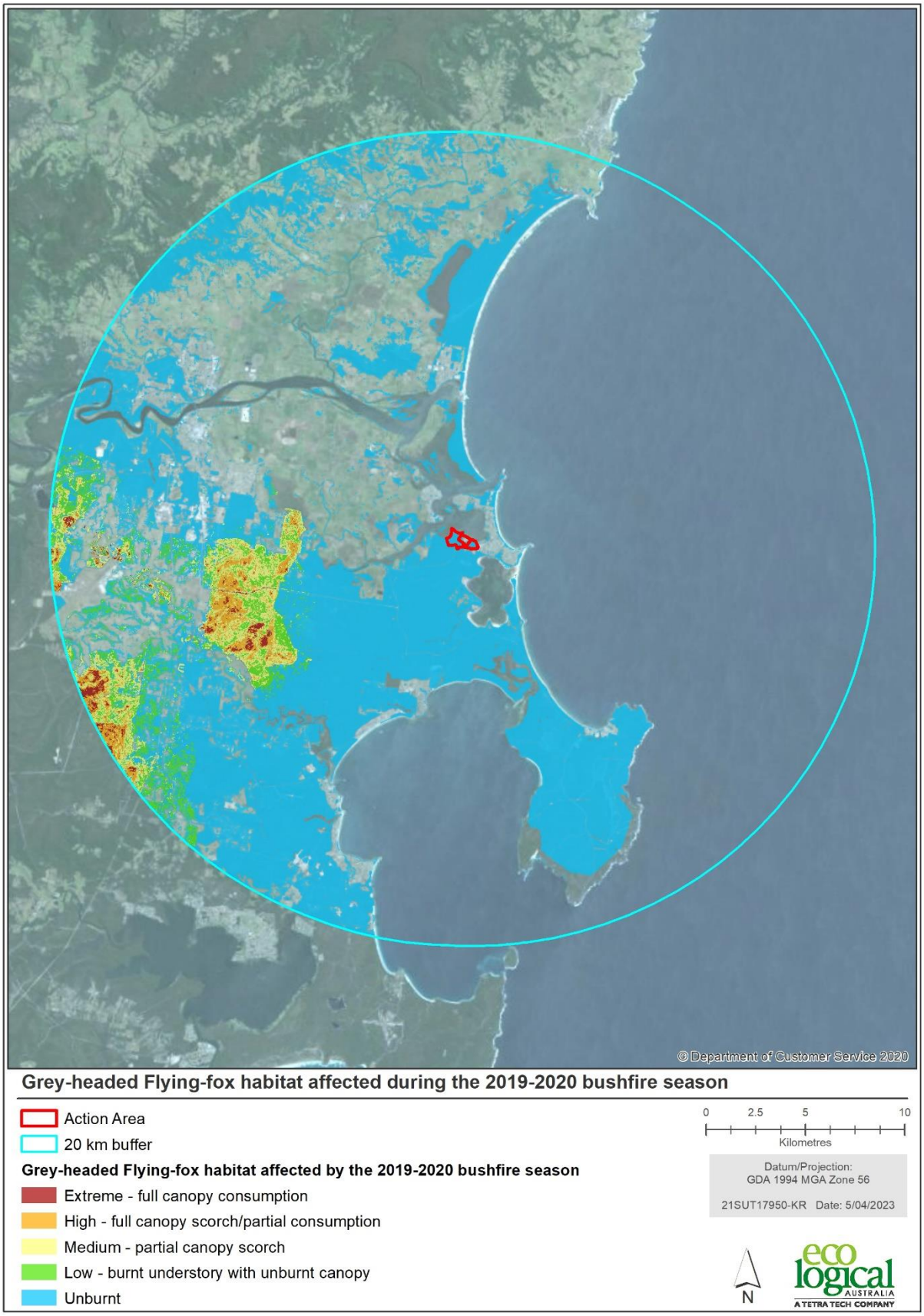

Figure 28: Grey-headed Flying-fox habitat affected by the 2019 – 2020 bushfires within 20 km of the action area

