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7 May 2026

Our ref: 25GWS11932

Legpro 70 Pty Ltd ATF Legpro 70 Unit Trust (Legacy)
Level 45, 25 Martin Place
Sydney NSW 2000

Attn: Harrison Morgan

Dear Harrison,

Re: Corrimal Coke Works Stage 2-4 Early Stage (Civil) Works (SSD-86131212) – Biodiversity Development Assessment Report (BDAR) Waiver Request

Legpro 70 Pty Ltd ATF Legpro 70 Unit Trust (herein referred to as the Proponent) is preparing a State Significant Development Application (SSDA) (SSD-86131212) for a residential development at 27 Railway Street, Corrimal. The subject land encompasses the former Corrimal Coke Works site and the study area refers to the 6.62 ha development footprint of the Stage 2-4 Early Stage (Civil) Works SSDA, as shown in Figure 1.

This BDAR Waiver Request has been prepared by Eco Logical Australia (ELA) to accompany the Stage 2-4 Early Stage (Civil) Works (SSD-86131212), which seeks development consent for facilitating civil works and subdivision to support the concurrent Stage 2a Built Form SSDA (SSD-83789711) and the future redevelopment of Stages 2-4 of the Corrimal Coke Works Precinct. The civil works proposed by this SSDA include the construction of the Central Park, the Southern Park, and roads, drainage and stormwater infrastructure, and paper subdivision.

The Stage 2-4 Early Stage (Civil) Works SSDA was declared as State Significant Development (SSD) in the State Significant Development Declaration Ministerial Order (No 10) 2025 (dated 30 June 2025) at Clause 5(1)(n) in Schedule 1 (Amendment SSD Declaration Order 2025 (No 5)).

State Significant Development (SSD) is regulated under the *Environmental Planning and Assessment Act 1979* (EP&A Act). The EP&A Act requires proponents to apply to the Minister for Planning for development consent of SSD, supported by an Environmental Impact Statement (EIS). These applications are also subject to biodiversity assessment requirements under the *Biodiversity Conservation Act 2016* (BC Act). Clause 7.9 of the *Biodiversity Conservation Act 2016* (BC Act) requires that an SSD application must be accompanied by a biodiversity development assessment report (BDAR) unless the Planning Agency Head and the Environment Agency Head determine that the proposed

development is not likely to have any significant impact on biodiversity values. The DPHI website provides guidance on this matter and states:

For the purpose of deciding whether the requirement for a BDAR can be waived, a proposed development could be considered as unlikely to have any significant impact on biodiversity values if it:

- *will not clear or remove native vegetation other than:*
- *a few single trees with no native understorey in an urban context*
- *planted native vegetation that is not consistent with a Plant Community Type (PCT) known to occur in the same Interim Biogeographic Regionalisation of Australia (IBRA) subregion (e.g. street trees, trees in carparks, landscaping)*
- *will have negligible adverse impacts on threatened species or ecological communities, considering habitat suitability, abundance and occurrence, habitat connectivity, movement and water sustainability including consideration of any non-natural features, non-native vegetation and human-built structures*
- *will have negligible adverse impacts on protected animals because of impacts to flight path integrity.*

Eco Logical Australia Pty Ltd (ELA) was engaged by the Proponent to provide an assessment of biodiversity impacts of the proposed development. This letter provides an assessment of the proposals' impact on biodiversity values, within the study area, in accordance with the NSW Department of Planning & Environment's 2018 *Biodiversity development assessment report waiver determinations for SSD and SSI applications fact sheet*. Information to support the application is outlined in Table 1 and Table 2 below.

The assessment draws on data collected for the site wide BDAR (version 7) that was prepared for the proposed development by ELA in 2024. The assessment also includes a literature and database review of relevant information to assess the potential impacts to biodiversity values from the proposed development. This includes the review of the most recent vegetation mapping (NSW DCCEEW, 2024a), BioNet Atlas threatened flora and fauna species records within 5 km of the study area (NSW DCCEEW, 2024b), and the Biodiversity Values Map (NSW DCCEEW, 2024c).

The subject land, including the study area impacted by Stage 2-4 Early Stage (Civil) Works (SSD-86131212) has been subject to considerable historical clearing to facilitate its previous use as the Coke Works. The native vegetation that has since been planted offers limited habitat potential for threatened species and is a small patch of vegetation amidst a broader urban area that has been fragmented due to roads and housing. Vegetation within the study area has been approved for clearance under the Stage 2-4 Bulk Earthworks (BEW) DA-2023/823. Therefore, no vegetation removal or biodiversity impacts are proposed under the Stage 2-4 Early Stage (Civil) Works (SSD-86131212). This is under the assumption that all clearing will be carried out under the BEW Development Application (DA) and will be complete prior to this SSDA consent being enacted.

The assessment concluded that the proposed development is not likely to have a significant impact on biodiversity values. The proposal is unlikely to have an impact on habitat suitability for threatened species. No Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) will be impacted by the development.

To manage the potential for indirect impacts to threatened biodiversity values known to occupy the subject land, a range of mitigation measures have been included in Section 2.

This report is to be submitted in support of seeking a BDAR Waiver.

Regards,



Millie Hatch
Environmental Consultant



Figure 1: Location and land zoning

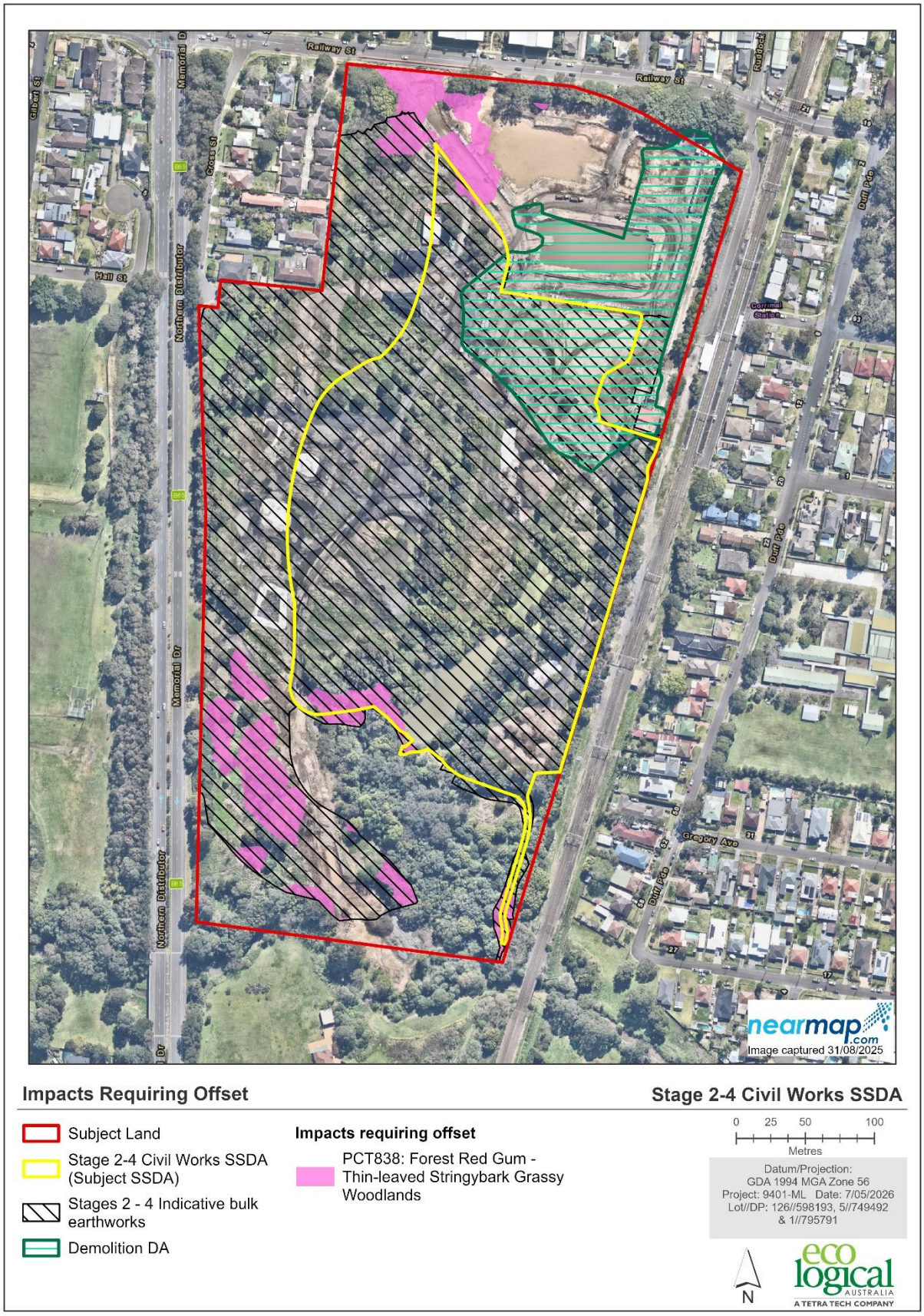


Figure 2: Area approved and offset under the Stage 2-4 Bulk Earthworks DA-2023/823

1. Biodiversity Development Assessment Report Waiver Request Information

The information requirements for a BDAR waiver request under the NSW Department of Planning and Environment's (DPE) 2018 Guidelines are provided in Table 1.

Table 1: BDAR waiver request information requirements

Requirement	Information
Administration	**Proponent:** Legpro 70 Pty Ltd ATF Legpro 70 Unit Trust (Legacy) **Project ID:** SSD-83789711 and SSD-86131212 **Completed by:** Millie Hatch – Graduate Environmental Consultant, B.Sc Ecology & M. Sustainability **Reviewed by:** Alex Gorey – Associate Ecologist / Accredited BAM Assessor (BAAS#22003) (Eco Logical Australia Pty Ltd), B.Sc Environmental Science and Geography and M. Sustainability, University of Sydney
Site Details	**Street Address** 27 Railway Street, Corrimal NSW 2518. **Lot and DP** The study area comprises the following lots: • Lot 201 DP1308649 • Lot 202 DP1308649 • Lot 103 DP1301632 **Local Government Area (LGA)** The study area is located within the Wollongong City Council LGA and is currently zoned as R3 (Medium Density Residential) and RE1 (Public Recreation) under the Wollongong Local Environmental Plan 2009 (Wollongong LEP 2009), as shown in Figure 1. The objectives of R3 zoning are as follows: • *To provide for the housing needs of the community within a medium density residential environment.* • *To provide a variety of housing types within a medium density residential environment.* • *To enable other land uses that provide facilities or services to meet the day to day needs of residents.* The objectives of RE1 zoning are as follows: • *To enable land to be used for public open space or recreational purposes.* • *To provide a range of recreational settings and activities and compatible land uses.* • *To protect and enhance the natural environment for recreational purposes.* • *To cater for the development of a wide range of uses and facilities within open spaces for the benefit of the community.* **Existing Development Site** The wider Corrimal Coke Works site covers an area of 18.2 hectares. Existing features across the subject land include roads, remnants of former Coke Works infrastructure, dams, and a mix of planted native and exotic vegetation. The subject SSDA only applies to the Stage 2-4 Civil Works area as shown by the yellow outline in Figure 1. **Previous Approvals** Separate DAs relevant to the Stage 2-4 Civil Works SSDA have been lodged to Wollongong City Council, and have been determined. These DAs propose works relating to subdivision, built form (apartment buildings), bulk earthworks, and vegetation management.

Requirement	Information
	• Stage 2-4 Bulk Earthworks (BEW) approved under DA-2023/823 (15 credits retired) • Demolition of Coke Works structures and removal of vegetation along one berm approved under the Demolition DA-2022/1249 Vegetation removal within the study area has been approved under the Stage 2–4 Bulk Earthworks package. These impacts have been offset through the retirement of 15 biodiversity credits into the Biodiversity Conservation Fund, ensuring compliance with the *Biodiversity Conservation Act 2016* and associated offsetting requirements (ELA 2024; A1). Potential impacts to native vegetation and the Grey-headed Flying Fox (GHFF) have been assessed in accordance with relevant biodiversity legislation.
Proposed Development	This BDAR Waiver refers to the proposed development of the Stage 2-4 Civil Works SSDA (SSD-86131212) at 27 Railway Street, Corrimal, on behalf of the proponent. The area of the land to which the Stage 2-4 Civil Works SSDA relates is 6.62 ha (Figure 1). The civil works SSDA (SSD-86131212) seeks development consent for the following works: • Torrens subdivision to create nine (9) new title lots (referred to as Lot 200, Lot 201, Lot 202, Lot 203, Lot 204, Lot 300, Lot 301, Lot 302, and Lot 303 in DP1313981). • Detailed civil works associated with the construction of local roads and drainage works relevant to future Stages 2-4. [Note. The detailed civil works will be enabled by the outcomes of the approved Stages 2 - 4 Bulk Earthworks DA (which includes vegetation management and creek alignment / embellishment works) (reference: DA-2023/823)]. • Construction of the Central Park (including embellishment works, lawn areas, landscaping, tree planting, equipment, and services). • Construction of the Southern Park (including embellishment works, lawn areas, landscaping, tree planting, equipment, and services). • Public domain works (landscaping, street tree planting, paving). • Reticulation of site services and infrastructure (electricity, telecommunication, water, and sewer). • Southern Bicycle Park

Biodiversity Assessment Criteria

Table 2 provides information regarding the impacts of the proposed development on biodiversity values in accordance with the Guidelines.

Table 2: Criteria to assess biodiversity under the BC Act and BC Regulation

Biodiversity Value	Meaning	Relevant	Response
Biodiversity Conservation Regulation 2017 **(Clause 1.4)**			
a) Threatened Species Abundance	The occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site.	N/A	The study area currently contains some areas of planted native and exotic vegetation (Figure 3). A site wide BDAR was prepared for the proposed development by ELA in 2024 (ELA 2024). The removal of the vegetation currently within the study area was assessed under this BDAR. The removal of vegetation within the study area has been approved under the Stage 2-4 Bulk Earthworks DA-2023/823. Direct impacts from the site wide development have been offset through the retirement of 15 biodiversity credits, as outlined in the BDAR (ELA 2024; A1) to offset impacts to 0.81 ha of PCT 3327 (previously PCT 838) (Illawarra Lowland Red Gum Grassy Forest). No additional impacts to biodiversity values are proposed under this SSDA (SSD-86131212).
b) Vegetation Abundance	The occurrence and abundance of vegetation at a particular site.	N/A	A site wide BDAR was prepared for the proposed development by ELA in 2024 (ELA 2024) to assess the impact to the biodiversity value of the study area. The removal of vegetation within the study area has been approved under the Stage 2-4 Bulk Earthworks DA-2023/823. Vegetation clearance has been approved and offset through the retirement of biodiversity credits (A1). No additional impacts to biodiversity values are proposed under this SSDA (SSD-86131212).
c) Habitat Connectivity	The degree to which a particular site connects different areas of habitat of threatened species to facilitate movement of those species across their range.	N/A	No vegetation removal is proposed as a part of the works subject to this BDAR waiver. Therefore, the works will not result in any further fragmentation or impact to landscape connectivity. The bulk earthworks and removal of vegetation within the study area has been approved under a previous DA (BEW DA-2023/823). Any potential biodiversity impacts associated with the subject land have been previously assessed through the site wide BDAR (ELA 2024). The impacts to the endangered PCT and the GHFF have been offset through the retirement of 15 biodiversity credits (ELA 2024, A1).

Biodiversity Value	Meaning	Relevant	Response
d) Threatened Species Movement	The degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle;	N/A	A site wide BDAR was prepared for the proposed development by ELA in 2024 (ELA 2024) to assess the impact to threatened species movements in the study area. The impacts to the endangered PCT and the GHFF have been offset through the retirement of 15 biodiversity credits (ELA 2024, A1). The proposed development is not expected to result in any further impact to habitat connectivity or MNES, given the vegetation and aquatic features within the study area have been approved for removal under the BEW DA-2023/823.
e) Flight Path Integrity	The degree to which the flight paths of protected animals over a particular site are free from interference.	N/A	A site wide BDAR was prepared for the proposed development by ELA in 2024 (ELA 2024) to assess the flight path integrity of the study area. The proposed development would not interfere with any known migratory flight paths or sever connectivity for protected animals within the subject land (ELA 2024). Impacts to GHFF have been assessed, approved and offset under the site wide BDAR and the retirement of 15 biodiversity credits (ELA 2024, A1). No additional impacts to biodiversity values are proposed under this SSDA (SSD-86131212).
f) Water Sustainability	The degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site.	N/A	A site wide BDAR was prepared for the proposed development by ELA in 2024 (ELA 2024) to assess the impact to the water sustainability in the study area. While waterbodies are present within the broader subject land, including two artificial dams and an unnamed stream, these features do not support any Threatened Ecological Communities (TECs) or provide critical habitat for threatened species. The two artificial dams, located at the southern extent of the subject land, have been previously field validated and assessed as being in poor ecological condition. One dam is partially located within the subject land and has been approved for removal under Stage 2-4 BEW DA-2023/823 (Figure 6). These impacts have been approved under the previous Stage 2-4 BEW DA-2023/823 and are not included within the scope of the Stage 2-4 Early Stage (Civil) Works SSDA (SSD-86131212). No additional impacts to biodiversity values are proposed under this SSDA (SSD-86131212).
			Biodiversity Conservation Act **(Clause 1.5 (2))**
a) Vegetation Integrity	The degree to which the composition, structure and function of vegetation at a	N/A	A site wide BDAR was prepared for the proposed development by ELA in 2024 (ELA 2024) to assess the impact to the vegetation integrity of the study area. Vegetation within the study area has been approved for removal under the Stage 2-4 BEW DA-2023/823.

Biodiversity Value	Meaning	Relevant	Response
	particular site and the surrounding landscape has been altered from a near natural state.		The proposed development will not compromise vegetation integrity, as no native remnant vegetation remains within the development footprint and current planted and exotic vegetation has been approved for removal under a previous DA (DA-2023/823). No additional impacts to biodiversity values are proposed under this SSDA (SSD-86131212).
b) Habitat Suitability	The degree to which the habitat needs of threatened species are present at the particular site.	N/A	A site wide BDAR was prepared for the proposed development by ELA in 2024 (ELA 2024) to assess the impact to the habitat suitability of the study area. The area subject to Stage 2a Built Form does not provide habitat for threatened species. The development footprint contains 2 dams which do not provide habitat for threatened species and has also been approved for removal under the Stage 2-4 BEW DA-2023/823 (ELA 2024). Following the removal of PCT 3327 during the bulk earthworks phase (DA-2023/823) the subject land will not constitute any potential habitat resources for the GHFF. The impacts to the endangered PCT and the GHFF have been offset through the retirement of 15 biodiversity credits (ELA 2024, A1). No additional impacts to biodiversity values are proposed under this SSDA (SSD-86131212).

2. Mitigation Measures

This section contains mitigation measures and controls that are to be implemented alongside the Stage 2-4 civil works of the Corrimal Cokeworks site. These measures have been taken from the following site-specific assessments and management plans:

- Corrimal Cokeworks Site Wide BDAR – Version 7 (ELA 24 September 2024) (A2)
- Corrimal Residential Development Grey-headed Flying-fox Management Plan (MP) – Version 7 (ELA 24 September 2024) (A3)
- Corrimal Cokeworks Vegetation Management Plan (VMP) (ELA 25 September 2024) (A4)
- Threatened Species Licence (TSL) (DOC24/644921-3) (A5)

If the mitigation measures recommended in these reports are implemented the proposed development is unlikely to have a significant impact on native vegetation, the GHFF camp, and any existing riparian areas within the site. A summary of the relevant mitigation measures has been provided in Table 3.

Table 3: Summary of mitigation measures from the BDAR, GHFF MP, VMP and TSL.