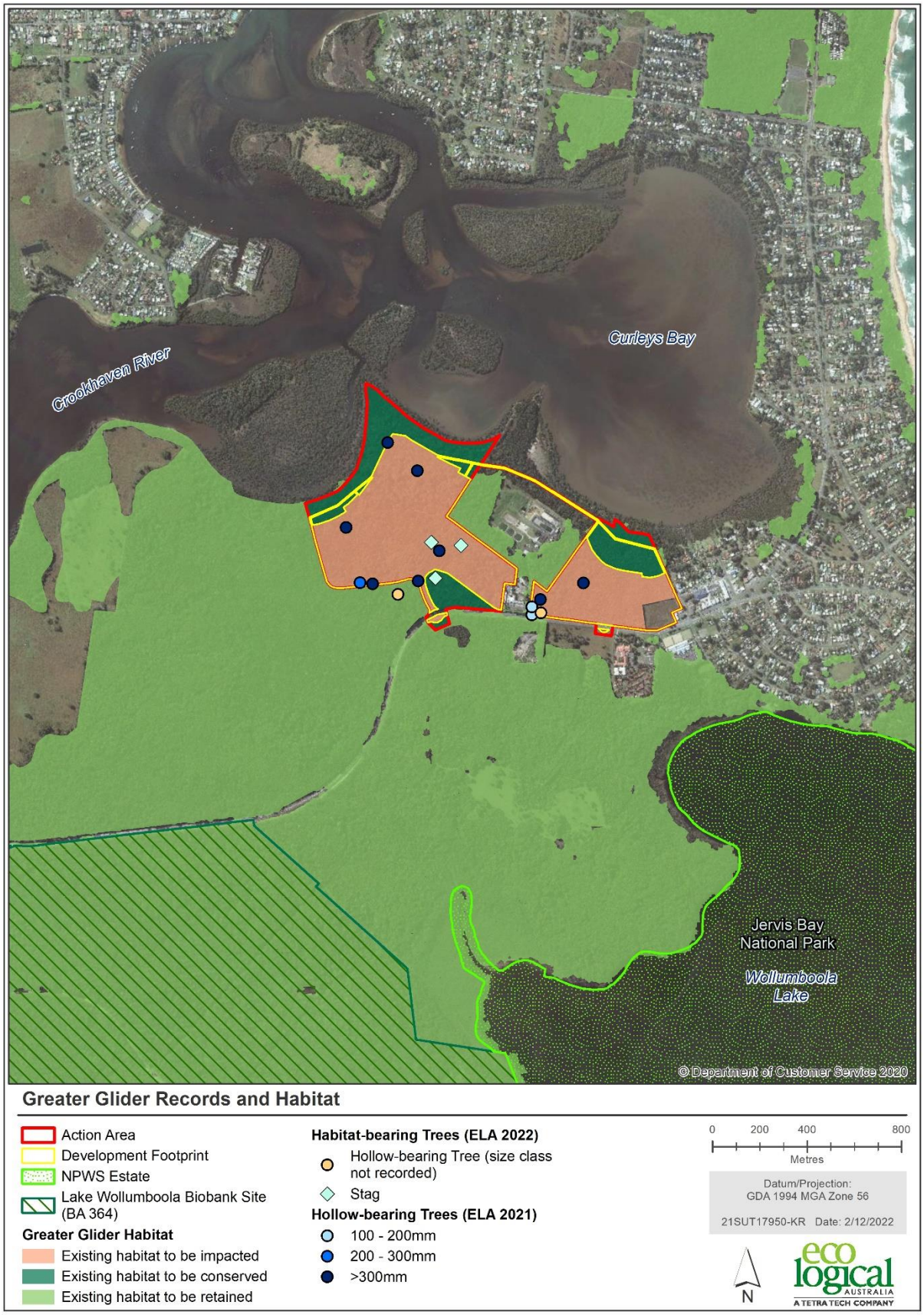

Figure 29: Greater Glider records and habitat in the action area

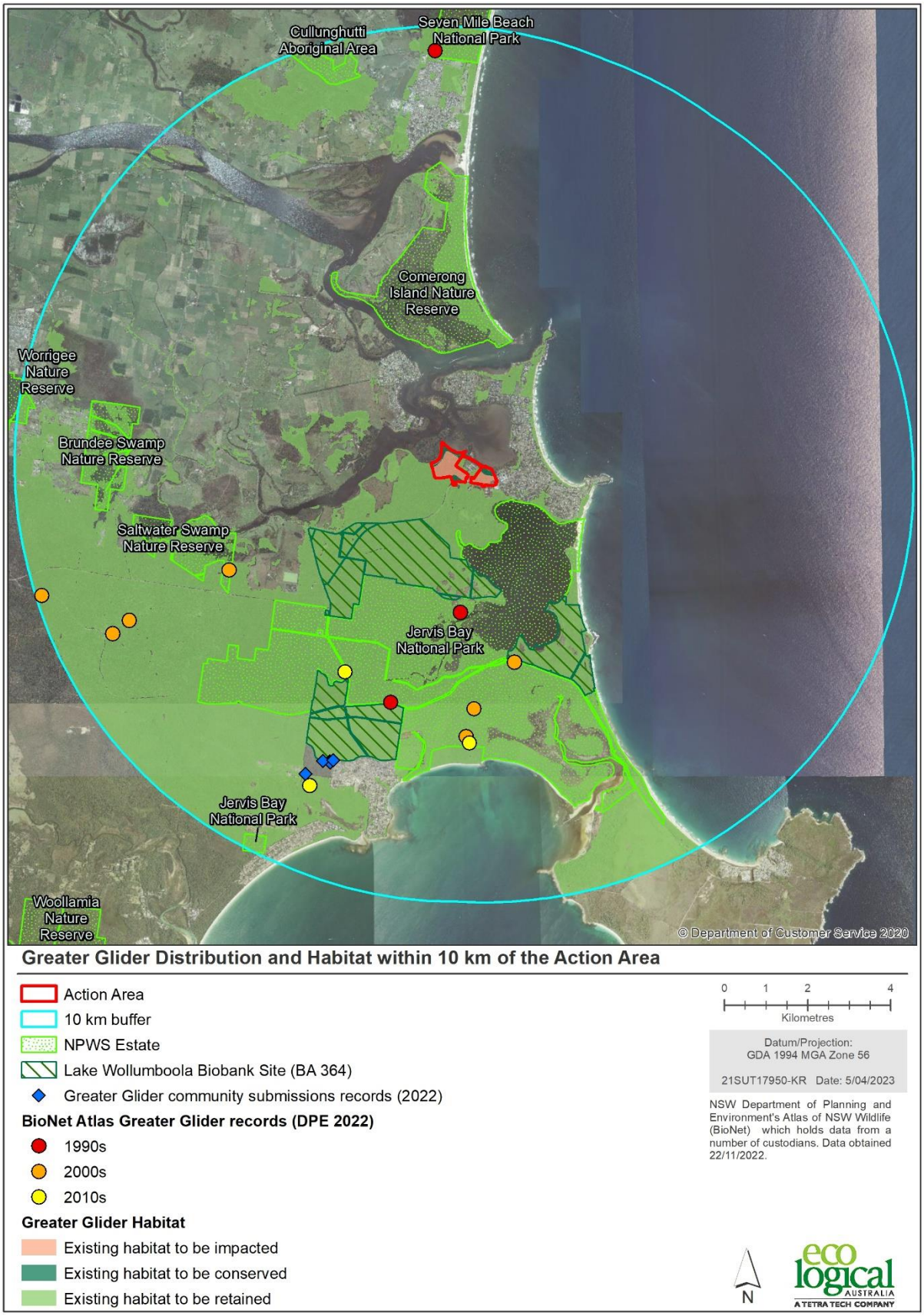

Figure 30: Greater Glider distribution and habitat within 10 km of the action area