Project stage	Hazard	Mitigation measure	Associated management plan
Prior to works commencing (Pre-construction)	Workers not aware of biodiversity values and GHFF camp sensitivities	• All staff and contractors are to undertake environmental inductions regarding disease risk associated with flying-foxes and stop work triggers. • All staff and contractors are to undertake environmental inductions regarding disease risk associated with flying-foxes and stop work triggers. • Maps showing no go areas to be placed in site offices, all staff briefed during tool box talk or pre-work briefing on the location of important environmental features and control measures in place to protect this area.	BDAR, GHFF MP, TSL
	Disturbance to GHFF camp	• All site works will be undertaken in accordance with the existing Threatened Species Licence (TSL) (DOC24/644921-3). • Works within 75 m of the flying fox camp should be scheduled/planned to be done while the flying foxes are absent from the site. • If the flying foxes do not vacate the site, or return earlier than expected, works within 75 m of the camp are to be done in accordance with the TSL. • Position plant and equipment as far from the camp as possible. • Do not stockpile materials within 75 m of the camp when the camp is occupied. • Chippers must not be used within 75 m of the camp. • A preliminary survey to confirm if flying-foxes are present must be conducted by a qualified flying-fox ecologist in the week prior to works commencing and must be repeated if works cease for a period of longer than three weeks. • Daily inspections by a suitably qualified and skilled person to determine if the camp has flying-foxes in it. • Prior to works commencing, a pre-clearance survey specifically targeting the Grey-headed Flying-fox must be completed. The survey will identify the extent of the camp, location, size and numbers.	GHFF MP, TSL
	Displacement, injury or death of fauna during clearing	• Prior to works commencing, a pre-clearance survey specifically targeting the Grey-headed Flying-fox must be completed. The survey will identify the extent of the camp, location, size and numbers. • On the first day of clearing, a suitably qualified ecologist must be present to monitor the Grey-headed Flying-fox camp. If the camp becomes distressed and do not settle, works must	BDAR; GHFF MP, TSL

Project stage	Hazard	Mitigation measure	Associated management plan
		cease until the camp settles. If the camp continues to become distressed, other mitigation measures such as noise attenuation may be required. • If bats are seen flying consistently during the day, works must cease and the ecologist will be called. • A trained ecological or licensed wildlife handler is to be present during clearing events. • Any fauna injured/separated during construction shall be promptly transported to a veterinarian for treatment.	
	Damage to native vegetation marked for retention	• Clearly demarcate areas for retention with fencing or flagging. Install "no-go" signage around areas to be retained to prevent unauthorised access. • Maps showing no go areas to be placed in site offices, all staff briefed during tool box talk or pre-work briefing on the location of important environmental features and control measures in place to protect this area. • If native vegetation on or adjacent to the site is damaged, implement ecological restoration, rehabilitation and ongoing maintenance compliant with the draft VMP (ELA 2022).	BDAR, VMP

Construction	Noise disturbance to fauna and neighbouring communities	• All site works will be undertaken in accordance with the existing Threatened Species Licence (DOC24/644921-3). The licence contains noise impact protocols.
		• Ensure all plant and equipment is maintained to Australian Standards to minimise noise generation. This includes:
		  ○ no more than eight hours of exposure to noise measured at 85 decibels
		  ○ no noise which exceeds 140 decibels, unless the camp is empty
		  ○ if noise exceeds 85 decibels, then the exposure time must decrease, consistent with the Australian Standards.
		• Position plant and equipment as far from the camp as possible.
		• Shield noise at its source, where possible.
		• Modify equipment to produce less noise or use alternative construction techniques.
		• Avoid construction or noise activities during hours when the GHFF are most settled in the camp.
		• Install noise barriers or attenuation devices on machinery or daily/seasonal timing of construction and operational activities to reduce impacts of noise if Grey-headed Flying-fox individuals are agitated and do not settle during construction.
			GHFF MP, TSL

Project stage	Hazard	Mitigation measure	Associated management plan
		• Only conduct clearing and operation of machinery inside of typical work hours (Monday - Friday 7 am - 5 pm and Saturday 8 am - 1 pm). No work to occur on Sundays	
	Light disturbance to nocturnal fauna	• Avoid shining lights toward the GHFF camp. • Conduct works during daylight hours.	GHFF MP
	Disturbance during extreme weather	• Works are not undertaken during times of extreme heat evens (> 38°C). • Minimise disturbance within 200 m of the camp during gale force winds and monitor animal welfare. • Monitor weather conditions and prepare teams to respond to heat stress. • Incident management protocols including flying-fox watch patrols and heat stress response. • The new water body designed to provide heat stress relief must be in place prior to dam dewatering occurring of the original dam.	GHFF MP
	Camp stress, injury or mortality	• Stop works procedure if flying-fox disturbance occurs in absence of ecologist. • Temporarily cease works until the flying foxes settle. • Contact an ecologist to monitor stress levels if the activity needs to be done the following day/s. • Investigate possible cause and cease action that was a factor, and revise management strategy as needed. • If at any time it is identified that ongoing disruption or harm occurs to any Grey-headed Flying-foxes, then works must cease and consideration give as to whether a referral to the Commonwealth DCCEEW is recommended.	GHFF MP, TSL
	Pollution of waterways and sediment runoff	• Install and regularly inspect sediment barriers to control the quality of water released from the site. • Develop an erosion and sediment control plan. • Use a water truck to wet down and suppress dust and cover stockpiles to minimise sediment movement.	BDAR, GHFF MP
	Dust impacts to fauna and community	• Adaptive dust monitoring programs to control air quality and potential indirect impacts to Grey-headed Flying-fox • Ensure all stockpiles are covered to prevent dust and sediment mobilisation during dry periods or periods of heavy wind	BDAR, GHFF MP

Project stage	Hazard	Mitigation measure	Associated management plan
		• Stage bulk earthworks to prevent extent of bare ground. Use a water truck to wet areas of bare ground. Conduct works outside of hot periods when rainfall is typically lower.	
	Weed invasion into retained areas of native vegetation	• Hygiene protocols (e.g. wash down facilities) to prevent the spread of weeds or pathogens. • Prohibit use of any invasive species in any landscaping. • Weed removal should follow a mosaic pattern, maintaining refuges in the mid- and lower storeys. • Vegetation 'no go' zones in place protect adjacent native vegetation. • Weed control consistent with the VMP (ELA 2022) • Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on planting invasive weed species and disturbance to nests and other niche habitats	BDAR, VMP
	Vehicle strike	• Temporary site fencing to protect significant environmental features such as remnant vegetation and prevent access by people. • A trained ecological or licensed wildlife handler to be present during clearing events. Any fauna injured/separated during construction shall be promptly transported to a veterinarian for treatment.	BDAR

	Human health risks from flying-fox contact	• All personnel working within 200 m of the camp will wear protective clothing including long sleeves and pants. Additional items such as eye protection and a hat are also recommended. Appropriate hygiene practices will be adopted such as washing hands with soap and water before eating/smoking.
		• A wash station will be available along with an anti-viral antiseptic (e.g. Betadine) should someone be bitten or scratched. If a person is bitten or scratched by a FF they should:
		  ○ wash the wound with soap and water for at least five minutes (do not scrub)
		  ○ contact their doctor immediately to arrange for post-exposure vaccinations.
		  ○ If flying-fox saliva contacts the eyes, nose, mouth or an open wound, flush thoroughly with water and seek immediate medical advice.
		  ○ Details of the nearest hospital or doctor who can provide post-exposure prophylaxis will be kept on site.
		• Only trained and vaccinated personnel are allowed to handle injured or dead flying-foxes.
			GHFF MP

Project stage	Hazard	Mitigation measure	Associated management plan
	Loss of aquatic habitat prior to availability of replacement	• A plan to de-water the dam closest to the camp and the creation of a replacement water body must be prepared (if not completed as part of the BEW DA consent). • The replacement water body must be created before the flying foxes return to the camp. • Supplementary aquatic habitat must be created prior to commencement of bulk earthworks.	GHFF MP
Operation	Human - GHFF conflict	• Access to the camp from residential development should be restricted. • Signage should be installed around the GHFF camp to inform the public. • Establish a 100 m buffer between the core mapped Grey-headed Flying-fox camp and any future development. • Provide the public and land users with contact details for WIRES/Sydney Wildlife for injured/dead fauna	GHFF MP
	Ongoing disturbance from maintenance activities	• Mowing and machinery use within core habitat managed under strict protocols. • Mowing and using brush-cutters within core habitat will be managed under strict protocols to promote vegetation regrowth and prevent disturbance to the camp. • Chainsaws may only be used to reduce a health and safety risk situation (e.g., unstable tree). • Chippers must not be used within 75 m of the camp. • Mowing, brush cutting or use of other powered machinery (chainsaws, chippers) will be permitted in adjacent areas (within the 100 m buffer off the development and retained lands) to maintain grass with scattered trees under strict protocols. • Landscape maintenance conducted in accordance with the TSL	GHFF MP; TSL

	Community concern and misinformation	• If not prepared as part of the BEW DA consent, a comprehensive and targeted flying-fox education and awareness program would be developed to provide accurate information to the local community about flying-foxes. The program will include:
		  ○ Grey-headed Flying-fox ecology and behaviour.
		  ○ Camp dynamics and numbers.
		  ○ Ways to manage risk to human health.
		  ○ Alleviate concerns regarding health and safety issues.
		  ○ Program of works proposed for the camp.
		  ○ Procedure for community feedback.
		  ○ Procedure for community feedback included in the education program.
			GHFF MP

Project stage	Hazard	Mitigation measure	Associated management plan
	Long-term habitat quality	• Revegetation with native vegetation consistent with Illawarra Lowlands Grassy Woodland (PCT 3327) along the riparian corridor. • Species selected consistent with PCT 3327. • Weed control consistent with the VMP.	VMP; GHFF MP
	Lack of monitoring data	• Monthly monitoring of the camp including population estimates and mapping of camp extent by qualified ecologists.	GHFF MP
	Human–fauna interface	• Establish and maintain a 100 m buffer from the core extent of the Grey-headed Flying-fox camp. • Design the buffer to exclude foraging resources and human infrastructure to minimise flying-fox–human interactions. • Allow recreational structures (e.g. play equipment) only within the outer 50 m of the buffer, in accordance with the DCP. • Ensure the inner 50% of the buffer is void of structures that would encourage human use. Any pathway within this area must serve a clear educational role aimed at fostering understanding and appreciation of Grey-headed Flying-foxes. • Incorporate low-growing or spiky vegetation within the buffer to restrict access and discourage encroachment. • Use buffer plantings to create a visual separation between the camp and residential areas.	GHFF MP
	Completion of new MP for operational phase	• A new GHFF MP will be prepared for the operational phase of development. This revised MP will include all of the above listed measures and be adapted to include any additional lessons learnt through the construction phase or changes that may have occurred with GHFF populations more broadly over time.	GHFF MP
	Dumping of rubbish in native vegetation by residential owners post construction	• Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats	BDAR
	Bushfire causing damage to residential properties, and injury or death to wildlife and people	• Smoke-free policy during construction. No construction activities on Total Fire Ban days. • Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls wood collection and fire management	BDAR

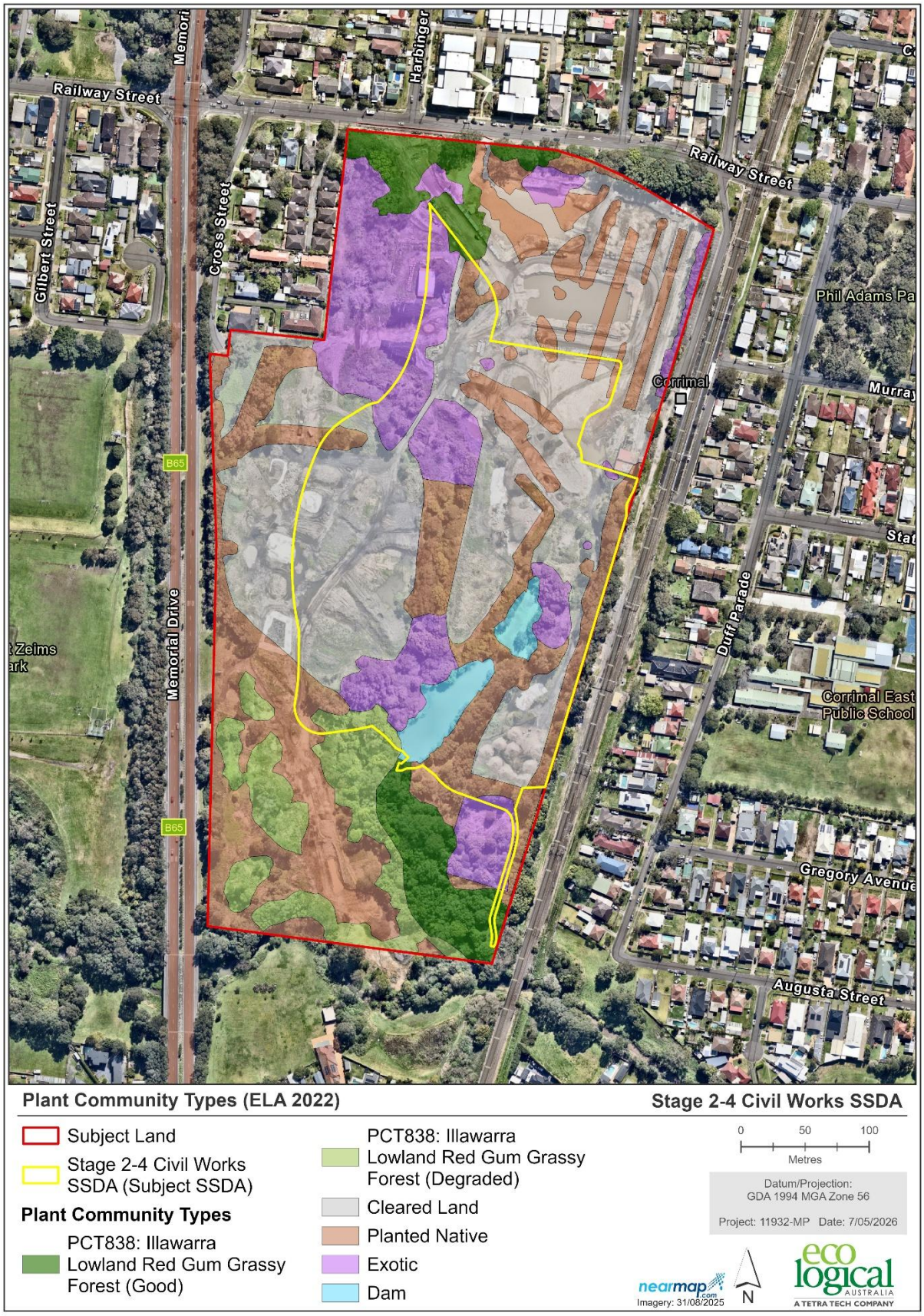


Figure 3: Plant Community Types (ELA 2022)

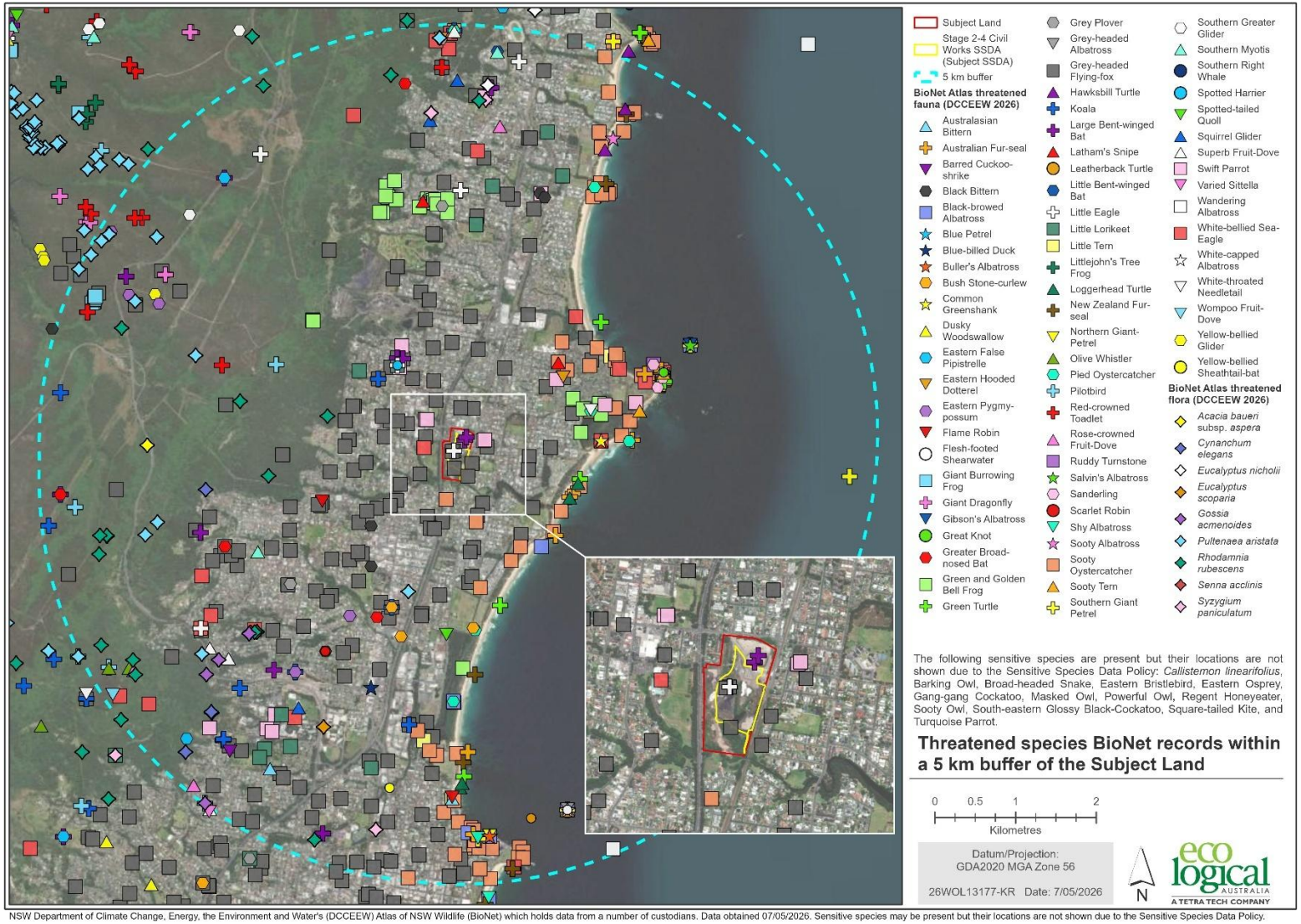


Figure 4: BioNet Threatened Species Records (NSW DCCEEW 2025)



Figure 5: Biodiversity Values

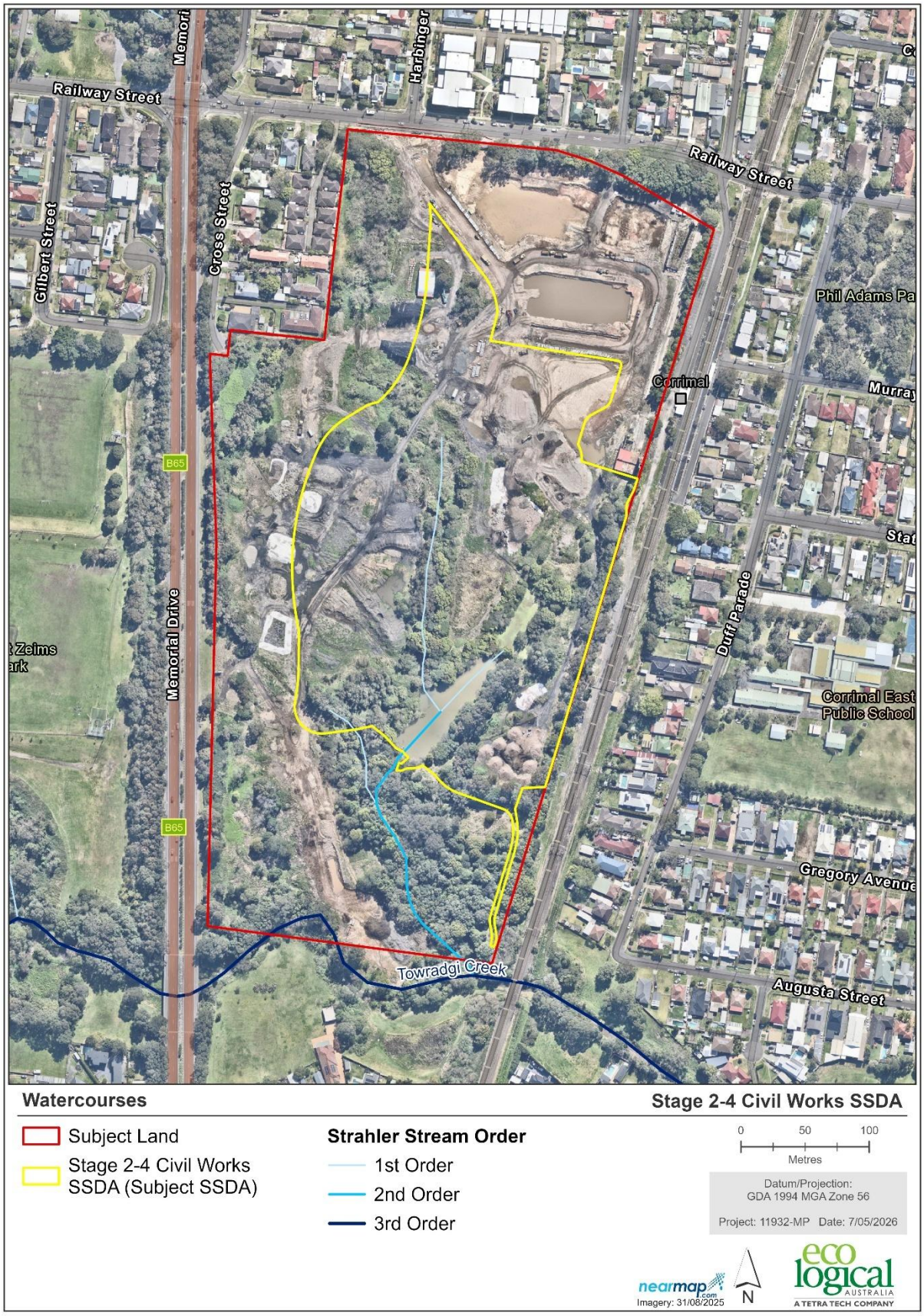


Figure 6: Watercourses

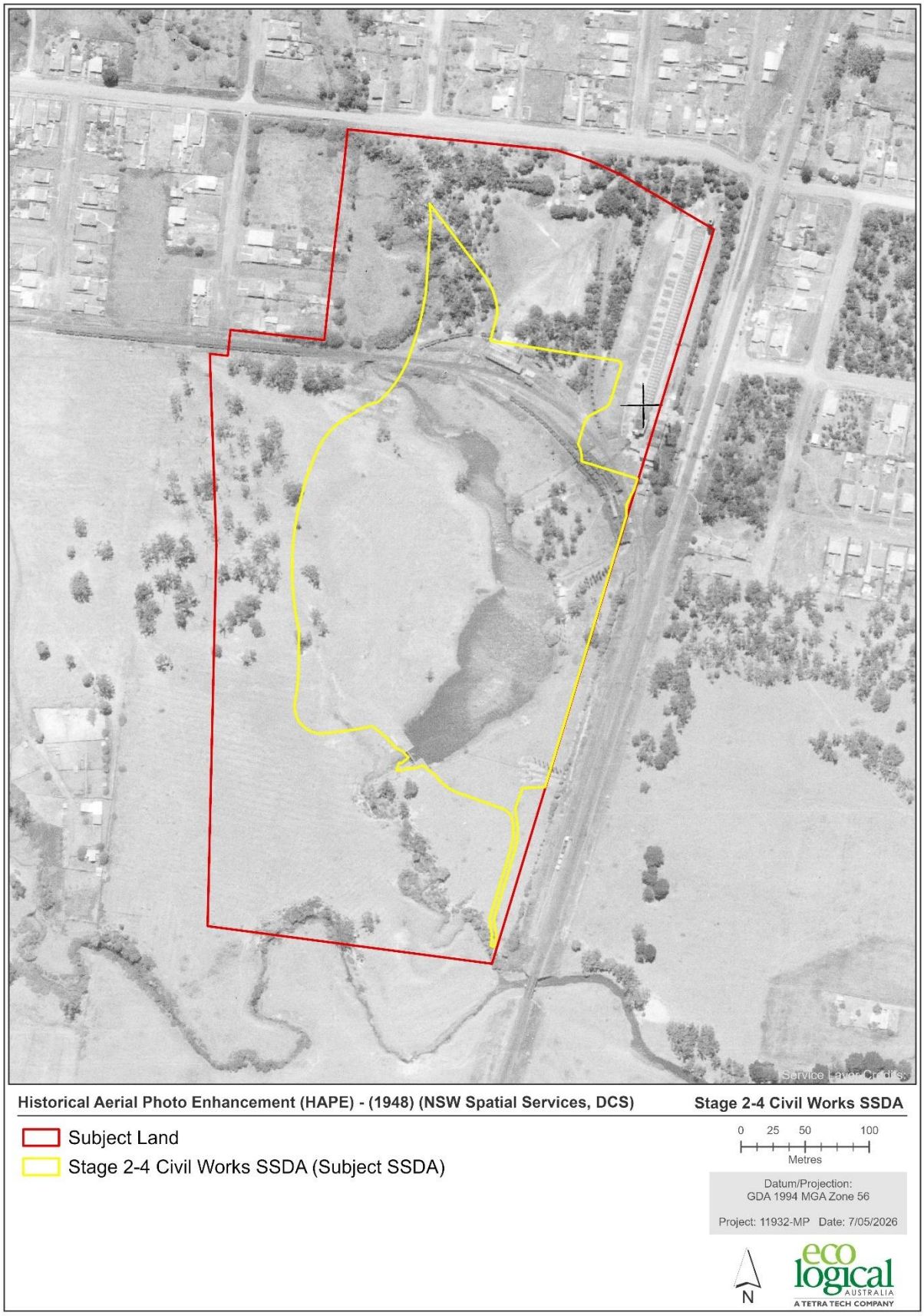


Figure 7: Historical Aerial Photo Enhancement (HAPE) – 1948 (NSW Spatial Services, DCS)



Figure 8: Historical Aerial Photo Enhancement (HAPE) – 1980 (NSW Spatial Services, DCS)



Figure 9: Historical Aerial Photo Enhancement (HAPE) – 2005 (NSW Spatial Services, DCS)

References

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A1 Confirmation of credit retirement for Stage 2-4 Bulk Earthworks

Biodiversity Conservation Trust

Statement confirming payment into the Biodiversity Conservation Fund for an offset obligation

Pursuant to section 6.33 of the *Biodiversity Conservation Act 2016*, the NSW Biodiversity Conservation Trust confirms that the following payments have been made into the Biodiversity Conservation Fund under section 6.30(1) of the Act to satisfy an obligation to retire biodiversity credits.

Payment made by	LegPro 70 Pty Ltd ATF LegPro 70 Unit Trust
Date received	28/08/2025
NSW statutory obligation reference[1]	DA-2023/823
Commonwealth EPBC Act controlled action reference (if applicable)[2]	No
BCT Reference	BCF925

Biodiversity credit retirement obligations satisfied by payment to the Biodiversity Conservation Fund:

Biodiversity credit type (Credit ID and name)	Offset trading group	EPBC Act Controlled Action offset obligation (Y / N)	Number of credits	Cost per credit (Exc. GST)	Total payment per credit type (Exc. GST)
838 - Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	No	7	$39,159.65	$274,117.55
838 - Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	No	8	$39,159.65	$313,277.20
10697 - Pteropus poliocephalus (Grey-headed Flying-fox)	Pteropus poliocephalus (Grey-headed Flying-fox)	No	3	$1,286.57	$3,859.71
Total (Exc. GST)					$591,254.46
GST					$59,125.45
Total (Inc. GST)					**$650,379.91**

Emily McCosker
Director Strategy & Finance
01/09/2025

[1] This refers to either; a development application number for a development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**), a State significant infrastructure approval under the previous Part 5.1 (now Part 5, Division 5.2) of the EP&A Act, a decision of a determining authority to carry out or approve the carrying out of an activity under Part 5 of the EP&A Act, or a biobank statement number or biodiversity certification number.

[2] This refers to a controlled action under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* for which a biodiversity offset obligation has been met through payment into the BCF.

A2 Biodiversity Development Assessment Report – Version 7 (ELA 2024a)

Attached as a separate document.

Corrimal Cokeworks Site Wide Biodiversity Development Assessment Report

Prepared for Legacy Property

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DOCUMENT TRACKING

Project Name	**Corrimal Cokeworks Site Wide Biodiversity Development Assessment Report (Stages 2-4)**
Project Number	23SYD-5060 / formerly 22SYD 2750
Project Manager	Alex Gorey
Accredited Assessor Certification	Alexandra Gorey BAAS#22003 I certify that this report has been prepared in the basis of the requirements of, and information provided under the Biodiversity Assessment Method and s6.15 of the BC Act. In preparing this assessment I have acted consistent with the Accredits BAM Assessor Code of Conduct. I have considered the circumstances and there is no actual or perceived conflict of interest. 
Prepared by	Tim Maher, Joseph Gleeson and Alex Gorey
Reviewed by	Alex Gorey, Meredith Henderson and Stacey Wilson
Approved by	Meredith Henderson
Status	**Final**
Version Number	**7**
Last saved on	**24 September 2024**

This report should be cited as 'Eco Logical Australia 2024. *Corrimal Cokeworks Site Wide Biodiversity Development Assessment Report* (Stages 2-4). Prepared for Legacy Property .'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Urbis and Legacy Property.

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Template 2.8.1

Executive Summary

Eco Logical Australia Pty Ltd (ELA) has been engaged by Legacy Property Pty Ltd to prepare this Biodiversity Development Assessment Report (BDAR) to assess impacts associated with all proposed stages of the development at 27 Railway Street Corrimal at (known as Corrimal Cokeworks). The impact calculations have been broken down into each stage, including the Demolition DA, Stage 1 and Stages 2-4. For reference, the three stages relate to the following:

- Demolition DA – enable demolition of built elements (buildings, berms and removal of vegetation)
- Stage 1 – bulk earthworks to enable the Stage 1 built form and heritage plaza DA
- Stages 2-4 – bulk earthworks and riparian corridor re-alignment to enable the stages 2-4 built form DA and creek-line restoration.

This BDAR will be submitted to Wollongong City Council to support a development application for Stages 2-4 of the development. The DA will be submitted for approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Biodiversity values relevant to the subject land were:

- PCT 838 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat).

The development footprint also contained the following:

- Planted native vegetation
- Exotic cover
- Existing hardstand surfaces, including concrete and cokeworks infrastructure.

A summary of credit requirements to offset impacts to PCT 838 are shown in Table 1. Impacts to planted native vegetation do not require offsets, consistent with the application of the Streamlined Assessment Module: Planted Native Vegetation.

Table 1: Summary of ecosystem and species credits required to offset the residual impacts for each stage of the proposed development

BDAR stage	Vegetation Zone	PCT ID	PCT Name	Credit Class	Direct impact (ha)	Credits required
Ecosystem credits						
Demolition DA	N/A	No PCTs present	N/A	N/A	N/A	N/A
Stage 1 bulk earthworks	1	838	Forest Red Gum - Thin-leaved Stringybark Grassy Woodlands	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	0.41	15

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BDAR stage	Vegetation Zone	PCT ID	PCT Name	Credit Class	Direct impact (ha)	Credits required
				This includes PCT's: 838, 1326		
Stage 2-4 bulk earthworks	1	838	Forest Red Gum - Thin-leaved Stringybark Grassy Woodlands	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion This includes PCT's: 838, 1326	0.81	15
Species credits						
Stage 2-4 bulk earthworks	Grey-headed Flying Fox			-	0.10	3
				Total	**1.37**	**33**

Mitigation measures for each stage have been proposed to manage specific indirect impacts and / or prescribed impacts relevant to each stage. There are overarching control measures that relate to all stages which include:

- Pre-clearance and clearance supervision by a suitably qualified ecologist
- Ensuring retained native vegetation is not indirectly affected
- Management of noise
- Dust suppression
- Minimising risk of vehicle strike and bushfire
- Preventing rubbish dumping.

In addition, all site works will be undertaken in accordance with the existing NSW Climate Change, Energy, the Environment and Water (DCCEEW) Grey-headed Flying Fox Licences (Appendices L-N). A Threatened Species Licence will also be required for Stage 2-4 of the proposed works following Development Approval (if approved).

With respect to the **Demolition DA,** the microbat management plan must be implemented, specifically the exclusion techniques proposed for Site 5. All works must be undertaken in accordance with the Threatened Species Licence (Appendix B of PoM Appendix G)

With respect to **Stage 1 bulk earthworks,** all works must be undertaken in accordance with he Threatened Species Licence (Appendix A of Pom Appendix G).

With respect to **Stages 2-4 bulk earthworks,** the Grey-headed Flying-fox Management Plan prepared by ELA (Appendix G) must be implemented. A plan will be submitted with this development application and a biodiversity conservation license will be obtained to support the completion of the works.

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Abbreviations

Abbreviation	Description
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Credit Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
CEEC	Critically Endangered Ecological Community
DCCEEW (Cth)	Commonwealth Department of Climate Change, Energy, the Environment and Water
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
GIS	Geographic Information System
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LLS	Local Land Service
NRAR	Natural Resourced Access Regulator
NSW	New South Wales
PCT	Plant Community Type
SEPP	State Environmental Planning Policy
TEC	Threatened Ecological Community
VIS	Vegetation Information System
WM Act	NSW *Water Management Act 2000*

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1. Introduction

This Biodiversity Development Assessment Report (BDAR) has been prepared by Alexandra Gorey, an Accredited Person (BAAS22003) to apply the Biodiversity Assessment Method 2020 (BAM) under the NSW *Biodiversity Conservation Act 2016* (BC Act). All credit calculations have been undertaken using the BAM Calculator (BAMC) version in case number 00033885.

This BDAR has also been updated following initial submission to address comments made from Council in a request for Information (RFI) issued 4 April 2024.

Definitions of terminology used throughout this report are presented in Appendix A.

1.1. General description of the subject land development footprint

The subject land is located on D'harawal Country, at Railway Street, Corrimal and consists of four lots (Lot 11 DP749492, Lot 5 DP749492, Lot 126 DP598190 and Lot 1 DP 795791) with a combined area of 18.16 ha. The subject land is within the Wollongong Local Government Area (LGA) and is located approximately 5 km north of the Wollongong city centre. The subject land is bounded by Memorial Drive on the west, Railway Street and residential housing to the north, the railway line and residential housing to the east, and the vegetated riparian area of Towradgi Creek to the south. The subject land is generally flat with a gentle slope towards Towradgi Creek in the south east. A large portion of the subject land comprises cleared land and existing hardstand surfaces. The subject land contains two remnant patches of native vegetation, and occurrences of exotic cover and planted native vegetation.

This report includes two base maps, the Location Map (Figure 1) and the site map (Figure 2).

1.2. Brief description of the proposal and development footprint

The proposed development contains the three main stages. The Demolition DA has been approved and works commenced. Stage 1 was approved and works commenced, with 15 credits retired. The third stage relates to this BDAR and proposed development Stages 2-4. Details on the proposal are outlined below.

1.2.1. Demolition DA

The proposed development is seeking removal of vegetation and demolition of cokeworks structures and infrastructure. The demolition DA was approved on 18 July 2024. The development was supported by a BDAR in the package DA-2022/1249.

1.2.2. Stage 1 BDAR

Stage 1 of the proposed development is positioned at the northern extent of the subject land and is 3.63 ha in extent. The proposed development includes:

- Bulk earthworks
- Tree and vegetation removal
- Ancillary works including compounds, access, parking, fencing and sediment management.

The Stage 1 DA development has been approved. The development was supported by a BDAR in the package (DA-2023/166).

1.2.3. Stage 2-4

The Stage 2-4 of the proposed development include:

- Bulk earthworks
- Tree and vegetation removal
- Establishment of the future riparian corridor
- Establishment of supplementary Grey-headed Flying-fox belly dipping habitat
- Ancillary works including compounds, access, parking, fencing and sediment management.

Stages 2-4 are 12.59 ha in size and area positioned along the western boundary and through to the southern extent of the subject land. Stage 2-4 development is the subject of this BDAR which will be submitted under a separate DA to stages 1 and Demolition.

1.3. Overall development context

This BDAR assesses all impacts associated with the proposed development. This BDAR assesses and describes impacts for Stages 2-4 of the development footprint.

1.4. Sources of information used

The following data sources were reviewed as part of this report:

- Biodiversity Assessment Method Calculator (data v 57, 1.4.0.00)
- BioNet Vegetation Classification 2023
- BioNet / Atlas of NSW Wildlife 5 km database search (EHG 2023)
- The Native Vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0 (Tozer et al. 2010)
- BioNet PCT predicted species reports
- Threatened Biodiversity Data Collection (DCCEEW 2023)
- Aerial photographs (Google Earth, Six Maps and NearMaps)
- Mapped Native Vegetation of the Illawarra Region (NPWS 2002)
- aerial mapping (SIXMaps)
- additional GIS datasets including soil, topography, geology and drainage
- Illawarra Coke Company Land – Biocertification Feasibility Assessment (ELA 2015)
- Eco Logical Australia 2022. 27 Railway Street, Corrimal Cokeworks Ecological Assessment. Prepared for Legacy Property and Illawarra Coke Company.

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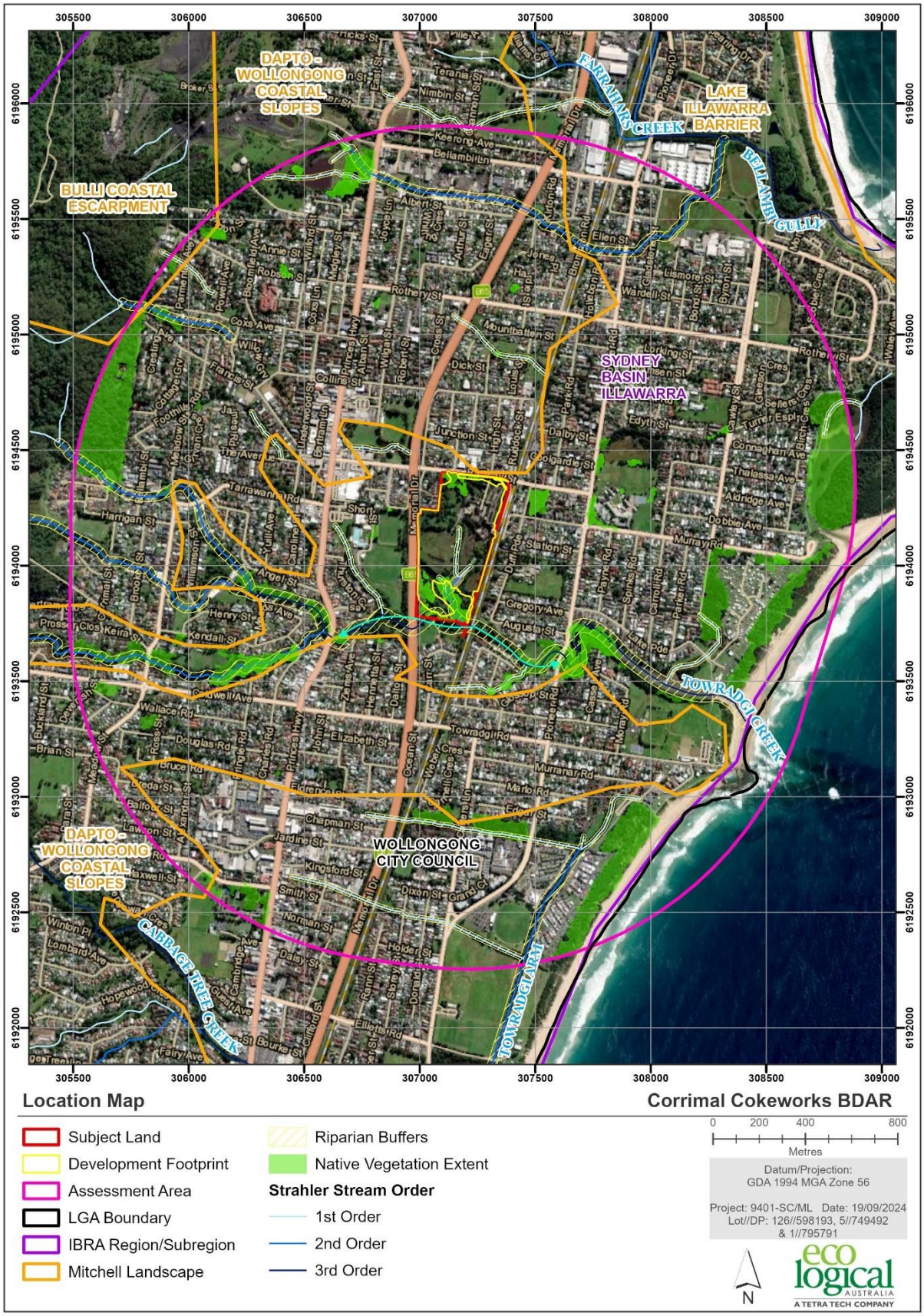


Figure 1: Location Map

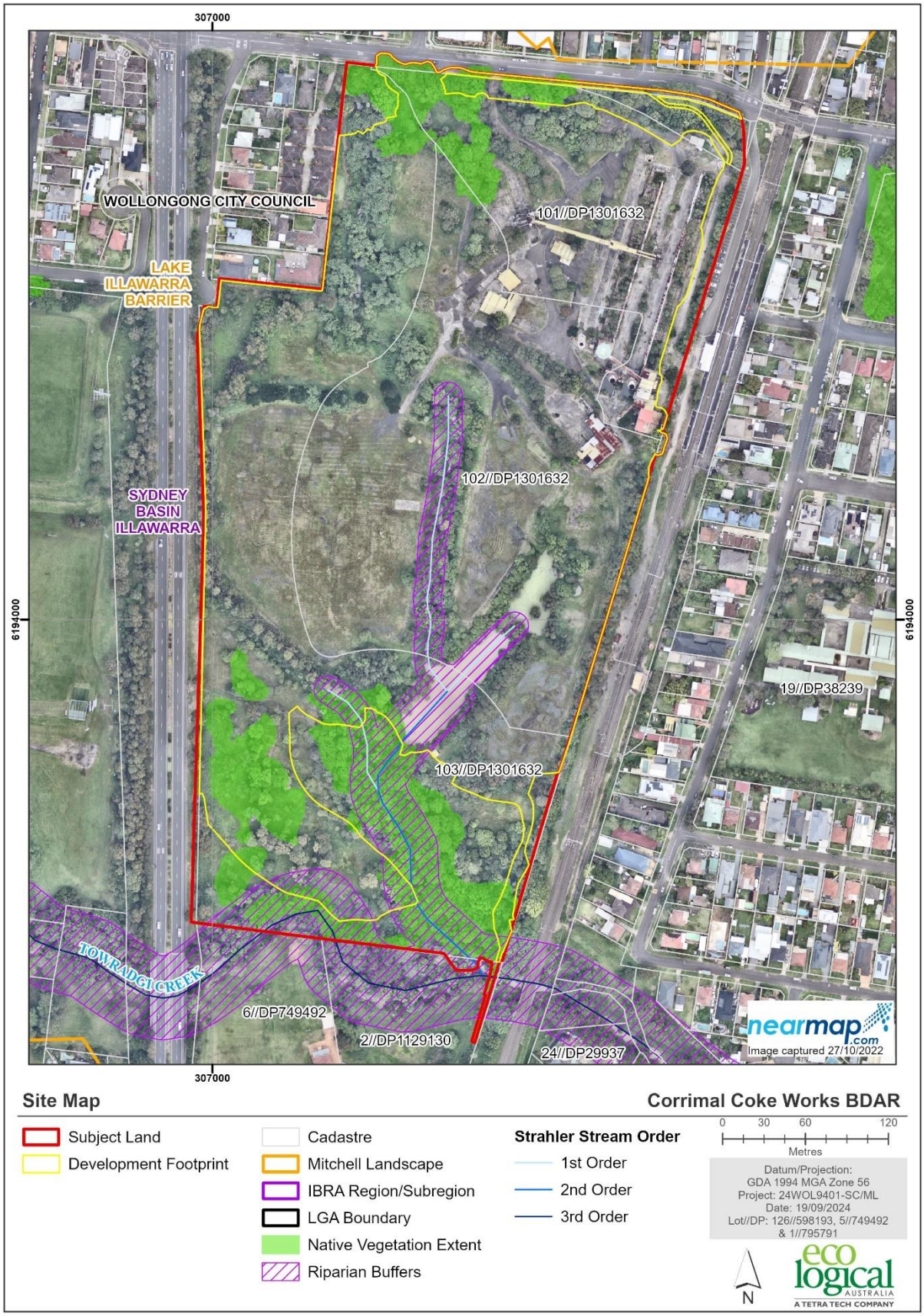


Figure 2: Site Map



Figure 3: Development context across the subject land

1.5. Legislative context

Legislation relevant to the development footprint is outlined in Table 2.