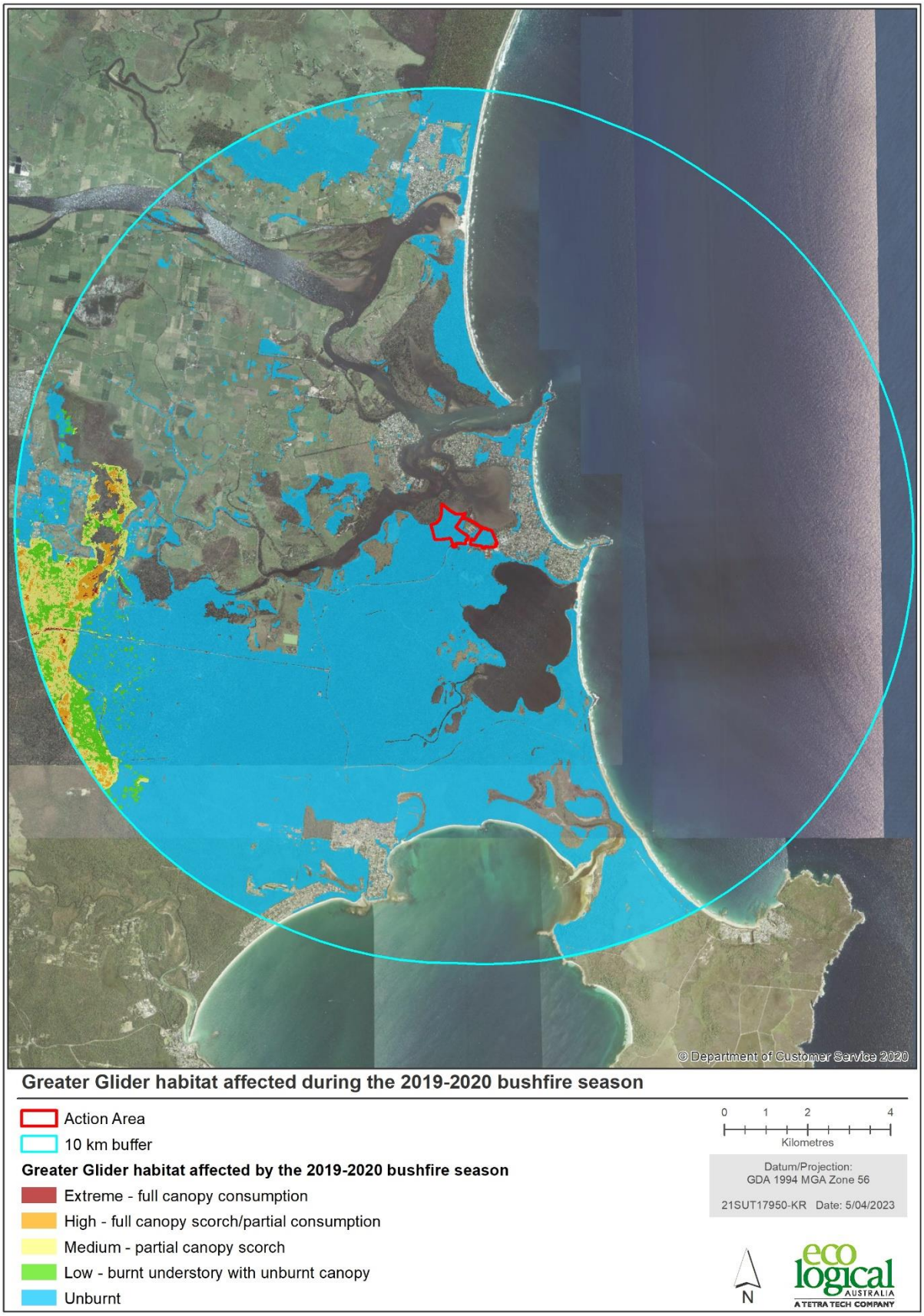

Figure 31: Greater Glider habitat affected by the 2019 – 2020 bushfires within 10 km of the action area