Table 2: Legislative context

Name	Relevance to the project	Report Section
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999	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. Matters of National Environmental Significance (MNES) have been identified on or near the development footprint. This report assesses impacts to MNES and concludes that the development is not likely to have a significant impact on MNES.	Section 8
State		
Environmental Planning and Assessment Act 1979	The EP&A Act is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of development proposals. The proposed development requires consent under the Wollongong Local Environmental Plan 2009 (LEP) and is to be assessed under Part 4 of the EP&A Act. Relevant Environmental planning Instruments are discussed below.	Entire report
Biodiversity Conservation Act 2016	The purpose of the BC Act is to maintain a healthy and productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. Development that has a significant impact on biodiversity values as set out in Part 7 of the BC Act and Part 7 of the Biodiversity Conservation Regulation 2017 are required to undertake an assessment in accordance with the Biodiversity Assessment Method (BAM) and submit a Biodiversity Development Assessment Report (BDAR) The proposed development triggers the area clearing threshold and therefore requires submission of a Biodiversity Development Assessment Report.	Entire report
Fisheries Management Act 1994	The objects of the FM Act are to conserve, develop and share the fishery resources of the State for the benefits of present and future generations. The Act provides protection and approval processes for activities which may impact on threatened species, protected marine vegetation or involve dredging, reclamation or obstruction of fish passage. The development does not involve impacts to Key Fish Habitat, does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage. A permit or consultation under the FM Act is not required.	N/A
Water Management Act 2000	The WM Act is the sustainable and integrated management of the state's water for the benefit for both present and future generations. If a 'controlled activity' is proposed on 'waterfront land', an approval is required under the Water Management Act (s91). 'Controlled activities' include: • the construction of buildings or carrying out of works (with the exception of land based private dwellings, a dual occupancy building or related ancillary facilities); • the removal of material or vegetation from land by excavation or any other means; • the deposition of material on land by landfill or otherwise; or • any activity that affects the quantity or flow of water in a water source.	Separate riparian report to be prepared.

Name	Relevance to the project	Report Section
	The project involves works on waterfront land and therefore requires a Controlled Activity Approval under s91 of the WM Act. The proposed development will impact waterfront land. Consistent with the WM Act, a controlled activity approval is required.	
Environmental Planning Instruments		
State Environmental Planning Policy (Resilience and hazards) 2021	The Resilience and Hazards SEPP applies to the development footprint. A portion of the development footprint is mapped on the Coastal Environment Area map which requires consideration before development consent can be granted.	Section 9
State Environmental Planning Policy (Biodiversity and Conservation) 2021	This State Environmental Planning Policy (SEPP) came into effect on March 1 2022 and among others has consolidated the following: • Sydney Drinking Water Catchment SEPP 2011 (now chapter 8) • The Vegetation in Non-Rural Areas SEPP 2017 (now chapter 2) • Koala Habitat Protection SEPP 2021 (SEPP KHP) (now chapter 4). All proposed developments in the Sydney drinking water catchment are required to have a neutral or beneficial effect on water quality (NorBE). The study area is not mapped within the Sydney drinking water catchment. The Vegetation in Non-Rural Areas SEPP 2017 aimed to protect the biodiversity values of trees and other vegetation in non-rural areas of the State, and to preserve the amenity of non-rural areas of the State through the preservation of trees and other vegetation. The provisions of this SEPP have been included in the Biodiversity and Conservation SEPP in Chapter 2. Chapter 2 applies to development that does not require consent. As the proposed development requires consent by Wollongong City Council, the Vegetation SEPP is not relevant to the proposal. Chapter 4: Koala Habitat Protection 2021 (SEPP KHP) contains the land-use planning and assessment framework for Koala habitat within the Metropolitan Sydney and Central Coast. The SEPP KHP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline. The development control provisions of the SEPP KHP apply to development applications relating to land within a council listed in Schedule 1 and: 1. Where there is an approved Koala Plan of Management for the land a. The development application must be consistent with the approved Koala Plan of Management that applies to the land. 2. Where there is no approved Koala Plan of Management for the land, if the land a. Has an area of more than 1 hectare, or b. Has, together with any adjoining land in the same ownership, an area of more than 1 hectare, whether or not the development application applies to the whole or only the part of the land. The site is: • within a council area listed in Schedule 1 of the SEPP (City of Wollongong) where all land use zones are subject to the provisions of the SEPP KHP except for RU1, RU2 and RU3. • not within an approved Koala Plan of Management Area. • more than 1 hectare (ha) in area • within the South Coast Koala Management Area.	N/A

Name	Relevance to the project	Report Section
	Therefore, the SEPP KHP applies to this site. However, the proposed development may be considered to have low or no impact on koalas or koala habitat, if so, Council may grant consent to the development application. The current proposal would involve the removal of koala use tree species listed under Schedule 2 of the SEPP KHP including, *Eucalyptus tereticornis*. This vegetation predominantly occurs within the subject site as isolated patches of remnant vegetation trees with little to no connection to larger areas of bushland as the site is set in an urban setting, surrounded by built areas. The site has been the subject of many site visits at dusk, and during the day. At no time were koala observed on the development footprint. Therefore while there may be preferred koala trees present, the development footprint does not contain highly suitable koala habitat and there have been no koalas recorded or observed in the footprint in the last 18 years. Therefore, subject site is likely to have low or no impact on Koalas.	
Wollongong Local Environment Plan (LEP) 2009	The subject land is zoned R3 Medium Density Residential. The development footprint is not mapped on the terrestrial biodiversity overlay or the riparian lands map. A portion of the subject land is mapped on the riparian lands map, however this does not overlap with the development footprint.	N/A
Wollongong Development Control Plan (DCP) 2009	The Wollongong DCP contains a site specific chapter for the subject land (Chapter D19) provisions relating to native vegetation, Grey-headed Flying-fox. The provisions in the DCP have been addressed as part of this report.	Section 9

2. Landscape features

The landscape features considered for this assessment are presented in Table 3, Figure 1 and Figure 2.

Table 3: Landscape features

Landscape feature	Subject Land/Development footprint	Assessment Area	Data source
IBRA Region(s)	Sydney Basin	Sydney Basin	Interim Biogeographic Regionalisation for Australia, Version 7
IBRA subregion(s)	Illawarra	Illawarra	Interim Biogeographic Regionalisation for Australia, Version 7
Rivers and streams	un-named first and second order tributaries of Towradgi Creek, realigned stream	Towradgi Creek, and numerous unnamed first, second and third order watercourses	NSW LPI Waterway mapping
Estuaries and wetlands	None present	None present	NSW directory of important wetlands
Connectivity of different areas of habitat	Connectivity throughout the subject land is limited to Towradgi Creek and the unnamed tributaries	Towradgi Creek and various unnamed tributaries.	Aerial imagery
Geological features of significance and soil hazard features	Not present.	Not present. The western edge of the assessment area reaches the footslopes of the escarpment.	Aerial imagery
Areas of Outstanding Biodiversity Value	Not present.	Not present.	Register of Declared Areas of Outstanding Biodiversity Value (DPIE 2020)
NSW (Mitchell) Landscapes	Lake Illawarra Barrier	Lake Illawarra Barrier, Dapto – Wollongong Coastal Slopes	NSW (Mitchell) Landscapes - version 3.1 (DPIE 2016)
Additional features required to be assessed	Nil.	Nil.	
Percent (%) native vegetation extent	The % native vegetation extent in the development footprint is 36.34 %	There are no differences between the mapped vegetation extent and the aerial imagery. The development footprint is approximately 15.19 ha and contains approximately 4.40 ha of vegetation. The assessment area is approximately 995 ha and contains approximately 66.2 ha of native vegetation (7 %).	Calculated using aerial imagery and ArcGIS software

3. Native Vegetation

3.1. Survey Effort

3.1.1. Vegetation validation

The field survey focused on validating / refining vegetation community mapping (NPWS 2002), compiling a list of flora observed in the subject land, identifying flora and fauna habitats, and identifying other features of conservation significance. Fauna species opportunistically observed during the field survey were also recorded.

An initial field survey was undertaken on 2 December 2014, by ELA ecologists Brian Towle and Rebecca Dwyer, over approximately three hours. The field survey involved a preliminary validation of the previous vegetation mapping across the subject land. To further inform the assessment, an additional field survey was undertaken on 18 March 2015 by ELA ecologists Brian Towle and Jack Talbert over approximately two hours. This additional site inspection involved recording all flora species observed and identifying fauna habitats across the subject land. Further site works were undertaken by restoration ecologist Paul Price in May 2017.

A secondary vegetation validation survey was conducted by ELA Ecologists Dr Meredith Henderson and Melaina Chapman on Monday 27 June 2022. The purpose of the additional vegetation validation was to ensure that the vegetation was mapped consistent with the BAM 2020. A total of one vegetation integrity survey plot was undertaken on the development footprint and two in the subject land to assess the composition, structure and function components of each vegetation zone in accordance with the BAM.

In 2023, the former Department of Planning and Environment made changes to the vegetation data repository. These changes included updating the names and numbers of plant community types (PCTs) along the coast of NSW. These new PCTs are known as East Coast PCT (EPCT). Since the vegetation plots were established prior to the release of these data, the legacy PCT have been used in this assessment.

All field data collected at full-floristic and vegetation integrity plots is included in Appendix B and Appendix C.

Table 4: Full-floristic PCT identification plots in the subject land/Development Site

	PCT ID	PCT Name	Condition	Area (ha)	Plots surveyed	Plots required for this BDAR
1	838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Moderate	0.52	1	1
2	838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands,	Degraded	0.65	1	1

PCT ID	PCT Name	Condition	Area (ha)	Plots surveyed	Plots required for this BDAR
	southern Sydney Basin Bioregion				
	Planted native vegetation	-	4.35	0 – not required under BAM	0 – not required under BAM
	Exotic	-	2.58	0 – not required under BAM	0 – not required under BAM
	Cleared land	-	6.69	0 – not required under BAM	0 – not required under BAM
	Dams	-	0.40		
		Total	**15.19**	**1**	**1**

3.2. Native vegetation extent on the subject land

There are no differences between the actual native vegetation extent and that shown in the imagery. Areas of non-native vegetation were mapped into Exotic. These areas did not contain flora species native to NSW and could not reasonably be assigned to a PCT. Areas which did not contain any vegetation were assigned to cleared land.

3.3. Plant Community Types present

One PCT was identified within the development footprint and is presented in Table 5. The development footprint also contained 2.58 ha of exotic cover, 6.69 ha of cleared land 4.353.59 ha of planted native vegetation. The exotic and cleared areas do not conform to a native PCT. The planted native vegetation was assessed against the Streamlined Assessment Module – Planted Native Vegetation and met the definition of planted native. It therefore was not assigned to a PCT.

Table 5: Plant Community Types in the development footprint

BDAR Stage	PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area	Percent cleared*
Demoliton DA	-	-	-	-	-	-
Stage 1	PCT 838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Coastal Valley Grassy Woodlands	Grassy Woodland	0.41 ha	85
Stage 2-4	PCT 838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Coastal Valley Grassy Woodlands	Grassy Woodland	0.81 ha	85

* the extent to which a species or ecological community is threatened with extinction, or the extent to which a PCT is estimated to have been cleared as provided by VIS as of 7 January 2023

3.3.1. Plant Community Type selection justification

In determining the PCT for the development footprint, various attributes were considered in combination to assign vegetation to the best fit PCT. Attributes included dominant species in each stratum and relative abundance, community composition, soils and landscape position. Reference was made to the PCT descriptions in the BioNet Vegetation Classification and the final scientific determinations for TECs. Possible PCT options are provided in Table 5.

Table 6: Potential PCTs

Selected PCT ID	PCT Name	Other PCT options
838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	**PCT 1326 Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion** This community occurs in the Sydney Basin Bioregion and the Illawarra Subregion which is consistent with the location of the development footprint. This PCT is dominated by *Eucalyptus globoidea, Eucalyptus longifolia, Eucalyptus tereticornis* and *Corymbia maculata*. The canopy species in the development footprint included *Eucalyptus pilularis, Eucalyptus botryoides* and *Eucalyptus tereticornis*. The canopy species in the development footprint are a poor match for the canopy species in PCT 1326. PCT 1326 also has a high abundance of *Melaleuca decora* which was not present in the development footprint. This PCT was not chosen due to the inconsistencies in dominant canopy and sub canopy species.
		PCT 829 Forest Red Gum - Coast Grey Box shrubby open forest on steep hills in the Bega Valley, South East Corner Bioregion This PCT only occurs in the South-east Corner Bioregion. The subject land is in the Sydney Basin Bioregion. Given the geographic distribution does not overlap, this PCT was not selected as the best-fit PCT.
		PCT 877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion This PCT occurs in the Sydney Basin but does not occur within the Illawarra Subregion. It occurs on rocky slopes and dry gullies below 500 m and is comprised of *Backhousia* myrtifolia. No *Eucalyptus* spp. are part of this community. This PCT was not selected due to the inconsistencies in geographic distribution, position in the landscape and floristic structure.

3.4. Threatened Ecological Communities

The development footprint contained one plant community type; PCT 838. PCT 838 was present in two condition zones; moderate and degraded, both of which met the definition of Illawarra Lowlands Grassy Woodland which is listed as endangered under the BC Act. PCT 838 can also form part of *Illawarra and South Coast Lowland Forest and Woodland*, is listed as critically endangered under the EPBC Act. The patch of PCT 838 in the development footprint did not meet the condition thresholds for listing under the EPBC Act. Although the patch size was > 0.5 ha, the groundcover layer did not contain at least 30%

native perennial understorey vegetation cover. A groundcover comprising 30% native perennial species is the minimum condition requirement to meet the EPBC Act listing.

The percentage of native groundcover was determined by assessing the plot data collected and the overall condition of each discrete patch of PCT 838. An assessment of the groundcover across the entire patch was made, consistent with the definition of a patch in the approved conservation advice (DotEE 2016). Despite localised areas of moderate condition groundcover, native perennial plant cover across the patch cover was <30%.

Table 7: Threatened Ecological Communities

Development stage	PCT ID	BC Act			EPBC Act		
		Listing status	Name	Area (ha)	Listing status	Name	Area (ha)
Stage 1	838 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands	E	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	0.41	CE	Illawarra and South Coast Lowland Forest and Woodland	0
Stage 2-4	838 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands	E	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	0.81	CE	Illawarra and South Coast Lowland Forest and Woodland	0

3.5. Vegetation integrity assessment

3.5.1. Vegetation zones

A total of two vegetation zones were identified in the development footprint based on the broad condition state of the PCT present. A total of two (2) vegetation integrity survey plots were collected in the subject land consistent with the BAM. Descriptions of vegetation zones are provided in Table 8.

3.5.2. Patch size

Patch size was calculated using available vegetation mapping for all patches of intact native vegetation on and adjoining the development footprint. Patch size is assigned to one of four classes (<5 ha, 5-24 ha, 25-100 ha or ≥100 ha). A patch size 5-25 ha was determined for the development footprint.

Table 8: Zone 1 PCT 838 Moderate Condition

838 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands			
Vegetation formation/class	Grassy woodland / Coastal Valley Grassy Woodland		
Conservation status	NSW BC Act EEC: Illawarra Lowlands Grassy Woodland		
	EPBC Act CEEC: N/A – does not meet EPBC Act condition thresholds.		
Description	This PCT occurred as a small remnant patch along the boundary of the subject land near Railway Street. The zone showed signs of previous disturbance and modification, mostly likely a result of previous cokeworks site. Previous modification included ongoing management through mowing and planting of native, horticultural species such as *Grevillea robusta*.		
Characteristic canopy trees	*Eucalyptus pilularis, Eucalyptus tereticornis*		
Characteristic mid-storey	*Pittosporum undulatum, Acacia longifolia* subsp. *longifolia, Acacia maidenii*		
Characteristic groundcovers	*Billardiera scandens, Dianella longifolia* var. *longifolia, Entolasia marginata, Microlaena stipoides* var. *stipoides* and *Geranium solanderi* var. *solanderi*		
Mean native richness	29		
Exotic species / HTW cover	12 % HTW cover, *Ageratina adenophora, Araujia sericifera, Asparagus aethiopicus, Cenchrus clandestinus, Chloris gayana, Chrysanthemoides monilifera* subsp. *rotundata, Cinnamomum camphora, Ehrharta erecta, Lantana camara, Ligustrum sinense, Ochna serrulata, Rubus rugosus*		
Condition	Moderate		
Variation and disturbance	Moderate levels of disturbance from previous clearing and ongoing maintenance during the operational phase of the cokeworks. The zone contained a high proportion and variety of high threat exotic species and other woody weeds in varying densities.		
No. sites sampled	2 (across the subject land – 1 in the development footprint).		
Threatened flora species	Absent.		
Fauna habitats	Potential foraging habitat for Grey-headed Flying-fox and highly mobile species such as birds and bats.		
Composition	**Structure**	**Function**	**Vegetation Integrity Score**
62	72.4	82.3	71.7



Table 9: PCT 838 in degraded condition in the subject land

838 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands			
Vegetation formation/class	Grassy woodland / Coastal Valley Grassy Woodland		
Conservation status	NSW BC Act EEC: Illawarra Lowlands Grassy Woodland		
	EPBC Act CEEC: N/A – does not meet EPBC Act condition thresholds.		
Description	This PCT occurred as a patch within the southern extent of the subject land, near Memorial Drive. This zone showed signs of historic clearing with some areas occurring as regrowth *Acacia* spp.		
Characteristic canopy trees	*Casuarina glauca* and *Acacia maidenii*		
Characteristic mid-storey	*Pittosporum undulatum, Glochidion ferdinandi* var. *ferdinandi, Acacia maidenii* and *Pandorea panorana*		
Characteristic groundcovers	*Microlaena stipoides* var. *stipoides, Dichondra repens, Oplismenus aemulus*		
Mean native richness	9		
Exotic species / HTW cover	18.6 % HTW cover, *Araujia sericifera, Asparagus aethiopicus, Cenchrus clandestinus, Ehrharta erecta,, Ligustrum sinense, Ochna serrulata, Solanum mauritanium, Sonchus oleraceus, Tagetes minuta, Lolium* sp.		
Condition	Degraded regrowth		
Variation and disturbance	High levels of disturbance from previous clearing and ongoing maintenance during the operational phase of the cokeworks. The zone contained a high proportion and variety of high threat exotic species and other woody weeds in varying densities. The canopy was largely absent of *Eucalyptus* sp. with other sub-canopy species dominant. The structural complexity was poor, and the abundance of native species in all structural layers was limited.		
No. sites sampled	1		
Threatened flora species	Absent.		
Fauna habitats	Potential foraging habitat for Grey-headed Flying-fox and highly mobile species such as birds and bats.		
Composition	**Structure**	**Function**	**Vegetation Integrity Score**
14	8.8	63.8	19.9

3.5.3. Assessing vegetation integrity

A vegetation integrity assessment using the BAM Calculator (BAMC) was undertaken and the results are outlined in Table 10.

Table 10: Vegetation integrity scores for stages 2-4

Veg Zone	PCT ID	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Presence of Hollow bearing trees	Current vegetation integrity score
1	838	Moderate	0.16	62	72.4	82.3	Yes	71.7
2	838	Degraded	0.65	14	8.8	63.8	No	19.9

3.6. Use of local data

Local data has not been used in the preparation of this BDAR.



Figure 4: Plant Community Types



Figure 5: Vegetation zones and plots

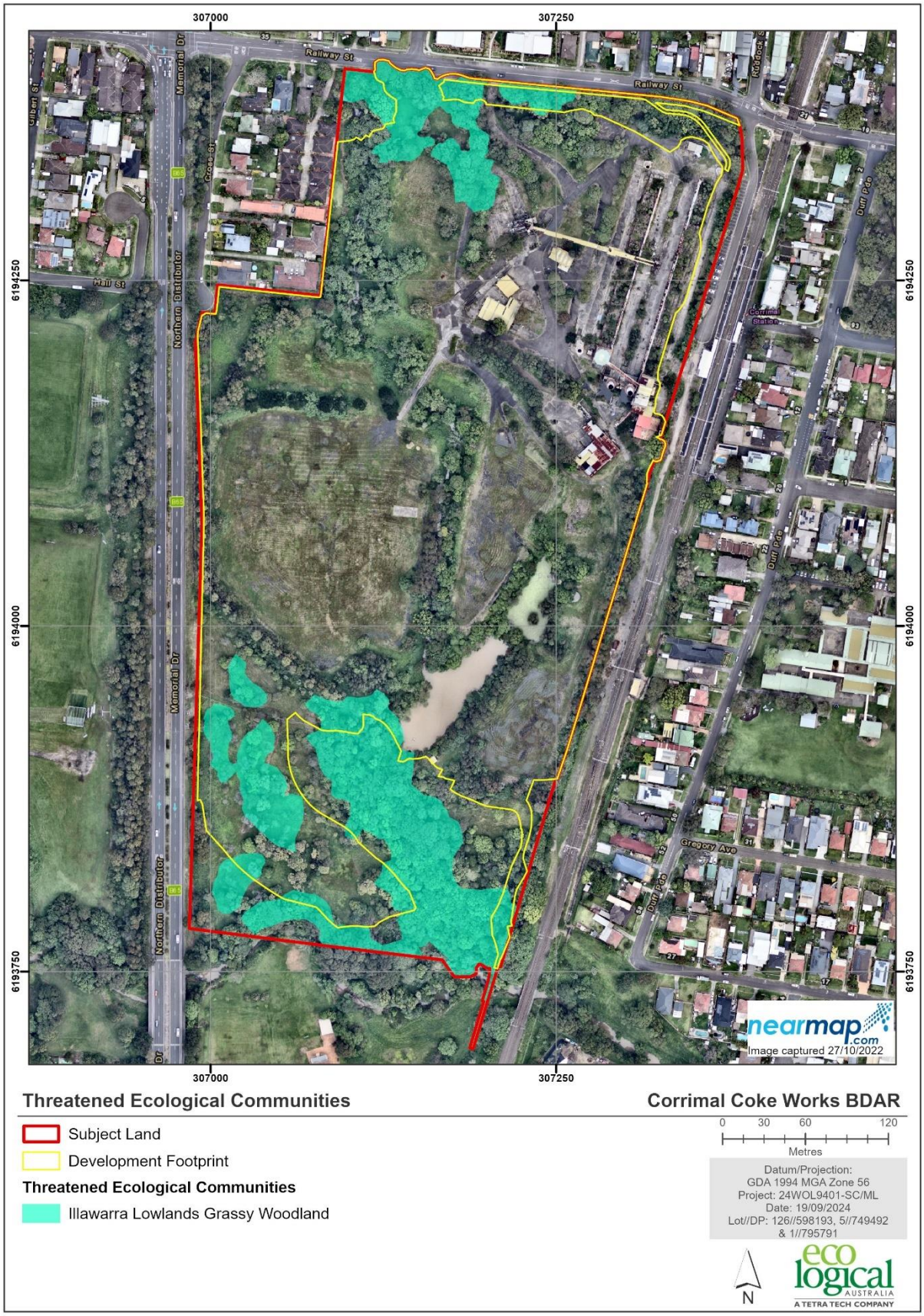


Figure 6: Threatened Ecological Communities

4. Use of streamlined assessment module – Planted native vegetation

Due to the presence of planted native vegetation within the development footprint, vegetation identified as 'Planted native' was assessed under the streamlined assessment module for planted native vegetation in accordance with Appendix D of BAM 2020. This appendix contains a decision-making key which provides a framework for the assessment of planted native vegetation. This framework is applied to the relevant area in Table 11.

Table 11: Decision-making key for the assessment of Planted native vegetation in accordance with Appendix D of the BAM 2020

Question	Response and justification
1) Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal? i Yes – the planted native vegetation must be allocated to the best-fit PCT and the BAM must be applied. ii **No – Go to 2**.	**No** – canopy species are clearly planted given their species, size and location amongst hardstand surfaces and between a fence line and road. No remnant native vegetation is present in the area. Where remnant native vegetation was adjacent to the planted native vegetation, it was mapped to a PCT rather than as part of the planted native polygon.
2. Is the planted native vegetation: a. Planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and b. The primary objective was to replace or regenerate a plant community type of a threatened plan species or its habitat? i Yes – the planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM ii **No – Go to 3**.	**No** – due to the location of canopy species, the trees were likely planted as roadside landscaping or as part of landscaping in the cokeworks facility.
3. Is the planted / translocated native vegetation individuals of a threatened species or other native species planted / translocated for the purpose of providing threatened species habitat under one of the following: a. A species recovery project b. *Saving our Species* project c. Other types of government funded restoration project d. Condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat e. Legal obligation as part of a condition of ruling of court. This includes regulatory directed or ordered remedial plantings (e.g. Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act) f. Ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan, or g. Approved vegetation management plan (e.g. as required as part of a Controlled Activity Approval for works on waterfront land under the NSW *Water Management Act 2000*)?	**No** – the native species present were not threatened and were not planted for rehabilitation, therefore it is unlikely that they were planted or translocated for the purposes of a. through g.

Question	Response and justification
i Yes – the planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM • **No – Go to 4**.	
4. Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration within a legal obligation to secure or provide for management of the native vegetation? i Yes – Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied) • **No – Go to 5**.	**No** – the planted native vegetation forms part of the landscaping for the previous cokeworks facility.
5. Is the planted native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as; windbreaks in agricultural landscapes, roadside plantings (including street trees, median stripes, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms? i **Yes – Go to D.2** Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied) ii No – Go to 6.	**Yes** – the planted native vegetation appears to be landscape plantings.
6. Is the planted native vegetation a species listed as a widely cultivated native species on a list approved by the Secretary of the Department (or an officer authorised by the Secretary)? i Yes – Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied) ii No – There may be other types of occurrences of planted native vegetation that do not easily fit into the decision-making key above.	N/A

4.1. Assessment of planted native vegetation for threatened species habitat

Areas of planted native vegetation were assessed for threatened species habitat using the same methods applied for the rest of the development footprint. These methods and results are detailed in Section 5. The planted native vegetation may provide an occasional foraging resource for the Grey-headed Flying-fox and the following threatened microbat species that were either identified as present or potentially present in the subject land during surveys ():

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) - potential
- *Miniopterus orinae oceanensis* (Large Bent-winged Bat) - present
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) - potential
- *Myotis macropus* (Southern Myotis) – potential.

Measures to mitigate and manage impacts to planted native vegetation are provided in Section 7. No species credits are required to offset the proposed impacts to planted native vegetation consistent with Appendix D2 and section 8.4 of BAM.

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5. Threatened species

5.1. Ecosystem credit species

Ecosystem credit species predicted to occur within the development footprint are generated by the BAMC following the input of VI data and the PCTs identified within Chapter 3. Ecosystem credit species predicted to occur at the development footprint, their associated habitat constraints, geographic limitations and sensitivity to gain class and reasons for inclusion and exclusion are included in Table 12.

5.2. Species credit species

5.2.1. Identification of species credit species

Species credit species that require further assessment on the development footprint (i.e. candidate species), their associated habitat constraints, geographic limitations and sensitivity to gain class are included in Table 13.

Table 12: Predicted ecosystem credit species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status	Justification for inclusion / exclusion
Anthochaera phrygia	Regent Honeyeater (Foraging)	-	-	High	Critically Endangered	Critically Endangered	Included Marginal foraging habitat available
Artamus cyanopterus cyanopterus	Dusky Woodswallow	-	-	Moderate	Vulnerable	Not Listed	Included Marginal foraging habitat available
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)	-	-	Moderate	Vulnerable	Endangered	Included Marginal foraging habitat available
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	Presence of *Allocasuarina* spp. and *Casuarina* spp.	-	High	Vulnerable	Vulnerable	Included Some *Allocasuarina* spp. and *Casuarina* spp. present in the stage 2-4 development footprint and scattered occurrences in stage 1.
Circus assimilis	Spotted Harrier	-	-	Moderate	Vulnerable	Not Listed	Included Marginal foraging habitat available
Daphoenositta chrysoptera	Varied Sitella	-	-	Moderate	Vulnerable	Not Listed	Included Marginal foraging habitat available
Dasyurus maculatus	Spotted-tailed Quoll	-	-	High	Vulnerable	Endangered	Excluded Species is vagrant. This species relies on large patches of intact vegetation (>100 ha). The subject land and development footprint are highly fragmented and exist within an urbanised landscape
Glossopsitta pusilla	Little Lorikeet	-	-	High	Vulnerable	Not Listed	Included Marginal foraging habitat available

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Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status	Justification for inclusion / exclusion
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	- Waterbodies - Within 1km of rivers, lakes, large dams or creeks, wetlands and coastlines.	-	High	Vulnerable	Not Listed	Included Marginal foraging habitat available
Hieraaetus morphnoides	Little Eagle (Foraging)	-	-	Moderate	Vulnerable	Not Listed	Included Marginal foraging habitat available
Hirundapus caudacutus	White-throated Needletail	-	-	High	Not Listed	Vulnerable	Included Marginal foraging habitat available
Lathamus discolour	Swift Parrot (Foraging)	-	-	Moderate	Endangered	Critically Endangered	Included Marginal foraging habitat available
Lophoictinia isura	Square-tailed Kite (Foraging)	-	-	Moderate	Vulnerable	Not Listed	Included Marginal foraging habitat available
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	-	-	High	Vulnerable	Not Listed	Included Marginal foraging habitat available
Miniopterus orianae oceanensis	Large Bent-winged Bat (Foraging)	-	-	High	Vulnerable	Not Listed	Included Marginal foraging habitat available
Neophema pulchella	Turquoise Parrot	-	-	High	Vulnerable	Not Listed	Included Marginal foraging habitat available
Ninox connivens	Barking Owl (Foraging)	-	-	High	Vulnerable	Not Listed	Included Marginal foraging habitat available

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Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status	Justification for inclusion / exclusion
Petroica boodang	Scarlet Robin	-	-	Moderate	Vulnerable	Not Listed	Included Marginal foraging habitat available
Petroica phoenicea	Flame Robin	-	-	Moderate	Vulnerable	Not Listed	Included Marginal foraging habitat available
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)	-	-	High	Vulnerable	Vulnerable	Included Potential foraging habitat available
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	-	High	Vulnerable	Not Listed	Included Marginal foraging habitat available
Tyto novaehollandiae	Masked Owl (Foraging)	-	-	High	Vulnerable	Not Listed	Included Marginal foraging habitat available

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Table 13: Candidate species credit species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act status	EPBC Act status	Justification for inclusion / exclusion
Anthochaera phrygia	Regent Honeyeater (Breeding)	As per Important Habitat Map	-	High	CE	CE	Excluded. Development footprint not mapped on the important areas map (checked 8 December 2022 and 26 August 2024))
Burhinus grallarius	Bush Stone-curlew	Fallen/standing dead timber including logs	-	High	Endangered	Not Listed	Excluded Development footprint does not contain sufficient logs. Development footprint also occurs in a highly modified landscape with no connectivity to other areas of potential habitat.
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	- Hollow bearing trees - Eucalypt tree species with hollows greater than 9 cm diameter	-	High	Vulnerable	Endangered	Excluded No hollow bearing trees with suitable hollow diameter were identified in the development footprint or within 200 m of the development footprint
Calyptorhynchus lathami	Glossy-Black Cockatoo (Breeding)	- Hollow bearing trees - Living or dead tree with hollows greater than 15cm diameter	-	High	Vulnerable	Vulnerable	Excluded No hollow bearing trees with suitable hollow diameter were identified in the

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act status	EPBC Act status	Justification for inclusion / exclusion
		and greater than 8m above ground					development footprint or within 200 m of the development footprint
Cercartetus nanus	Eastern Pygmy-possum	-	-	High	Vulnerable	Not Listed	Excluded Habitat is degraded. This species requires a midstorey of nectar producing native species and hollow bearing trees both of which are absent in the development footprint. the development footprint also exists in a highly fragmentated landscape with no connectivity to larger areas of potential habitat.
Chalinolobus dwyeri	Large-eared Pied Bat	- Cliffs - Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	-	Very High	Vulnerable	Vulnerable	Included Development footprint in proximity (noting greater than 2 km) to Illawarra escarpment. Marginal potential habitat in the form of abandoned buildings and cokeworks infrastructure

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Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act status	EPBC Act status	Justification for inclusion / exclusion
Chorizema parviflorum - endangered population	*Chorizema parviflorum Benth.* in the Wollongong and Shellharbour LGAs	-	Shellharbour and Wollongong LGAs	High	Endangered Population	Not Listed	Excluded Habitat is degraded. Although remnant vegetation is present in the development footprint, it has been subject to ongoing disturbance and management for the past 30 years. The potential habitat is degraded. There are no records for this species in proximity to the development footprint.
Cynanchum elegans	White-flowered Wax Plant	-	-	High	Endangered	Endangered	Excluded Habitat is degraded. Although remnant vegetation is present in the development footprint, it has been subject to ongoing disturbance and management for the past 30 years. The potential habitat is degraded. There are no records for this species in proximity to the development footprint.
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	Living or dead mature trees within suitable	-	High	Vulnerable	Not Listed	Included

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act status	EPBC Act status	Justification for inclusion / exclusion
		vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines					Potential habitat available in the development footprint.
Hieraaetus morphnoides	Little Eagle (Breeding)	Nest trees - live (occasionally dead) large old trees within vegetation)	-	Moderate	Vulnerable	Not Listed	Included Marginal habitat available in the development footprint.
Lathamus discolor	Swift Parrot (Breeding)	As per Important Habitat Map	-	Moderate	Endangered	Critically Endangered	Excluded Development footprint not mapped on the important areas map (checked 8 December 2022 and 26 August 2024)
Lespedeza juncea subsp. *sericea* - endangered population	*Lespedeza juncea subsp. sericea* in the Wollongong LGA	-	Wollongong LGA	High	Endangered Population	Not Listed	Excluded Habitat is degraded. This endangered population is only known to occur on a road side verge south of Dapto.
Lophoictinia isura	Square-tailed Kite (Breeding)	Nest Trees	-	Moderate	Vulnerable	Not Listed	Included Marginal habitat available in the development footprint.
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	- Caves - Cave, tunnel, mine, culvert or other	-	Very High	Vulnerable	Not Listed	Included Development footprint in proximity (noting

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Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act status	EPBC Act status	Justification for inclusion / exclusion
		structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave - " observation type code "E nest-roost - " with numbers of individuals >500					greater than 2 km) to Illawarra escarpment. Marginal potential habitat in the form of abandoned buildings and cokeworks infrastructure
Myotis macropus	Southern Myotis	- Hollow bearing trees - Within 200 m of riparian zone - Bridges, caves or artificial structures within 200 m of riparian zone - Waterbodies. This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site	-	High	Vulnerable	Not Listed	Included Potential foraging habitat in the form of dams present within the subject land. No dams or water bodies present in the stage 1 or demolition DA development footprints.
Ninox connivens	Barking Owl (Breeding)	- Hollow bearing trees - Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground	-	High	Vulnerable	Not Listed	Excluded Suitably sized hollows not present in the development footprint or within 100 m of the development footprint
Petaurus norfolcensis	Squirrel Glider	-	-	High	Vulnerable	Not Listed	Excluded

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act status	EPBC Act status	Justification for inclusion / exclusion
							The habitat in the development footprint is substantially degraded. The patch of potential habitat is small and isolated with limited connectivity to other areas of potential habitat. The closest records are in Woonona. There is no consistent vegetated corridor that would allow the species access to the subject land
Phascolarctos cinereus	Koala	Presence of koala use trees	-	High	Endangered	Endangered	Excluded The habitat in the development footprint is substantially degraded. The patch of potential habitat is small and isolated with limited connectivity to other areas of potential habitat.
Pimelea curviflora var. *curviflora*		-	-	High	Vulnerable	Vulnerable	Excluded The patch of PCT 838 in the development footprint is degraded, having suffered from ongoing disturbance and management.

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Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act status	EPBC Act status	Justification for inclusion / exclusion
Pimelea spicata	Spiked Rice-flower	-	Within 5 km of coast	High	Endangered	Endangered	Excluded The patch of PCT 838 in the development footprint is degraded, having suffered from ongoing disturbance and management. There are also no records for this species within the LGA.
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	Breeding Camps	-	High	Vulnerable	Vulnerable	Included Known GHFF camp in the subject land
Pterostylis gibbosa	Illawarra Greenhood	-	-	High	Endangered	Endangered	Excluded Habitat is degraded. The only records for this species are south of Dapto near Albion Park. Where it occurs in the Illawarra region, it is generally found in areas containing a canopy of *Melaleuca* sp. with a sparse groundcover. The patch of PCT 838 in the development footprint did not contain suitable habitat niches for this species. The groundcover was

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Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act status	EPBC Act status	Justification for inclusion / exclusion
							densely covered with grasses.
Tyto novaehollandiae	Masked Owl (Breeding)	- Hollow bearing trees - Living or dead trees with hollows greater than 20cm diameter	-	High	Vulnerable	Not Listed	Excluded Suitably sized hollows not present in the development footprint or within 100 m of the development footprint
Zieria granulata	Illawarra Zieria		-	High	Endangered	Endangered	Excluded Excluded. Habitat is substantially degraded. Species typically found on dry ridge tops and rocky outcrops on shallow volcanic soils. Less frequently found on low lying areas. Marginal habitat available.

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5.2.2. Assessment of habitat constraints and vagrant species

An assessment of habitat constraints was completed in Table 13.

5.2.3. Candidate species requiring further assessment

Following a review of the predicted candidate species in the BAM-C, seven species were considered for further assessment (Table 14).

Table 14: Candidate species requiring further assessment

Species	Common Name	Habitat Constraints	Justification for inclusion / exclusion
Chalinolobus dwyeri	Large-eared Pied Bat	- Cliffs - Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	Included Development footprint in proximity (noting greater than 2 km) to Illawarra escarpment. Marginal potential habitat in the form of abandoned buildings and cokeworks infrastructure
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Included Potential habitat available in the development footprint.
Hieraaetus morphnoides	Little Eagle (Breeding)	Nest trees - live (occasionally dead) large old trees within vegetation)	Included Marginal habitat available in the development footprint.
Lophoictinia isura	Square-tailed Kite (Breeding)	Nest Trees	Included Marginal habitat available in the development footprint.
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	- Caves - Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave - " observation type code "E nest-roost - " with numbers of individuals >500	Included Development footprint in proximity (noting greater than 2 km) to Illawarra escarpment. Marginal potential habitat in the form of abandoned buildings and cokeworks infrastructure
Myotis macropus	Southern Myotis	- Hollow bearing trees - Within 200 m of riparian zone - Bridges, caves or artificial structures within 200 m of riparian zone - Waterbodies. This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site	Included Potential foraging habitat in the form of dams present within the subject land. No dams or water bodies present in the stage 1 or demolition DA development footprints.
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	Breeding Camps	Included Known GHFF camp in the subject land, to the south of the development footprint

5.3. Targeted survey methods

5.3.1. Litoria aurea (Green and Golden Bell Frog) habitat assessment

Green and Golden Bell Frog 2018

Although not predicted to occur by the BAM-C, a precautionary approach was taken and a habitat assessment was conducted for *Litoria aurea* (Green and Golden Bell Frog).