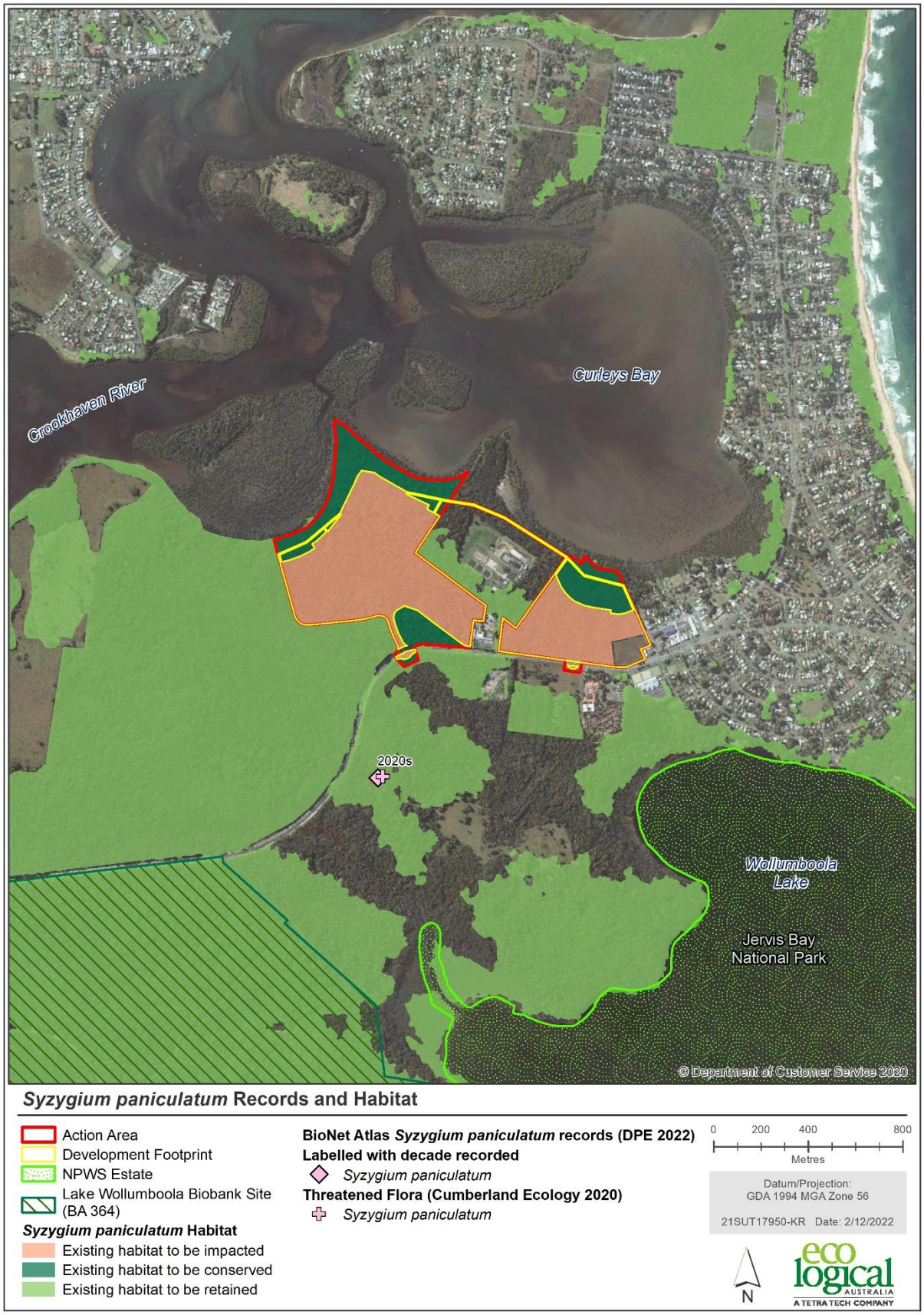

Figure 32: Records and habitat for Syzygium paniculatum in the action area

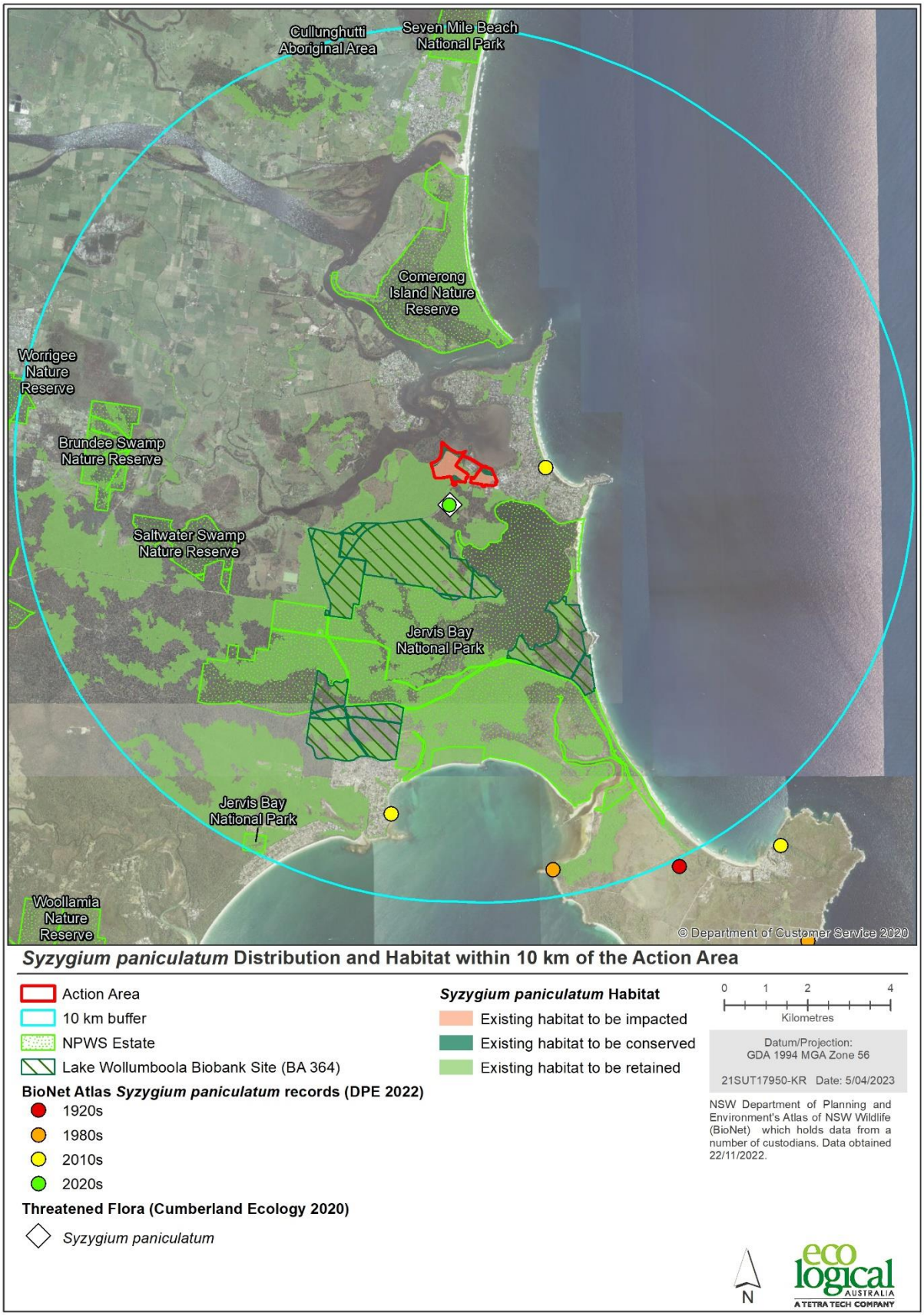

Figure 33: Distribution and habitat for Syzygium paniculatum in the locality

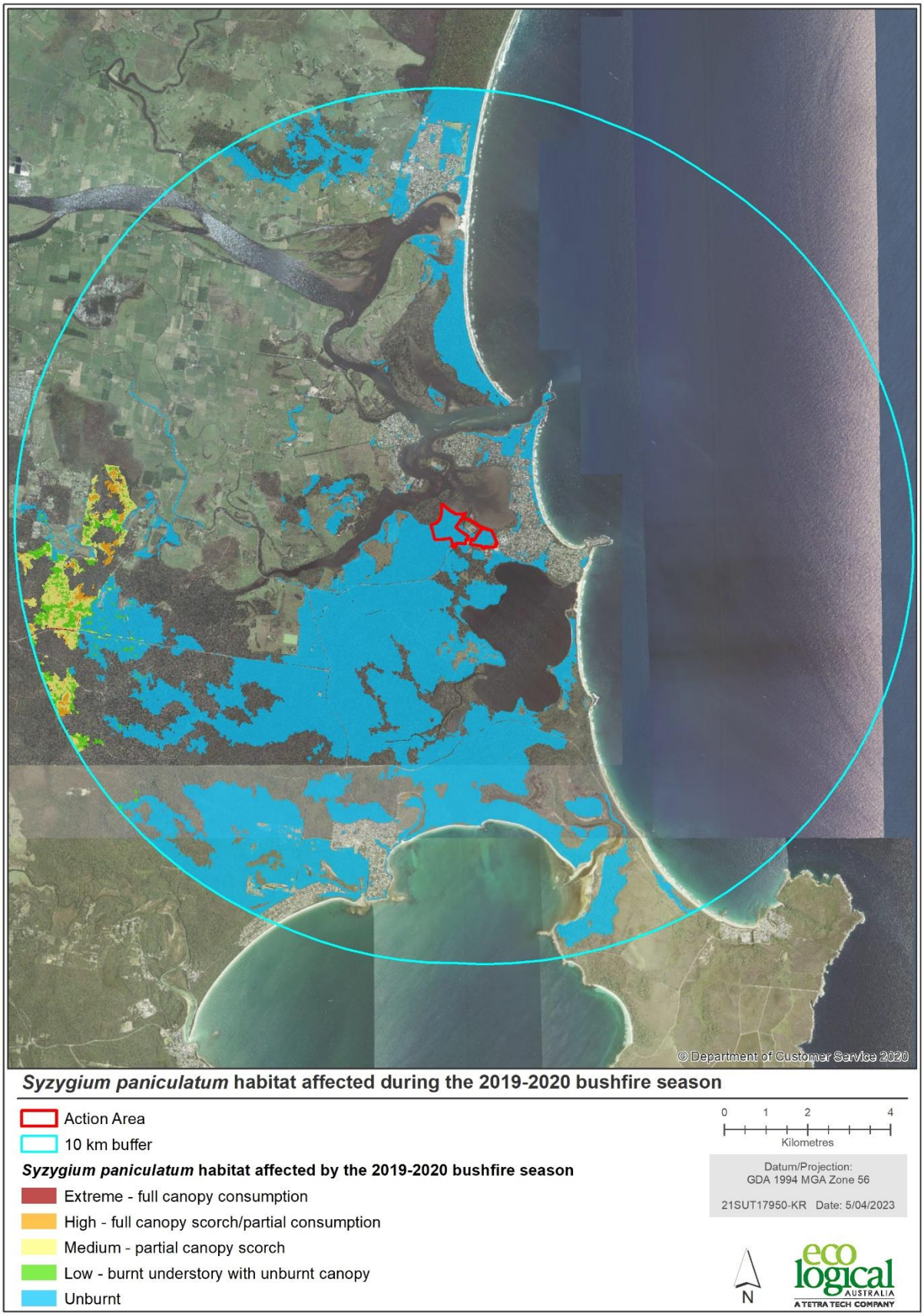

Figure 34: Potential habitat for Syzygium paniculatum affected by the 2019 – 2020 bushfires

Appendix D Targeted survey effort and methodology

5.2. Survey effort and method

SURVEY METHODOLOGY ELA 2021 – 2022

The dates and person hours of the 2021 – 2022 survey effort is described in Table 13. All surveys were completed by two ELA ecologists.

Threatened flora

Threatened flora surveys were completed in areas of suitable habitat for the following species:

- *Caladenia tessellata*
- *Calochilus pulchellus*
- *Cryptostylis hunteriana*
- *Prasophyllum affine*
- *Pterostylis gibbosa*
- *Pterostylis vernalis*
- *Rhizanthella slateri*
- *Syzygium paniculatum.*

Parallel transects between 5 and 10 m apart were completed. Where the vegetation was dense and visibility was low, transects were 5 m apart. In more open vegetation where visibility was high, transects were 10 m apart.

Diurnal bird surveys

Diurnal bird surveys were conducted to detect large stick nests that could provide suitable breeding habitat for the White-bellied Sea Eagle and Osprey. The entire action area was traversed on foot and the canopy was surveyed.

Amphibian surveys

Amphibian surveys were conducted for *Litoria aurea* (Green and Golden Bell Frog, GGBF) within potential habitat (dams).

Call-playback of GGBF and nocturnal searches were conducted over four nights at two small farm dams containing potential habitat. Nocturnal surveys involved broadcasting of calls for a minimum of five minutes followed by at least five minutes over four nights. Spotlighting was also conducted following the call playback.

Spotlighting

Spotlighting for arboreal fauna was completed across the action area on 12 – 16 December 2021. Surveys commenced after dusk during nightfall and included random meanders through the action area. The surveyors were looking for eye shine or activity.

Hair tubes

A total of 130 hair tubes were set within potential habitat for White-footed Dunnart and New Holland Mouse. 75 Hair tubes were set from 5 April – 15 June 2022 and 55 hair tubes were set from 14 April – 15 June 2022 (70 and 61 nights respectively; total of 8,605 hair tube trapping nights).

Hair samples were analysed by Georgiana Storey ('*Scats About',* ANU).

Remote cameras

Infrared remote cameras were used in conjunction with bait stations to identify arboreal fauna species. Thirty-(30) arboreal cameras were placed approximately 1 – 2 m off the ground and secured to a tree. Bait stations were secured to an opposing tree at an approximate height of 1.5 – 2 m and were parallel with the camera. Bait consisted of honey, peanut butter, oats, and with / without sardines. Cameras were dispersed throughout potential habitat for target species.

19 cameras were set from 5 April – 15 June 2022 and 11 cameras were set from 14 April – 15 June 2022, totalling 131 survey nights equating to 2,001 camera survey nights.

SURVEY METHOD ELA 2015 – 2017

Threatened flora

Targeted surveys were conducted for one threatened orchid species, *Cryptostylis hunteriana* (Leafless Tongue Orchid). Surveys involved systematic traverses in potential habitat conducted over 3 days during 10 -14 December 2015 by ELA staff (Table 13, Table 14 and Figure 11). A combination of transects and random meander were undertaken over approximately 3 persons survey days in potential habitat.