Water bodies considered potential habitat for the Green and Golden Bell Frog were considered in terms of:

- size and depth of water body including ephemeral waterways or temporarily inundated grassland
- presence of fringing vegetation, proximity to bushland and level of shading
- level of pollution or disturbance
- presence of predatory fish, namely *Gambusia holbrooki* (Plague Minnow)
- presence of basking or refuge habitat including exposed rock or debris.

An assessment of the habitat features either present or absent was made and noted with supporting photos.

Green and Golden Bell Frog 2022

A follow up assessment of potential Green and Golden Bell Frog habitat was conducted by Dr Frank Lemckert on 6 December 2022 for a total of 2 person hours. Frank is a BAM recognised expert for the Green and Golden Bell Frog and was an author on the BAM Frog Survey Guidelines. The subject land assessed all waterbodies, including riparian corridors, dams and ephemeral pools of water. Notes on the following criteria were collected:

- size and depth of water body including ephemeral waterways or temporarily inundated grassland
- presence of fringing vegetation, proximity to bushland and level of shading
- level of pollution or disturbance
- presence of predatory fish, namely *Gambusia holbrooki* (Plague Minnow)
- presence of basking or refuge habitat including exposed rock or debris.

5.3.2. Grey-headed Flying Fox habitat assessment

The assessment of the known Grey-headed Flying-fox included consideration of:

- number of individuals
- size of camp / area of occupancy
- age of individuals present
- activities observed during survey (roosting, foraging)
- tree or shrub species utilised.

The boundary of the camp was mapped using Avenza Maps. The boundary of the camp was defined as the area of occupancy (bats using trees) at the time of survey. Numbers were estimated by counting roosting individuals. Where types of behaviour were observed, they were noted.

5.3.3. Microbat habitat assessment and targeted survey effort 2018

Habitat assessment

The habitat assessment was undertaken by Ecologist Alex Gorey on 18 October 2018 for a total of 4 person hours. A follow up inspection was completed by Dr Frank Lemckert in July 2019. Habitat for the following bats was assessed:

- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus schreibersii oceanensis* (Large Bent-winged Bat)
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Myotis macropus* (Southern Myotis).

The threatened species habitat assessment was conducted consistent with the survey guidelines for Australia's threatened bats (DEWHA 2010; OEH 2018) and focused on abandoned buildings in the subject land. The aim of the habitat assessment was to identify signs of use or potential areas of roosting habitat. Each building was assessed against the predicted species ecology and known roosting behaviour. Abandoned buildings were considered in terms of:

- presence of dark, enclosed spaces suitable for roosting including the presence of wooden crevices or structures
- protection within the building and likelihood of predation
- signs of currently roosting species, including individuals, groups or guano
- potential exposure to temperature and humidity changes
- species ecology and breeding / roosting behaviour
- clear flyways (entry / exit pathways) that would not result in predation.

A waypoint was taken for each building which was then assessed using the above criteria. Where a building was considered to contain potential habitat, it was noted.

Further targeted survey effort is described in Sections 5.3.3 and 5.3.4 below.

Echolocation surveys

Targeted microbat surveys were conducted consistent with the Survey guidelines for Australia's threatened bats (DEWHA 2010). Prior to survey, the potential habitat in the subject land was determined through the habitat assessment. Attended echolocation surveys were conducted for four survey nights (total of 6 detector hours) on 17 and 18 December 2018 (Figure 4). The targeted surveys were conducted by ELA ecologists Alex Gorey and Lauren Perkins. The stag watches focused on the coke ovens in the subject land. Stag watches aimed at positively identifying any microbats exiting the coke ovens or flying overhead within the subject land and recording calls (if present) using an echolocation recording device. Stag watches commenced half an hour before dusk and continued for 1 hour after dusk (commencement approximately 7.45 pm). The location of each stag watch was marked using a

handheld GPS unit. After the stag watch was complete, short transects were walked holding the echolocation device.

Bat calls were analysed by ELA ecologist Dr Rodney Armistead using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales and south-east Queensland and north-east New South Wales and the accompanying reference library of over 200 calls from north-eastern NSW (Reinhold et al. 2001; Pennay et al. 2004).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Rinehold et al. 2001). To ensure reliable and accurate results protocols were followed (Appendix D).

5.3.4. Targeted microbat surveys 2022 / 2023

Echolocation surveys

Targeted survey for threatened microbats was completed consistent with the *'Species credit' threatened bats and their habitats* guideline (OEH 2018) across the subject land. Four echolocation devices were deployed at different locations across the subject land from 20 November 2022 to 19 December 2022 and 11 January 2023 to 1 February 2023. The devices were set to record from 30 minutes prior to dusk to 30 minutes after dawn.

The location of the echolocation devices are shown on Figure 7.

Microbat calls were analysed by RA Environmental Consulting using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales and south-east Queensland and north-east New South Wales and the accompanying reference library of over 200 calls from north-eastern NSW (Reinhold et al. 2001; Pennay et al. 2004).

Roost emergence surveys

Following the completion of the echolocation surveys, roost emergence surveys were conducted for five nights at the buildings across the subject land on 21 – 23 and 28-29 March 2023. The purpose of the roost emergence surveys was to determine whether any microbats were utilising the buildings for roosting.

The buildings in the subject land were split into seven sites and surveys occurred across the seven sites. Each site was surveyed by two team members to allow more than one side of the building to be observed. The buildings surveyed were rotated each evening (Figure 8, Table 15). The only sites that were not initially surveyed were the coke ovens (sites 6 and 7).

Surveys commenced at 7.15 pm and continued until 8.45 pm each evening. The timing of the surveys were designed to coincide with twilight, which at the time of surveys was from 7.30 pm – 8.30 pm.

Each team member used an echolocation recording device during the surveys. The devices were pointed directly at the buildings, in particular at suspected entry and exit points.

The purpose of this was to assist in determining the identification of microbat species, which may be emerging from the potential exit points.

The second night of survey identified microbats emerging from site 5. To determine where the microbats were emerging from, all 6 team members surveyed site 5 on night 3 to help determine the specific emergence location.

A further two nights of roost emergence surveys were carried out at site 5 using a thermal camera to detect the heat signatures of bats and determine the location of the roost within the structures. Surveys were conducted in autumn and commenced at 3 pm on the sixth night and 5 pm on the seventh to coincide with autumn twilight. Surveys finished at 6 pm both nights. Echolocation devices were also used during thermal camera surveys.

Table 15: Roost emergence survey details

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Night 1 20 March	Stacey Wilson & Kara Tuck	Alex Gorey & Scott Chrystal	Joseph Gleeson & Claire Plunkett	No survey	No survey	No survey	No survey
Night 2 21 March	No survey	No survey	No survey	Meredith Henderson & Claire Plunkett	Stacey Wilson & Joseph Gleeson	Alex Gorey	Erin Hodgkin
Night 3 22 March	No survey	No survey	No survey	No survey	All staff (6 people)	No survey	No survey
Night 4 28 March	Alex Gorey & Erin Hodgkin	Stacey Wilson & Claire Plunkett	Observed from 8.15 pm onwards by Alex Gorey & Erin Hodgkin	No survey	Joseph Gleeson	No survey	No survey
Night 5 29 March	Scott Chrystal	No survey	Erin Hodgkin	Joseph Gleeson & Kara Tuck	Alex Gorey & Claire Plunkett	Meredith Henderson	Alex Gorey (paired with site 5 due to proximity)
Night 6 16 May					Alex Gorey & Joseph Gleeson		
Night 7 17 May					Alex Gorey & Joseph Gleeson		
Total	**5 people across 3 Nights**	**4 people across 2 nights**	**5 people across 3 nights**	**4 people across 2 nights**	**11 people across 6 nights**	**2 people across 2 nights**	**2 people across 2 nights**

5.3.5. Ongoing Grey-headed Flying-fox Camp Monitoring

Monitoring of the Grey-headed Flying-fox camp has occurred on a monthly basis since July 2019 – late 2022 and sporadically from 2017 – July 2019. Since January 2023, monitoring has occurred weekly. The monitoring program commenced in July 2019 and was consistent with the Flying-fox Camp Management Creating Buffers data sheet (OEH 2015), which is designed to monitor camps prior to, during and after the implementation of level 2 management actions (buffers). Monitoring focused on the following:

- number of individuals present
- area of occupation
- young present or absent.

Monitoring was achieved by completing fly-out counts at dusk by two suitably qualified ecologists. Handheld clickers were used to count bats es they exited the camp.

5.3.6. Nest searches

Traverses of the subject land were completed on 27 June 2022 by Dr Meredith Henderson and Melaina Chapman to identify large stick nests that may be used by raptors for breeding. The canopy within the subject land was observed from the ground.

5.3.7. Flora searches

The habitat in the development footprint for this species was considered marginal, given the historic disturbance across the subject land. Opportunistic searches were conducted concurrently with vegetation validation and collection of full vegetation integrity plots across the following dates:

- 27 June 2022
- 11 November 2020
- 11 July 2019
- 13 March 2019.

The random meander technique was completed through areas of native vegetation.

5.4. Targeted survey results

5.4.1. Summary

Two species credit species were identified in the subject land during survey. The Grey-headed Flying-fox is known to occur in a camp at the southern extent of the subject land and the Large Bent-winged Bat was identified in Site 5 during the 2022 / 2023 survey effort (Table 16).

Table 16: Summary of targeted survey results

Species	Common Name	Habitat Constraints	Results of survey
Chalinolobus dwyeri	Large-eared Pied Bat	- Cliffs - Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	**Absent** Not identified in the development footprint during echolocation surveys.

Species	Common Name	Habitat Constraints	Results of survey
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	**Absent** No nests identified in the subject land.
Hieraaetus morphnoides	Little Eagle (Breeding)	Nest trees – live (occasionally dead) large old trees within vegetation)	**Absent** No nests identified in the subject land.
Lophoictinia isura	Square-tailed Kite (Breeding)	Nest Trees	**Absent** No nests identified in the subject land.
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	- Caves - Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave - " observation type code "E nest-roost - " with numbers of individuals >500	**Present** Identified in the subject land during echolocation surveys.
Myotis macropus	Southern Myotis	- Hollow bearing trees - Within 200 m of riparian zone - Bridges, caves or artificial structures within 200 m of riparian zone - Waterbodies. This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site	**Absent** Not identified in the subject land during echolocation surveys.
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	Breeding Camps	**Present** Known camp in the subject land, to the south of the development footprint.

Following completion of targeted surveys, the species credit species that are present in the development footprint are outlined in Table 17. Further details regarding the outcome of targeted surveys for each species is outlined below.

Table 17: Species credit species included in the assessment

Species	Common Name	Species presence	Geographic limitations	Number of individuals / Habitat (ha)	Biodiversity Risk Weighting
Pteropus poliocephalus	Grey-headed Flying-fox	Present in subject land. Not present in the development footprint	-	Camp present determined breeding camp by DCCEEW**	2
Miniopterus orianae oceanensis	Large Bent-winged Bat	Present in subject land and Demolition DA	-	Species credit for breeding only. Area where species are	3

Species	Common Name	Species presence	Geographic limitations	Number of individuals / Habitat (ha)	Biodiversity Risk Weighting
		development footprint		present is not breeding habitat (See section 5.4.3)	

**On advice received from DCCEEW (Teams Meeting on 3 April 2023) the camp present has been assumed to contain breeding females due to the presence of the species during the breeding season. Therefore, a species polygon for this species has been drawn consistent with the bat survey guidelines (OEH 2018) which requires the extent of the camp to be mapped as the polygon (Figure 11).

5.4.2. Litoria aurea (Green and Golden Bell Frog) habitat assessment

Green and Golden Bell Frog - 2018

This species prefers small, ephemeral pools containing sedges which form fringing vegetation. The ephemeral pools are used for breeding and must contain basking habitat in the form of rocks, woody debris and sometimes rubbish and refuge habitat close to the breeding location.

The subject land was not considered to provide habitat for Green and Golden Bell Frog. Dam 1 was large, measuring 30 m wide x 65 m long. Dam 1 was deep and did not contain any areas of shallow pooling, ephemeral water. The fringing vegetation was dominated by midstorey shrubs and small trees which hung over the edge of the dam. As a result, the edges of the dam did not support any sunny bank areas, refuge or basking habitat.

Dam 2 was large, measuring approximately 100 m long x 40 m wide, and flowed over a dam wall into the riparian corridor. Dam 2 was deep and did not contain any areas of shallow, pooling ephemeral water. The fringing habitat was limited to planted midstorey shrubs and small trees, bare dirt and exotic groundcover species. No suitable fringing vegetation in the form of sedges or rushes was present. The banks of the dam were heavily shaded and did not support basking habitat in sunny locations.

The riparian corridor in the subject land contains regular, heavy flows from Dam 2. The banks of the riparian corridor were heavily shaded by midstorey species. The shaded understorey has resulted in an absence of fringing vegetation along the edges of the riparian corridor with no sunny breakthrough spaces that could be used for basking habitat. The presence of small, ephemeral pools was limited, given the heavy flow over the dam wall and through the corridor from Dam 2.

All of the water bodies in the subject land contained *Gambusia holbrooki* (Plague Minnow). Plague Minnow are known to exclude natives through dominating habitat with aggressive behavior towards other fish species or amphibians, and their eggs – their presence generally indicates a reduction and possible exclusion of native fish species. Plague Minnow were also identified in the riparian corridor and dams in 2014. This would suggest that the presence of Plague Minnow since 2014 would have inhibited the reproductive capacity of any Green and Golden Bell Frogs present.

Green and Golden Bell Frog – 2022

The 2022 survey re-affirmed the results of the 2018 habitat assessment. Following the La Niña period, the subject land contained pools of water with emergent *Typha orientalis* (Bulrush). These pools were

surveyed for tadpoles and adult frogs. Calls for *Litoria aurea* were played and the Bulrush was thoroughly searched for *Litoria aurea*. The tadpoles were identified as *Litoria* sp. No Green and Golden Bell Frogs were identified in the Bulrush nor were any identified during the survey. Green and Golden Bell Frogs, if present, typically respond to calls and can be found relatively easily amongst Bulrush. It was concluded that the tadpoles were likely *Litoria peronii* (Peron's Tree Frog).

An assessment of historic records over the past 30 years (Bionet 2022) which shows five records to the east of the subject land adjacent to Bellambi Lake. There are five records from 1999 and 2003. In 2007, this population was considered extant (DCCEEW 2022). The next closest cluster of records is at Woonona Heights which also represents a sub-population that was last recorded as extant in 2007 (DCCEEW 2022). There are no historic records for this species within the development footprint or subject land. The two closest known sub-populations are separated from the development footprint by residential development, roads and a train line. There is no aquatic or vegetated connectivity that would enable any individuals to disperse from the sub-populations into the development footprint.

5.4.3. Threatened microbat habitat assessment and targeted survey

The threatened species habitat assessment and targeted microbat survey conducted to survey guidelines in 2018 did not identify any signs of occupation or individuals during the survey. The results of the echolocation survey did not return any positive or potential microbat calls during the survey period. No microbats were seen entering or exiting the coke ovens, nor were any seen flying overhead during the survey period. Short traverses of the southern extent of the coke ovens did not record any calls or identify any individuals during the survey.

5.4.4. Targeted microbat surveys 2022 / 2023

Surveys during 2022 and 2023 identified the following species as either present or potentially present in the subject land:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) - potential
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat) - present
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) - potential
- *Myotis macropus* (Southern Myotis) – potential.

The microbat analysis report in Appendix J provides details on the results of the echolocation surveys and analysis. There were two potential calls for Southern Myotis / Nyctophilus sp. in the development footprint. The calls could not be separated to obtain a definite Southern Myotis calls. The calls were recorded at the northern end of the subject land. The echolocation devices placed at the dams did not record any definite or potential Southern Myotis calls. Appendix J details that due to the lack of definite Myotis calls, absence of any potential call data from the echolocation devices positioned at the dams and the two potential calls being recorded at the northern end of the subject land, it is highly unlikely that the dams provide a suitable foraging resource for this species. Therefore, a species polygon for Southern Myotis has not been drawn.

The echolocation data identified Large Bent-winged Bat calls from site 5 (Figure 8) occurring during twilight which suggested roosting behaviour. This result facilitated the roost emergence surveys. The roost emergence surveys identified microbats exiting site 5 during twilight.

The echolocation data collected during the roost emergence survey was analysed and identified calls for the Large Bent-winged Bat. The roost emergence surveys did not detect any other emergence activities at any other buildings in the development footprint. Site 5 is the only building with confirmed microbat activity. The area surveyed as part of Site 5 was comprised of the remnant powerhouse, grinding plant and the quenching towers. The microbats were observed exiting the western face of the remnant powerhouse / grinding plant. No activity was observed in the quenching towers. A review of the subterranean and above ground features of the quenching towers and the grinding plant identified that there is no connection between the structures. Therefore, it is assumed that the remnant powerhouse and the grinding plant are the two potential roosting locations. Further survey using thermal imaging will be completed to determine a more precise location of the roost.

The Large Bent-winged Bat is known to utilise artificial structures for roosting, such as mines, culverts and abandoned buildings. The species breeds in maternity caves which have specific temperature and humidity requirements, with the species preferring humid and subhumid atmospheres (Dwyer 1965). The known maternity roosts have specific structural complexities and formations. The complexities of the caves can vary. Common features include:

- High humidity
- Ammoniated atmospheres
- Temperatures ranging from mid tens to high 20's (depending on location within the cave, i.e. passage and main chamber).

The species use different roosts during the over-wintering phase which includes migrating away from the maternity caves. They can congregate in smaller colonies in caves and humanmade structures. The over-wintering roosts are normally cool which can facilitate hibernation. There is some research to suggest that females occupy the over-wintering roosts until September, and then commence their migration to maternity caves (Lunney and Burgin 2004).

The three major maternity roosts in NSW are Willi Willi caves near Kempsey, Drum Cave at Bungonia and Church Cave at Wee Jasper (Lunney and Burgin 2004). These roosts occur in limestone karst systems with domed caverns, where the quantity of bats present increase the temperate and humidity, which also assists in the development of young (Dwyer 1965). Juveniles are born and raised within the maternity camps.

There is no evidence to suggest that the Large Bent-winged Bat utilises built structures of the same typology as those in the subject land for breeding. Breeding has been confirmed to occur in caves with only isolated occurrences of disused coal mines being used as 'maternity roosts' in the Hunter Valley (Lunney and Burgin 2004).

Initial analysis of the May 2023 thermal camera survey has indicated that Large Bent-winged Bat calls were detected again at site 5, although none were identified either within or emerging from the building. The initial data review showed that there was less activity and over a smaller window of time immediately prior to, and after dusk. A majority of activity ceased after this time.

A species polygon has not been drawn for this species.

5.4.5. Pteropus poliocephalus (Grey-headed Flying-fox)

A small camp of *Pteropus poliocephalus* (Grey-headed Flying-fox) was identified in the subject land and were using a small patch of *PCT 838 Forest Red Gum Thin-leaved Stringybark Grassy Woodland* adjacent to the dam and existing riparian corridor (May 2017). The camp occupied an area extending from approximately the dam wall south, along the riparian corridor. The camp has fluctuated in numbers since May 2017 with fluctuations ranging from 0 – 6,000 individuals. Ongoing surveys have identified that the camp empties in Winter and early Spring with core numbers estimated to be around 200-500 individuals (Appendix H).

The individuals present were relying on canopy species for roosting including *Eucalyptus* spp., *Pittosporum* spp., *Cinnamomum camphora*, *Casuarina glauca*, *Olea europaea* subsp. *cuspidata* and *Ligustrum* spp. The fly out counts consistently observed the individuals leaving the camp each evening and flying toward the escarpment. It is likely that the large expanses of native vegetation along the escarpment are providing a foraging resource (Appendix G).

The Grey-headed Flying-fox mate in early Autumn and give birth around October. After mating, larger camps tend to break up to accommodate for sparser food resources. This smaller camp may be a breakaway camp from a larger camp and is utilised once breeding is complete. Pups have also been observed once at the camp in November 2019, following a significant period of absence of bats. Therefore, the camp on the development site is a breeding camp. A species polygon has been created for this species (Figure 11) and credits generated.

5.4.6. Nest searches

No large stick nests that could support breeding for raptors were identified in the subject land or development footprint. No further assessment of candidate raptor species is required.

5.4.7. Flora searches

No threatened flora species were identified in the subject land or development footprint during survey. No further assessment of flora species is required.