Threatened fauna

The survey method is generally derived from the *Threatened Species Survey and Assessment Guidelines* (DEC 2004) and EPBC Act guidelines. Surveys were conducted by ELA over several months from 7 December 2016 to 10 February 2017.

It should be noted that the eastern portion of the BCAA has been subject to intensive surveys by previous ecological consultants (see literature review section above). ELA consulted with OEH regarding proposed survey design and it was determined that the following survey design was suitable for the candidate species.

Details of the survey method, locations are provided below and are summarised in Figure 10, Table 13 and Table 15.

Elliot B traps (arboreal)

Three (3) sites of 12 Elliot B traps were set within potential habitat for target species (Figure 10, Table 13 and Table 15). Each trap site was set in a line, with traps approximately 20 m apart. Elliot B traps were deployed from 12 to 16 December 2016 (4 nights; total of 144 Elliot B trapping nights). Traps were set approximately 2-3 m up a tree, attached to a wooden stage drilled to the tree trunk. Traps were baited with a mixture of peanut butter, honey, oats, and sardines, and included insulation. Traps were covered with a plastic bag in the event of rain.

Remote camera traps (arboreal)

Infrared remote cameras were used in conjunction with bait stations to identify arboreal fauna species. Thirty-six arboreal (36) cameras were placed approximately 1 – 2 m off the ground and secured to a tree. Bait stations were secured to an opposing tree at an approximate height of 1.5 – 2 m. Bait consisted of honey, peanut butter, oats, and sardines. Cameras were dispersed throughout potential habitat for target species.

Remote cameras were left in-situ from 9 December 2016 to 8 February 2017 (62 nights), equating to a total of 2232 camera nights.

Call playback

Spotlighting was conducted on 7, 12, 13 and 14 December 2016 within the action area for arboreal mammals, including Yellow-bellied Glider, Greater Glider and Koala.

Spotlight survey

Spotlighting survey was conducted after each broadcast within the action area on 7, 12, 13 and 14 December 2016. Two ecologists' traversed tracks and bushland with hand held spotlights and head torches during the survey. A total of approximately 8 persons hours were spent spotlighting.

Remote camera traps (terrestrial)

Infrared remote cameras were used in conjunction with bait stations to identify terrestrial fauna species. Four (4) cameras were secured approximately 1 m up a tree and angled towards the ground, where a bait station was deployed, secured by a tent peg. Bait consisted of honey, peanut butter, oats, and sardines. Cameras were dispersed throughout potential habitat for target species.

Remote cameras were left in-situ from 9 December 2016 to 8 February 2017 (62 nights), equating to a total of 248 camera nights.

Pitfall traps

Two 200 m transects of 15 traps each (5 clusters / groups of 3 traps, each cluster spaced 50 m apart) were set within potential habitat for White-footed Dunnart and Eastern Pygmy-possum.

Trapping was conducted over 3 sessions (11 nights total; a total of 1,440 pitfall trapping nights):

- 12 – 16 December 2016 (4 nights),
- 10 -14 January 2017 (4 nights),
- 6 – 10 February 2017 (4 nights)*.

During trapping, pitfalls contained a thin layer of leaf litter to provide shelter to trapped fauna. Pitfalls contained a small block of foam to ensure fauna could float in the event of rain. A small hole was drilled in the base of each pitfall trap to allow water to drain out in the event of rain. Each cluster of pitfalls included a drift fence approximately 30 – 40 cm high, dug into a trench, which passed over each pitfall trap. Drift-fences were maintained throughout the survey, as some were infrequently impacted by weather and cattle. Pitfall traps were closed between trapping sessions.

*Traps were closed on 7 February 2017 due to heavy rainfall.

Elliot A traps

A combination of Elliot A traps and hair tubes (see next section below) were conducted in addition to pitfall trapping to target White-footed Dunnart and Eastern Pygmy-possum.

Two (2) sites of 20 Elliot A traps were set within potential habitat for White-footed Dunnart; a total of 40 traps (Figure 10, Table 13 and Table 15.). Each trap site was set in a grid formation (4x5), with traps approximately 10 m apart. Elliot A traps were deployed from 12 to 16 December 2016 (4 nights; total of 160 Elliot A trapping nights). Traps were set on flat ground adjacent to fallen logs, large tree trunks, or beneath dense vegetation. Traps were baited with a mixture of peanut butter, honey, oats, and sardines, and included insulation. Traps were covered with a plastic bag in the event of rain.

Hair tube

Two (2) sites of 20 hair tubes were set within potential habitat for White-footed Dunnart (a total of 40 hair tubes). Each hair tube was placed within 5 m of an Elliot A trap (Figure 10, Table 13 and Table 15.). Hair tubes were deployed from 9 December 2016 to 8 February 2017 (62 nights; total of 2480 hair tube trapping nights).

Hair samples were analysed by Georgiana Storey (‘*Scats About’,* ANU).

Bird census

Four locations within SEPP 14 Wetlands within 100 m of Crookhaven River were surveyed for migratory and wetland specifically for EPBC listed species. Approximately 20 minutes were spent conducting a census at dawn or dusk. Additional areas surveyed were conducted along the edge of the wetland included searches in suitable habitat for sightings, nests, indicative footprints in mud/sand and feathers.

Opportunistic bird observations were also recorded when conducting fieldwork. Birds were identified based on either direct observation or knowledge of calls.

Songmeters

A total of two (2) songmeters were deployed from 9 to 23 December 2016 within the BCAA. Songmeters were set to record between dawn and dusk. Two songmeters were located within potential habitat for waterbirds species (i.e. Australian Bittern and Black Bittern). Three songmeters were located within potential habitat for migratory bird species. Two (2) hours were selected at random and analysed for the targeted migratory species to identify bird calls.

Microbat echolocation recording and identification

Six (6) Anabat ultrasonic recording devices were deployed within the BCAA. Three anabats were recording between the 7 December and 15 December 2016 (over 8 nights) and the remaining three anabats were recording between 13 and 14 December 2016.