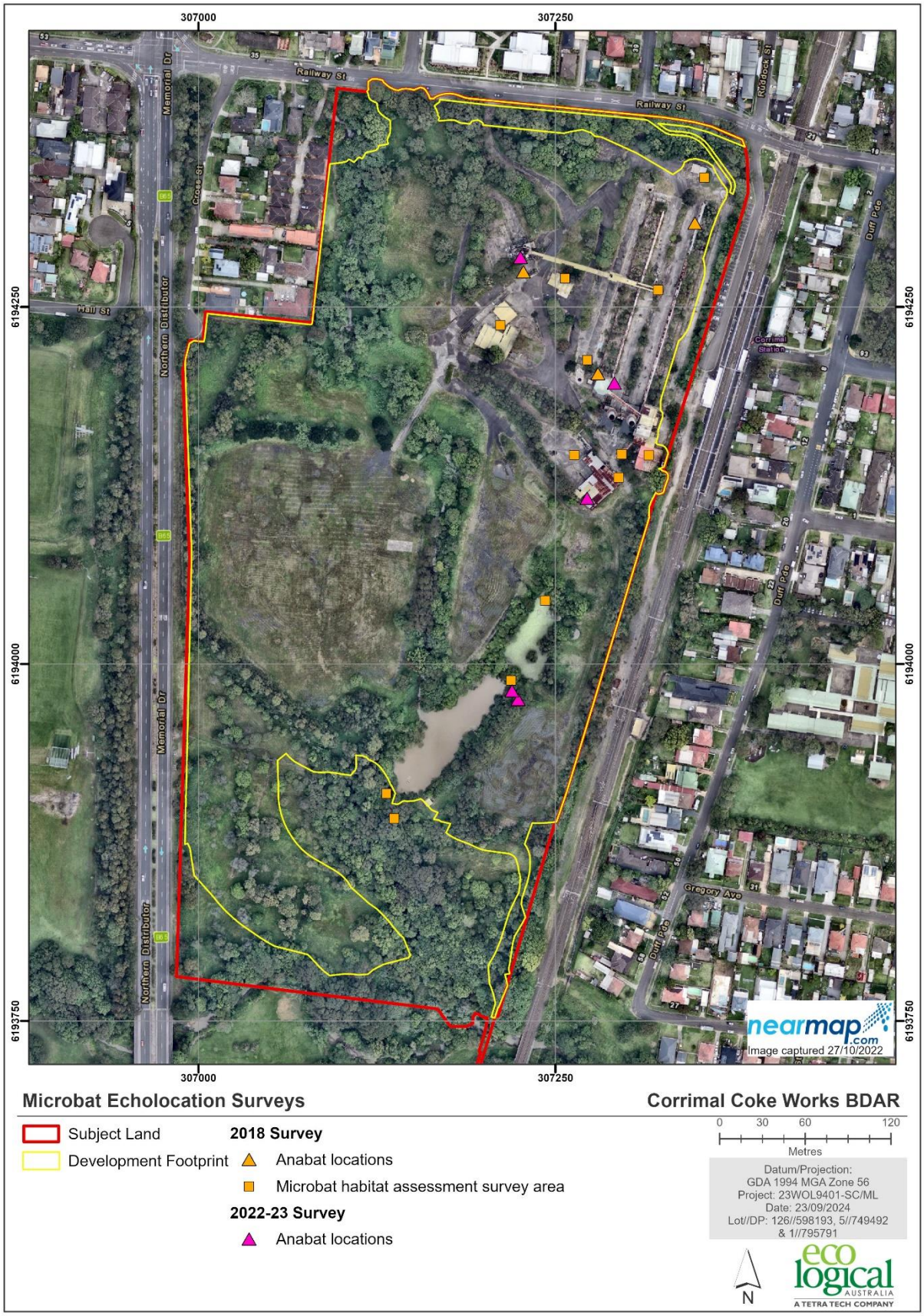


Figure 7: Threatened microbat targeted surveys during 2018 and 2022 / 2023



Figure 8: Roost emergence survey locations 2023 and stag watch locations 2018



Figure 9: Location of Green and Golden Bell Frog habitat assessment (ELA 2018 and 2022)

5.4.8. Expert reports

An expert report has been prepared for the Green and Golden Bell Frog (ELA 2023, Appendix K). The expert report concluded that:

- The subject land contains suitable habitat for the Green and Golden Bell Frog, although it is highly variable in quality
- The subject land contains suitable foraging habitat in the form of low grassy areas, debris and denser vegetation
- Despite the presence of suitable habitat, the location of the habitat features in relation to one another are not favourable due to their distance from waterbodies
- The land within 200 m of the subject land is highly urbanised, very poor habitat for the Green and Golden Bell Frog and forms a large barrier to any connections between existing populations of Green and Golden Bell Frog and the subject land
- Given the highly urbanised surrounding landscape and limited movement of the Green and Golden Bell Frog from breeding sites (rarely >500 m) any Green and Golden Bell Frog are highly unlikely to migrate to, or through, the subject land.

Therefore, a species polygon has not been provided for this species.

5.5. Identification of prescribed additional biodiversity impact entities

5.5.1. Karst, caves, crevices, cliffs, rocks and other geological features of significance

The subject land does not contain any karsts, caves, crevices, cliffs, rocks or other geological features of significance.

5.5.2. Human-made structures and non-native vegetation

The development footprint contains numerous human-made structures which were previously used as part of the cokeworks facility. The structures include coke ovens and other pieces of infrastructure used for the processing and movement of coke around the facility. A majority of the structures are derelict and have suffered from vandalism since the cokeworks ceased operation. Some of the damage includes fires that have burnt out floors and ceilings, damage and removal of wall and roof panels and breaking of windows and doors.

The development footprint also contains non-native vegetation in the form of exotic groundcover and midstorey species with some planted exotic canopy.

5.5.3. Habitat connectivity

The habitat connectivity in the development footprint is negligible. The development footprint is surrounded by development. There is limited connectivity which would only be accessible by highly mobile species such as birds and bats.

5.5.4. Water bodies, water quality and hydrological processes

There are no water bodies in the development footprint. The development footprint has been extensively modified which may have affected the natural hydrological flows throughout the development footprint. There is evidence of previous alterations to hydrological processes in the subject land. Two large human-made dams are present at the southern extent of the subject land.

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These dams may be used by Grey-headed Flying Fox. Flying foxes have not been observed using the dam as belly dipping habitat since dusk fly-out monitoring of the camp began in 2019. The riparian corridor that currently runs through the subject land was realigned and is not entirely in its natural position. During periods of heavy rainfall, some hardstand areas and drains near the buildings become temporarily inundated. Some of these areas were observed to contain *Typha orientalis* (Bulrush) and may provide temporary habitat for amphibians.

5.5.5. Wind farm developments

Not applicable.

5.5.6. Vehicle strikes

The proposed development will increase the number of roads within the locality. However, the increase in the road network is unlikely to increase the chance of vehicle strike. The development footprint is already isolated and does not support terrestrial mammals such as Kangaroos or Wombats that are likely to be subject to vehicle strike.

6. Avoiding and Minimising Impacts on Biodiversity Values

6.1. Locating and designing a project to avoid and minimise impacts on biodiversity values

6.1.1. Direct and indirect impacts

The proposed development footprint is the area required to facilitate the development consistent with the site specific DCP for Corrimal. The development of the concept plan, of which Stages 2-4 are part, was a result of extensive consultation with Council and relevant stakeholders. The development footprint has been determined through consideration of biodiversity values and the following constraints:

- Historic heritage
- Traffic
- Social and economic.

A majority of the development footprint is in areas where there are limited biodiversity values. These areas include cleared land, exotic vegetation and human-made structures. The development footprint is 15.19 ha, of which 63.73 % comprises cleared or exotic land. Of the remaining 36.27 %, 31.27 % is comprised of planted native vegetation and dams and 7.70 % is remnant native vegetation.

The 7.70 % of native vegetation is comprised of PCT – *PCT 838 Forest Red Gum - Thin-leaved Stringybark Grassy Woodlands* in two conditions, moderate and degraded. The moderate condition PCT comprises 0.52 ha of the 1.58 ha of the community throughout the development footprint, with the remaining 0.65 ha forming the PCT in degraded condition.

The removal of PCT 838 in moderate condition in stage 1 was unavoidable to facilitate access off Railway Street. Numerous designs and consultation with Council were conducted during the entry / exit design process. Three options were presented:

- Single lane roundabout off Harbinger Street
- Installation of traffic signals on Railway Street
- Signalised four-way intersection off Harbinger Street.

Traffic safety for both vehicles and pedestrians and the presence of PCT 838 were considered. Communication from Council identified that the single lane roundabout, although resulting in increased impacts to PCT 838 would result in the best safety and traffic outcome. Communication from Council indicated that although PCT 838 met the BC Act definition for Illawarra Lowlands Grassy Woodland, the conservation significance of the vegetation is low to moderate based on the size of the patch, current land use, future land use and potential for ongoing indirect impacts (Email dated 9 May 2019 – Jon Bridge to Mike Williams - Appendix I). Therefore, the single lane roundabout was pursued.

The location and design of the development footprint is consistent with the masterplan for the Corrimal cokeworks site as presented in the DCP. The purpose of the masterplan was to create a holistic vision for the subject land, including the local and state heritage listed parts of the subject land which must be retained (see section 5.1.1(b) of the DCP). Portions of the bulk earthworks footprint are within the

Treetop Escarpment (Wollongong DCP – Chapter 19) which requires the retention of trees along the corner of Railway Street and the entry to Corrimal Train Station. The bulk earthworks footprint has remained outside of the retention area.

Following a meeting with Council on 5 September 2024 Legacy have amended the development footprint to reduce impacts to TEC Illawarra Lowlands Grassy Woodland in the southern section of the site. The Stage 2-4 earthworks involved in the proposed realignment of the watercourse in the subject land was reduced to avoid the patch of the Illawarra Lowlands Grassy Woodland in moderate condition (PCT 838_moderate) in the south-eastern corner of the subject land. The previous development footprint proposed removal of the patch of TEC in the south-eastern corner. Figure 10 shows where the updated development footprint has avoided impacts to the TEC compared to the former development footprint.



Figure 10: Comparison Plan showing reduced impacts to TEC of the final footprint

6.1.2. Prescribed biodiversity impacts

Prescribed impacts relevant to the proposed development include the removal of human-made structures, dams and creekline exotic vegetation. The proposed development would remove a majority of the prescribed impacts across the development footprint. Some prescribed impacts in the form of coke ovens and other cokeworks infrastructure would be retained as part of the proposed works.

The human-made structures were assessed to determine suitability to provide roosting habitat for threatened microbats. Recent echolocation and roost emergence surveys determined that site 5 only is being used as roosting habitat for the Large Bent-winged Bat. No other structures recorded emergence activity during echolocation surveys or roost emergence surveys. The building would not be used as a maternity roost as the Large Bent-winged Bat breeds in maternity caves. The location and design of the development footprint with respect to removal of structures was agreed to as part of the planning proposal and has responded to Historic Heritage requirements across the subject land. The proposed development footprint is consistent with the approved planning proposal and DCP.

The exotic vegetation was assessed as providing a marginal foraging resource for the Grey-headed Flying-fox. Surveys at dusk to observe fly-out consistently showed the bats migrating toward the escarpment, most likely to forage. If the exotic vegetation was used, it would be intermittently and would not be relied upon. No belly dipping has been observed in the human made dam on the development site during the three years of fly-out monitoring of the flying fox camp

The proposed development would not interfere with any known migratory flight paths, sever connectivity, or affect any geological features of significance.

As part of the proposed development, the future riparian corridor will be constructed and revegetated with native vegetation that will form part of Plant Community Type (PCT) 838 – Forest Red Gum Thin-leaved Stringybark Grassy Woodlands under a vegetation management Plan (VMP, ELA 2024). This PCT is consistent with the PCT that the camp is currently occupying in the subject land. The vegetation densities will decrease along the outer edges of the riparian corridor, to decrease potential conflicts with humans and land use. The planting list includes a range of native *Eucalyptus* sp. and midstorey species that would provide foraging and roosting habitat for the Grey-headed Flying Fox where it is close to the current camp extent. In addition, the exotic vegetation present in the VMP area may present roosting habitat for GHFF and as such established exotic trees over 8m high should be staged in their removal or potentially retained if that retention does not impede implementation of the VMP programme. Staging of removal may require some proportion of revegetation be moved into the maintenance period.

In accordance with Chapter 19 of the Wollongong DCP, the realigned riparian corridor design is to incorporate a “belly dip” area in the south to enhance the protection of the Grey-headed Flying-fox camp.

The proposed revegetation occurs along the western extent of the proposed subdivision and ties into the existing creekline near Towradgi Creek. The camp is currently positioned downstream of a human-made dam that was used a settling pond during the operation of the Cokeworks facility. As part of the construction process, the dam will be dewatered which may temporarily affect the water resources adjacent to the camp. It is expected that the realignment of the watercourse that runs throughout the

subject land would provide water resources in the long-term and should be designed to include pools that can be used for belly dipping.

The proposed realigned stream is proposed to be constructed to mimic a natural stream as much as possible to minimise impacts to hydrology and biodiversity from the realignment. The applicant has commissioned a geomorphology report to achieve this. The new stream includes the following controls to reduce erosion, reduce damage to riparian vegetation and encourage habitat creation for fauna:

- Cascade structures: installation of anchor boulders within the upstream channel to create a cascade effect with a series of shallow pools.
- Rock revetment: Rock revetment is proposed in the channel at high shear stress locations and along the side slopes of the channel at locations of high shear stress up to the 100 year flood level.
- Riffles: Rock riffles will be placed at either end of the proposed ponds. Large stones will be placed across the stream approximately 20cm apart on the downstream face to form a low flow fish passage.
- Log jams: Removed trees branches will be placed on the banks of the creek as an additional measure of protection whilst promoting aquatic fauna habitat.

Engineering drawings showing the application of these controls are shown in Appendix L.

7. Assessment of Impacts

7.1. Direct impacts

7.1.1. Demolition DA

The direct impacts of the development for this stage of the BDAR are outlined in Table 18. No impacts to any remnant vegetation would occur in this stage.

Table 18: Direct impacts to native vegetation stage Demolition DA stage

Vegetation type	BC Act listing	EPBC Act listing	Direct impact (ha)
Planted native – does not conform to a PCT	N/A	N/A	0.59

7.1.2. Stage 1 Bulk Earthworks

The direct impacts of the development of this stage of the BDAR on:

- native vegetation and threatened ecological communities are outlined in Table 19
- prescribed biodiversity impacts are outlined in Section 7.4.

Table 19: Direct impacts to native vegetation stage 1

PCT ID	PCT Name	BC Act listing	EPBC Act listing	Direct impact (ha)
838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands	E	N/A	0.41
	Planted native – does not conform to a PCT	N/A	N/A	0.55
			Total	**0.96**

7.1.3. Stage 2-4 Earthworks

The direct impacts of the development of this stage of the BDAR on:

- native vegetation and threatened ecological communities are outlined in Table 20.
- prescribed biodiversity impacts are outlined in Section 7.4.

Table 20: Direct impacts to native vegetation stage 2-4

PCT ID	PCT Name	BC Act listing	EPBC Act listing	Direct impact (ha)
838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands	E	N/A	0.81
	Planted native – does not conform to a PCT	N/A	N/A	3.59
			Total	**4.40**

7.1.4. Grey-headed Flying Fox species polygon

The extent of the roosting habitat of the Grey-headed Flying Fox camp was recorded over three years of monitoring and mapped. The proposed Stage 2-4 BEW development footprint will affect a small area of the roosting habitat by 0.10 hectares. The species polygon for these impacts is shown Figure 11.

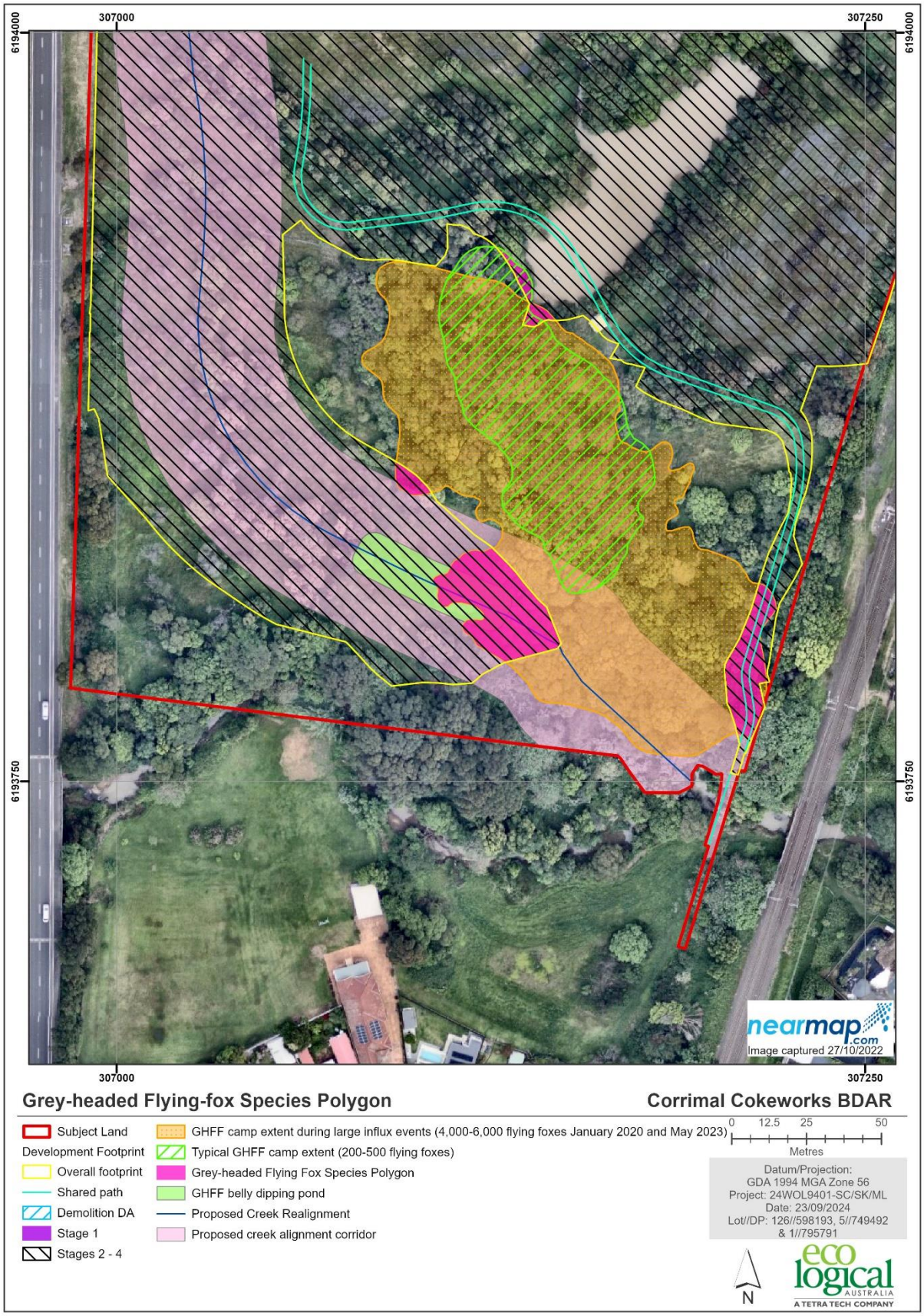


Figure 11: Grey- headed Flying Fox species polygon

7.2. Change in vegetation integrity

The change in vegetation integrity scores for the different BDAR stages are outlined in Table 21.

Table 21: Change in vegetation integrity scores

BDAR stage	Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity	Credits required
Demolition DA	N/A	Not present	N/A	N/A	N/A	N/A	N/A	N/A
Stage 1	1	838	Moderate	0.41	71.7	0	-71.7	15
Stage 2-4	1	838	Moderate	0.16	62	0	-62	7
Stage 2-4	1	838	Degraded	0.65	19.9	0	-19.9	8
							Total	**30**

7.3. Indirect impacts

The indirect impacts of the development are outlined in Table 22.

7.4. Prescribed biodiversity impacts

The development footprint for the demolition DA has the prescribed biodiversity impacts as outlined in Table 23.

The development footprint for Stage 1 has the prescribed biodiversity impacts as outlined in Table 24.

The development footprint for Stages 2-4 has the prescribed biodiversity impacts as outlined in Table 25.