All six (6) Anabats were positioned separately on hollow-bearing trees (HBT’s) / stags within 200 m of a permanent water course (Crookhaven River) along the western border of the BCAA, targeting potential *Myotis macropus* (Southern Myotis) breeding habitat.

Anabats were set to record between 6 pm to 6 am. A total of 30 recording nights were completed. Calls were analysed and identified by ELA staff, Mitchell Scott and Rodney Armistead, with additional assistance from Alicia Scanlon.

Stag watch – *Myotis macropus* (breeding habitat)

The BCAM requires surveys for breeding habitat for the Southern Myotis. This is defined as any hollow-bearing trees within 200 m of watercourses within the BCAA.

A search of hollow-bearing trees was conducted within a 200 m buffer along the riparian corridor within the BCAA. All hollow-bearing trees were marked with a hand-held GPS.

A combination of stag watching and echometers were used to determine the presence of Southern Myotis. Stag watching was undertaken during the survey for one (1) night on each hollow-bearing tree / stag with 200 m of a permanent water course, on 7, 13, and 14 December 2017. Up to three ecologists were surveying different hollows on each night.

Amphibian survey (GGBF)

Amphibian surveys were conducted for *Litoria aurea* (Green and Golden Bell Frog, GGBF) within potential habitat.

Call-playback of GGBF and diurnal / nocturnal searches were conducted over several days and one night at two small farm dams containing potential habitat. Nocturnal surveys involved broadcasting of calls for a minimum of five minutes followed by at least five minutes over one separate night. Spotlighting was also conducted following the call playback. Diurnal surveys were conducted haphazardly during other diurnal surveys.

The tables below describe the survey effort completed by ELA over 2021 and 2022, 2015 – 2017 (Table 13, Table 14) and by other consultancies from 1993 through to 2013 (Table 15, Table 16).

Table 13: Targeted survey effort for flora and fauna (ELA 2021 – 2022)

Date	Targeted species	Survey method	Survey effort	Notes
12 – 14 December 2021	*Cryptostylis hunteriana*	Parallel transects 10 m apart in suitable habitat	4 person days (32 person hours)	Reference population checked at Sussex Inlet Golf Course and confirmed to be in flower.
12 – 14 December 2021	White-bellied Sea Eagle, Osprey	Searches for stick nests and diurnal observations	2 person days (16 person hours)	
12 – 14 December 2021	Green and Golden Bell Frog	Call playback and spotlighting in areas of suitable habitat (dams)	8 person hours	
19, 27 May, 15 June and 16 July 2022	Greater Glider, Yellow-bellied Glider, Koala, Spot-tailed Quoll	Spotlighting	8 person hours	
5 April – 15 June 2022	Whit-footed Dunnart	130 baited hair tubes	8,605 survey nights	
5 April – 15 June 2022	Greater Glider, Yellow-bellied Glider, Koala, Spot-tailed Quoll	30 baited remote cameras (arboreal)	2,001 camera nights	
27 – 28 September 2022	*Caladenia tessellata* *Pterostylis gibbosa* *Pterostylis vernalis* *Rhizanthella slateri*	Parallel transects 10 m apart in areas of suitable habitat	32 person hours	*Caladenia tessellata* was confirmed flowering in a Coastal location (Gippsland, Victoria) on 26-27/9/22 and in a tableland location on 21/10/22 and 19/11/22. *Pterostylis gibbosa* was confirmed flowering at the Worrigee Nowra reference site on 28/9/22 *Pterostylis vernalis* was confirmed flowering at Flat Rock West Nowra reference site on 6/9/22 (and was still flowering 18/11/22)

Date	Targeted species	Survey method	Survey effort	Notes
17 – 18 November 2022	*Calochilus pulchellus* *Prasophyllum affine*	Parallel transects 10 m apart in areas of suitable habitat	20 person hours	*Calochilus pulchellus* was confirmed flowering on 21/10/22 and was still flowering on 21/11/22 at Vincentia reference sites *Prasophyllum affine* reference sites were checked on 28/9/22 and 18/11/22 with no flowers recorded at any of three reference sites checked.

Table 14: ELA Survey effort for threatened flora and fauna (2015 – 2017)

Date	Targeted species	Survey method	Survey effort
10 – 14 December 2015	*Cryptostylis hunteriana, Rhodamnia rubescens, Rhodomyrtus psidioides, Melaleuca biconvexa*	Transects and random meanders in suitable habitat	3 person days (24 hours)
12 – 16 December 2016	Arboreal mammals (Koala, Spot-tailed Quoll, Greater Glider, Yellow-bellied Glider)	Baited 131pprox B Traps (arboreal)	144 trap nights
9 December 2016 – 8 February 2017	Arboreal mammals (Koala, Spot-tailed Quoll, Greater Glider, Yellow-bellied Glider)	Baited remote camera traps (arboreal)	2,232 camera nights
9 December 2016 – 8 February 2017	Ground dwelling mammals (Koala, Spot-tailed Quoll)	Baited remote camera traps (terrestrial)	248 camera nights
7, 12, 13, 14 December 2016	*Petaurus norfolcensis* (Squirrel Glider)	Call Playback	8 person hours
7, 12, 13, 14 December 2016	Koala, Greater Glider, Yellow-bellied Glider	Spotlighting	8 person hours
12 – 16 December 2016 (4 nights), 10 -14 January 2017 (4 nights), 6 – 10 February 2017 (4 nights)*.	White-footed Dunnart, New Holland Mouse	Pitfall traps	1,440 trap nights

Date	Targeted species	Survey method	Survey effort
12 to 16 December 2016	Eastern Pygmy Possum, White-footed Dunnart, New Holland Mouse	Elliot A traps	160 trap nights
9 December 2016 – 8 February 2017	White footed Dunnart, New Holland Mouse	Hair tubes	2,480 trap nights
-	White-throated Needletail, Eastern Curlew, Common Greenshank, Fork-tailed Swift, Osprey, Lathams Snipe	Bird census	-
9 – 23 December 2016	White-throated Needletail, Eastern Curlew, Common Greenshank, Fork-tailed Swift, Osprey, Lathams Snipe, Glossy Black Cockatoo, Gang-gang Cockatoo	Songmeters	14 survey days (132pprox.. 112 survey hours)
7 December – 15 December 2016 (over 8 nights) and 13 – 14 December 2016	*Chalinolobus dwyeri* (Large-eared Pied Bat)	Echolocation devices	30 survey nights
7, 13 and 14 December 2017	*Myotis macropus* (Southern Myotis)	Stag watches	Approx 6 survey nights
	Litoria aurea	Amphibians surveys at dams	Approx 3 days and one night

Table 15: Previous ecological surveys conducted within the western portion of the BCAA (adapted from the SLR 2013 report) within West Culburra

Survey method	Culburra W 1993 Daly and Leonard	Culburra W 1996 Daly and Leonard, Hoye	Culburra W 1997 Gunninah	Culburra W 2001 Gunninah	Culburra W 2002 Gunninah	Culburra W 2007 InSights	Culburra W 2010 Lesryk Env Con	Culburra W 2012/2013 SLR
FLORA								
	-	-	-	-	-	-	-	7 days flora and fauna surveys
FAUNA								
Harp traps		4 nights		1,700 nights			4 nights	8 nights

Survey method	Culburra W 1993 Daly and Leonard	Culburra W 1996 Daly and Leonard, Hoye	Culburra W 1997 Gunninah	Culburra W 2001 Gunninah	Culburra W 2002 Gunninah	Culburra W 2007 InSights	Culburra W 2010 Lesryk Env Con	Culburra W 2012/2013 SLR
Anabat		4 nights		25 nights	2 nights	4 nights	70 hrs	160 hrs
Elliot A		55 nights		805 nights			300 nights (ground and arboreal)	0
Elliot B arboreal	75 nights			150 nights			300 (not separated)	0
Cage trapping			101 nights	101 nights			24 nights	
Hair funnel (small terrestrials)		380 nights		4.25 hrs			400 nights	1280 nights
Pitfall	110 nights		170 nights	170 nights			72 nights	
Spotlighting	11.5 hrs	4 nights	62.5 hrs	11hrs 55 mins	4 hrs	11 hrs	24 hrs	28.5 hrs
Infrared cameras (terrestrial only)							192 hrs (8 days)	500 hrs
Nocturnal Call-playback			1.5 hrs	22.6 hrs (Owls, Yellow-bellied Glider, Koala and Black Bittern)	1 hr 52 mins (Owls, Squirrel Glider, Yellow-bellied Glider, Koala)	1 hr Call playback (Owls, Yellow-bellied Glider)	3 hours	19 hours
Bird surveys				14 nights	4 hours	16 hours	25 person hrs (5/day)	

Table 16: Fauna species previously recorded within the BCAA by other consultants and from BioNet records

Scientific name	Common name	Credit species	TSC listing	EPBC listing	Record
Amphibian					
Litoria aurea	Green and Golden Bell Frog	Species	E	V	BioNet
Aves					
Callocephalon fimbriatum	Gang-gang Cockatoo	Ecosystem	V	V	BioNet
Calyptorhynchus lathami	Glossy Black-cockatoo	Ecosystem	V	V	BioNet, SLR 2013
Haematopus longirostris	Pied Oystercatcher	Species	E	-	BioNet
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	-	Ma, M	BioNet
Hieraaetus morphnoides	Little Eagle	Ecosystem	V	-	BioNet
Hirundapus caudacutus	White-throated Needletail	Ecosystem	-	M	BioNet
Hydroprogne caspia	Caspian Tern	-	-	M	BioNet
Limosa lapponica	Bar-tailed Godwit	-	-	V	BioNet
Lophoictinia isura	Square-tailed Kite				SLR 2013
Numenius madagascariensis	Eastern Curlew	-	-	CE, M	BioNet
Numenius phaeopus	Whimbrel	-	-	M	BioNet
Petroica boodang	Scarlet Robin	Ecosystem	V	-	BioNet
Tringa nebularia	Common Greenshank	-	-	M	BioNet
Aves (nocturnal)					
Ninox strenua	Powerful Owl	Ecosystem	V	-	BioNet, SRL 2013
Mammal (flying)					
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Ecosystem	V	-	BioNet, SRL 2013
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Ecosystem	V	-	BioNet, SRL 2013
Mormopterus norfolkensis	Eastern Freetail-bat	Ecosystem	V	-	BioNet, SRL 2013

Scientific name	Common name	Credit species	TSC listing	EPBC listing	Record
Myotis macropus	Southern Myotis	Dural species	V	-	BioNet
Pteropus poliocephalus	Grey-headed Flying-fox	Dural species	V	V	SRL 2013
Scoteanax rueppellii	Greater Broad-nosed Bat	Ecosystem	V	-	BioNet, SRL 2013
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	Ecosystem	V	-	SRL 2013

E = ENDANGERED, MA = MARINE, M = MIGRATORY, V = VULNERABLE

Appendix E Site photos

Provided as a separate attachment.

Appendix F Culburra West Urban Development Project, Culburra Beach (SLR 2013)

Provided as a separate attachment.

Appendix G Culburra Golf Course SIS Addendum Report (Cumberland Ecology 2017)

Provided as a separate attachment.

Appendix H Culburra Golf Course – Long Bow Point Part Lots 5 and 6 in DP 1065111 Species Impact Statemen (Gunninah 2015)

Provided as a separate attachment.

Appendix I Culburra 18 Hole Golf Course, Long Bow Point Culburra (Insites 2011)

Provided as a separate attachment.

Appendix J Land and Environment Court Consent LEC No. 2019/78149

Provided as a separate attachment.

Appendix K West Culburra ACHA (South East Archaeology 2012)

Provided as a separate attachment.

Appendix L Supplementary Aboriginal Cultural Heritage Assessment (Dr. J Kamminga 2020)

Provided as a separate attachment.

Appendix M State Significant Development Assessment: West Culburra Concept Proposal SSD 3846 (Allan Price and Scarratts Pty Ltd 2020)

Provided as a separate attachment.

Appendix N Trust Deed

Provided as a separate attachment.

Appendix O Avifauna studies at West Culburra (ELA 2021)

Provided as a separate attachment.

Appendix P Revised West Culburra Beach Concept Plan – Aquatic Ecology Assessment Report (MPR 2020).

Provided as a separate attachment.