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Table 22: Assessment of indirect impacts all stages

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
Sedimentation and contaminated and/or nutrient rich run-off	Construction	Runoff during construction	Moderate. Throughout development footprint with potential to encroach onto unnamed stream to the west	After heavy rainfall	Bulk earthworks phase during rainfall events	Short term
Noise, dust or light spill	Construction	Noise and dust from machinery movement No night works proposed - light spill unlikely	Light spill n/a Dust and noise moderate - likely to carry beyond development footprint and may indirectly impact the flying fox Camp	Daily during bulk earthworks. Intermittently after vegetation removal, during truck movement, dry periods or heavy winds	Intermittently throughout bulk earthworks phase	Short term
Inadvertent impacts on adjacent habitat or vegetation	Construction	Damage to existing native vegetation marked for retention	Minor. Vegetation to be retained outside the development footprint is limited to the north western boundary of the development footprint. This vegetation is proposed for removal in subsequent subdivision stages.	During bulk earthworks	During bulk earthworks phase	Short term
Transport of weeds and pathogens from the site to adjacent vegetation	Construction	Spread of weeds from adjacent areas	Minor. Vegetation in adjacent areas already contain high level of exotic species (see vegetation zone descriptions in Section 3.5.	During bulk earthworks daily due to vehicle movement and dust and water movement	Bulk earthworks phase	Medium term
Rubbish dumping	Construction / operation	Rubbish dumping from construction workers, public during bulk earthworks and future residents	Moderate	Intermittently when contractors are on site and during occupation by residents	Ongoing	Ongoing

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
Increase in predatory species populations	Construction / operation	Increase presence of exotic fauna species such as feral cats	Minor. The subject land already exists in a highly urbanised setting and would be subject to predatory populations. The scope of works is unlikely to cause an increase in predatory populations.	During construction and ongoing after completion of construction	Ongoing	Ongoing
Increase in pest animal populations	Construction / operation	Increase presence of exotic fauna species such as *Acridotheres tristis* (Common Myna)	Minor. The subject land already exists in a highly urbanised setting and would support pests. The scope of works is unlikely to cause an increase in pest species.	During construction and ongoing after completion of construction	Ongoing	Ongoing

Table 23: Direct impacts on prescribed biodiversity impacts in the Demolition DA footprint

Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
Karst, caves, crevices, cliffs, rocks and other geological features of significance	N/A	N/A	N/A	N/A
Human made structures or non-native vegetation	Demolition of buildings and infrastructure previously used as part of the cokeworks facility. Impacts will occur only during the bulk earthworks phase during the demolition DA. Clearing of non-native vegetation in the form of exotic cover.	Large Bent-winged Bats were identified emerging from site 5. This is the only structure on the subject land where bat activity was confirmed. Consequence is removal of over-wintering nonbreeding habitat for the species. The non-native vegetation may provide an occasional foraging	The habitat is not used for breeding. The Grey-headed Flying-fox would not rely on the exotic vegetation in the development footprint and would be used as part of a range of foraging resources.	Flyout observations of the Grey-headed Flying-fox camp consistently observe the camp exiting toward the escarpment. Bats have not been observed foraging on the exotic vegetation in the development footprint.

Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
		resource for the Grey-headed Flying-fox. The exotic plants would be used occasionally and form part a foraging network throughout the locality. The consequence would be a minor reduction in marginal foraging habitat.		
Habitat connectivity	Removal of planted native vegetation that contributes to patchy vegetation cover. The vegetation would be removed during the demolition of the berms and other hardstand infrastructure	Negligible reduction in connectivity for highly mobile species.	Habitat connectivity throughout the development footprint and subject land is extremely limited. The habitat would be accessible by highly mobile species only, such as birds and bats. The proposed development would reduce the amount of native vegetation, however is unlikely to affect connectivity given the fragmented nature of the subject land and surrounding landscape.	N/A.
Water bodies, water quality and hydrological processes	No waterbodies would be directly affected as part of the demolition DA. Water quality in the streams to the west and south of the development footprint may be affected during periods of heavy rainfall when runoff could occur. This would be expected during the bulk earthworks phase.	Potential mobilisation of sediment into the stream to the west and south of the development footprint.	No waterbodies are present in the development footprint. Hydrological processes are unlikely to be affected, given the previous use of the subject land included extensive modifications and changes to the natural hydrological processes. Other stages of the development would realign the existing unnamed stream to the west, which would include completely reshaping the creek line.	Figure 3
Wind turbine strikes on protected animals	N/A	N/A	N/A	N/A

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Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
Vehicle strikes	Increase in local road network and vehicle traffic during the construction phase. This would occur daily.	Negligible. Increase in vehicle strike to native fauna unlikely.	The development footprint is positioned in a highly urbanised landscape. The vegetation within the development footprint is not of a size to allow occupation by species that commonly suffer from vehicle strike (i.e. Kangaroos). This is exacerbated by the extremely limited connectivity to other vegetation throughout the locality.	N/A

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Table 24: Direct impacts on prescribed biodiversity impacts in the Stage 1 development footprint

Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
Karst, caves, crevices, cliffs, rocks and other geological features of significance	N/A	N/A	N/A	N/A
Human made structures or non-native vegetation	Clearing of non-native vegetation in the form of exotic cover.	The non-native vegetation may provide an occasional foraging resource for the Grey-headed Flying-fox. The exotic plants would be used occasionally and form part a foraging network throughout the locality. The consequence would be a minor reduction in marginal foraging habitat.	The Grey-headed Flying-fox would not rely on the exotic vegetation in the development footprint and would be used as part of a range of foraging resources.	Flyout observations of the Grey-headed Flying-fox camp consistently observe the camp exiting toward the escarpment. Bats have not been observed foraging on the exotic vegetation in the development footprint.
Habitat connectivity	Removal of both remnant and planted native vegetation that contributes to patchy vegetation cover. The vegetation would be removed during the bulk earthworks phase.	Negligible reduction in connectivity for highly mobile species.	Habitat connectivity throughout the development footprint and subject land is extremely limited. The habitat would be accessible by highly mobile species only, such as birds and bats. The proposed development would reduce the amount of native vegetation, however is unlikely to affect connectivity given the fragmented nature of the subject land and surrounding landscape.	N/A.
Water bodies, water quality and hydrological processes	No waterbodies would be directly affected as part of the proposed development. Water quality in the stream to the west of the development footprint may be affected during period of heavy rainfall when runoff	Potential mobilisation of sediment into the stream to the west of the development footprint.	No waterbodies are present in the development footprint. Hydrological processes are unlikely to be affected, given the previous use of the subject land included extensive modifications and changes to the natural hydrological processes. Other stages of the development would realign the	Figure 3

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Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
	could occur. This would be expected during the bulk earthworks phase.		existing unnamed stream to the west, which would include completely reshaping the creek line.	
Wind turbine strikes on protected animals	N/A	N/A	N/A	N/A
Vehicle strikes	Increase in local road network and vehicle traffic during the construction phase. This would occur daily.	Negligible. Increase in vehicle strike to native fauna unlikely.	The development footprint is positioned in a highly urbanised landscape. The vegetation within the development footprint is not of a size to allow occupation by species that commonly suffer from vehicle strike (i.e. Kangaroos). This is exacerbated by the extremely limited connectivity to other vegetation throughout the locality.	N/A

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Table 25: Direct impacts on prescribed biodiversity impacts in Stages 2-4 development footprint

Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
Karst, caves, crevices, cliffs, rocks and other geological features of significance	N/A	N/A	N/A	N/A
Human made structures or non-native vegetation	Clearing of non-native vegetation in the form of exotic cover.	The non-native vegetation may provide an occasional foraging resource for the Grey-headed Flying-fox. The exotic plants would be used occasionally and form part a foraging network throughout the locality. The consequence would be a minor reduction in marginal foraging habitat.	The Grey-headed Flying-fox would not rely on the exotic vegetation in the development footprint and would be used as part of a range of foraging resources.	Flyout observations of the Grey-headed Flying-fox camp consistently observe the camp exiting toward the escarpment. Bats have not been observed foraging on the exotic vegetation in the development footprint.
Habitat connectivity	Removal of remnant and planted native vegetation that contributes to patchy vegetation cover. The vegetation would be removed during the bulk earthworks phase.	Negligible reduction in connectivity for highly mobile species.	Habitat connectivity throughout the development footprint and subject land is extremely limited. The habitat would be accessible by highly mobile species only, such as birds and bats. The proposed development would reduce the amount of native vegetation, however is unlikely to affect connectivity given the fragmented nature of the subject land and surrounding landscape.	N/A.
Water bodies, water quality and hydrological processes	The unnamed stream running along the north western boundary of the subject land would be removed and reshaped as part of stages 2-4. This would result in a temporary disruption to the hydrological	Temporary disruption to flows. Potential mobilisation of sediment into the retained corridor in the south-east of the subject land during construction and reshaping	Bulk earthworks required to facilitate reshaping of stream. Currently, the stream present is in poor condition, is dominated by aquatic and terrestrial weeds and has poor flow. The stream currently	Waterbodies on the development site are shown in Figure 3

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Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
	processes across the subject land, however the re-establishment of a 40 m wide corridor is likely to improve the water flow, water quality and hydrological processes across the subject land. The process of reshaping the stream may result in downstream impacts to the retained portion of the corridor in the south eastern corner of the subject land. The man-made dam at the development site will also be removed.		running through the subject land was diverted to assist in the operation of the cokeworks. The proposed impacts, although temporarily affecting hydrological flows, are likely to result in an improved aquatic outcome. A Dam-dewatering Plan is required for the removal of the large dam on the development site.	
Wind turbine strikes on protected animals	N/A	N/A	N/A	N/A
Vehicle strikes	Increase in local road network and vehicle traffic during the construction phase. This would occur daily.	Negligible. Increase in vehicle strike to native fauna unlikely.	The development footprint is positioned in a highly urbanised landscape. The vegetation within the development footprint is not of a size to allow occupation by species that commonly suffer from vehicle strike (i.e. Kangaroos). This is exacerbated by the extremely limited connectivity to other vegetation throughout the locality.	N/A

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7.5. Mitigating and managing direct and indirect impacts

Measures proposed to mitigate and manage impacts at the development footprint before, during and after construction with respect to the demolition DA are outlined in Table 26 .

Measures proposed to mitigate and manage impacts at the development footprint before, during and after construction with respect to Stage 1 are outlined in Table 26 .

Measures proposed to mitigate and manage impacts at the development footprint before, during and after construction with respect to Stages 2-4 the are outlined in Table 26 .

7.6. Mitigating prescribed impacts

Measures proposed to mitigate and manage prescribed biodiversity impacts in the Demolition DA development footprint before, during and after construction are outlined in Table 27.

Measures proposed to mitigate and manage prescribed biodiversity impacts Stage 1 development footprint before, during and after construction are outlined in Table 27.

Measures proposed to mitigate and manage prescribed biodiversity impacts in the Stages 2-4 development footprint before, during and after construction are outlined in Table 27.

7.7. Adaptive management strategy

An adaptive management strategy is not proposed as part of this BDAR.

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Table 26: Measures to mitigate and manage impacts during the Demolition DA

Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Displacement, injury or death to native fauna from vegetation clearing	Construction activities resulting in the removal of native vegetation leading to fauna moving out of the area or being injured or killed. Complete exclusion surveys for the Large Bent-winged bat prior to any demolition of site 5 occurring. If exclusion is unsuccessful, remove the building during breeding season when bats are in maternity caves.	Medium	1. All site works will be undertaken in accordance with the existing NSW DCCEEW Grey-headed Flying Fox Licences Appendices L-N. A Threatened Species Licence will be required for Stage 2-4 of the proposed works following Development Approval (if approved) 2. A trained ecological or licensed wildlife handler to be present during clearing events for buildings 3. Undertake pre-clearance survey by suitably qualified ecologist. If nests are present, ensure ecologist is on site to supervise clearing 4. Prior to works commencing, a pre-clearance survey specifically targeting the Grey-headed Flying-fox must be completed. The survey will identify the extent of the camp, location, size and numbers. 5. Prior to the demolition of structure, the microbat management plan must be implemented successfully to exclude all microbats.	Low	Pre-construction/construction Prior to and during felling of hollow bearing trees	Contractor to engage suitably qualified ecologist

Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Damage to native vegetation marked for retention	Construction activities may damage or kill native vegetation marked for retention through accidental clearing.	Medium	1. clearly demarcate areas for retention with fencing or flagging. Install "no-go" signage around areas to be retained to prevent unauthorised access. Implementation of VMP in areas of native vegetation to be retained 2. Maps showing no go areas to be placed in site offices, all staff briefed during tool box talk or pre-work briefing on the location of important environmental features and control measures in place to protect this area. 3. If native vegetation on or adjacent to the site is damaged, implement ecological restoration, rehabilitation and ongoing maintenance compliant with the draft VMP (ELA 2022).	Low	Prior to, during and after construction	contractor and all site workers to be aware of no-go areas. Developer to engage suitably qualified ecologist or bush regenerator to prepare and implement the VMP.
Pollution of waterways	Pollution and spread of weeds, rubbish, sediment and/or nutrient runoff into the surrounding environment via drainage lines during high rainfall events.	Low	1. Install and regularly inspect sediment barriers to control the quality of water released from the site into the receiving environment if required. 2. Develop an erosion and sediment control plan.	Low	during bulk earthworks	contractor and all site workers.

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Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Noise disturbance to fauna and neighbouring communities	Noise generated by construction activities can displace native fauna and impact quality of life of communities	Medium	only conduct clearing and operation of machinery inside of typical work hours (Monday - Friday 7 am - 5 pm and Saturday 8 am - 1 pm). No work to occur on Sundays. All site works will be undertaken in accordance with the existing NSW DCCEEW Grey-headed Flying Fox Licences Appendices L-N. A Threatened Species Licence will be required for Stage 2-4 of the proposed works following Development Approval (if approved). The licences contain noise impact protocols.	Low	during construction	contractor
Dust generation	intermittent disturbance to neighbouring communities and native fauna from dust	Low	1. Adaptive dust monitoring programs to control air quality and potential indirect impacts to Grey-headed Flying-fox in accordance with the Threatened Species licences and Plan of Management. 2. Ensure all stockpiles are covered to prevent dust and sediment mobilisation during dry periods or periods of heavy wind 3. Stage bulk earthworks to prevent extent of bare ground. Use a water truck to wet areas of bare ground. Conduct works outside of hot periods when rainfall is typically lower.	Low	during construction	contractor

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Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Weed invasion into uninfected areas of native vegetation	Vehicle traffic can spread weeds into areas of uninfected native vegetation.	High	1. Hygiene protocols (e.g. wash down facilities) to prevent the spread of weeds or pathogens between infected areas and uninfected areas 2. Prohibit use of any invasive species in any landscaping	Medium	prior to and during construction	contractor and all workers
Vehicle strike	Construction machinery colliding with wildlife and/or people causing injury or death	Medium	1. Temporary site fencing to protect significant environmental features such as remnant vegetation and prevent access by people. 2. A trained ecological or licensed wildlife handler to be present during clearing events. Any fauna injured/separated during construction shall be promptly transported to a veterinarian for treatment.	Low	Construction / operation	Contractor and suitably qualified ecologist/ wildlife handler
Increase in pests and risk of disease	Impacts to adjacent native vegetation associated with edge effects including increased competition and predation, increased risk of disease and invasion by exotic species.	Low	1. Vegetation 'no go' zones in place protect adjacent native vegetation. 2. Weed control consistent with the VMP (ELA 2022) 3. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on planting invasive weed species and disturbance to nests and other niche habitats	Very low	Construction / operation	Contractor/qualified restoration ecologists

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Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Rubbish dumping	Dumping of rubbish in native vegetation by residential owners post construction	Low	1. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats	Very Low	Construction / operation	Developer
Bushfire	Bushfire causing damage to residential properties, and injury or death to wildlife and people	High	1. Smoke-free policy during construction. No construction activities on Total Fire Ban days. 2. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls wood collection and fire management	Low	Construction / operation	Contractor

Table 27: Measures to mitigate and manage impacts during Stage 1

Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Displacement, injury or death to native fauna from vegetation clearing	Construction activities resulting in the removal of native vegetation leading to fauna moving out of the area or being injured or killed. The removal of hollow bearing trees resulting in displacement of adults, fledglings and young.	Medium	1. All site works will be undertaken in accordance with the existing NSW DCCEEW Grey-headed Flying Fox Licences Appendices L-N. A Threatened Species Licence will be required for Stage 2-4 of the proposed works following Development Approval (if approved) 2. Instigate clearing protocols including pre-clearing surveys, daily surveys and staged clearing. A trained ecological or licensed wildlife handler to be present during clearing events. 3. Tree felling outside of spring and summer (main breeding season for native birds and microbats) and undertake pre-clearance and clearance survey by suitably qualified ecologist. 4. Prior to works commencing, a pre-clearance survey specifically targeting the Grey-headed Flying-fox must be completed. The survey will identify the extent of the camp, location, size and numbers.	Low	Pre-construction/construction Prior to and during felling of hollow bearing trees	Contractor to engage suitably qualified ecologist

Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Damage to native vegetation marked for retention	Construction activities may damage or kill native vegetation marked for retention through accidental clearing.	Medium	1. Clearly demarcate areas for retention with fencing or flagging. Install "no-go" signage around areas to be retained to prevent unauthorised access. Implementation of VMP in areas of native vegetation to be retained 2. Maps showing no go areas to be placed in site offices, all staff briefed during tool box talk or pre-work briefing on the location of important environmental features and control measures in place to protect this area. 3. If native vegetation on or adjacent to the site is damaged, implement ecological restoration, rehabilitation and ongoing maintenance compliant with the draft VMP (ELA 2022).	Low	Prior to, during and after construction	Contractor and all site workers to be aware of no-go areas. Developer to engage suitably qualified ecologist or bush regenerator to prepare and implement the VMP.
Pollution of waterways	Pollution and spread of weeds, rubbish, sediment and/or nutrient runoff into the surrounding environment via drainage lines during high rainfall events.	Low	1. Install and regularly inspect sediment barriers to control the quality of water released from the site into the receiving environment if required. 2. Develop an erosion and sediment control plan.	Low	During bulk earthworks	Contractor and all site workers.

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Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Noise disturbance to fauna and neighbouring communities	Noise generated by construction activities can displace native fauna and impact quality of life of communities	Medium	1. Only conduct clearing and operation of machinery inside of typical work hours (Monday - Friday 7 am - 5 pm and Saturday 8 am - 1 pm). No work to occur on Sundays 2. All site works will be undertaken in accordance with the existing NSW DCCEEW Grey-headed Flying Fox Licences Appendices L-N. A Threatened Species Licence will be required for Stage 2-4 of the proposed works following Development Approval (if approved). The licences contain noise impact protocols.	Low	During construction	Contractor
Dust generation	intermittent disturbance to neighbouring communities and native fauna from dust	Low	1. Adaptive dust monitoring programs to control air quality and potential indirect impacts to Grey-headed Flying-fox 2. Ensure all stockpiles are covered to prevent dust and sediment mobilisation during dry periods or periods of heavy wind 3. Stage bulk earthworks to prevent extent of bare ground. Use a water truck to wet areas of bare ground. Conduct works outside of hot periods when rainfall is typically lower.	Low	During construction	Contractor

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Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Weed invasion into uninfected areas of native vegetation	Vehicle traffic can spread weeds into areas of uninfected native vegetation.	High	1. Hygiene protocols (e.g. wash down facilities) to prevent the spread of weeds or pathogens between infected areas and uninfected areas 2. Prohibit use of any invasive species in any landscaping	Medium	Prior to and during construction	Contractor and all workers
Vehicle strike	Construction machinery colliding with wildlife and/or people causing injury or death	High	1. Temporary site fencing to protect significant environmental features such as remnant vegetation and prevent access by people. 2. A trained ecological or licensed wildlife handler to be present during clearing events. Any fauna injured/separated during construction shall be promptly transported to a veterinarian for treatment.	Low	Construction / operation	Contractor and suitably qualified ecologist/ wildlife handler
Trampling of threatened flora species	Construction machinery and food traffic resulting in the trampling and death of threatened flora species	Low	1. Native vegetation to be retained clearly demarcated for retention. Install "no-go" signage around areas to be retained to prevent unauthorised access	Very Low	Construction / operation	Contractor
Increase in pests and risk of disease	Impacts to adjacent native vegetation associated with edge effects including increased competition and predation, increased risk of disease and	High	1. Vegetation ‘no go’ zones in place protect adjacent native vegetation. 2. Weed control consistent with the VMP (ELA 2022) 3. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on	Low	Construction / operation	Contractor/qualified restoration ecologists

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Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
	invasion by exotic species.		planting invasive weed species and disturbance to nests and other niche habitats			
Rubbish dumping	Dumping of rubbish in native vegetation by residential owners post construction	Low	1. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats	Very Low	Construction / operation	Developer
Bushfire	Bushfire causing damage to residential properties, and injury or death to wildlife and people	High	1. Smoke-free policy during construction. No construction activities on Total Fire Ban days. 2. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls wood collection and fire management	Low	Construction / operation	Contractor

Table 28: Measures to mitigate and manage impacts during Stages 2-4

Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Displacement, injury or death to native fauna from vegetation clearing	Construction activities resulting in the removal of native vegetation leading to fauna moving out of the area or being injured or killed. Construction activities resulting in disturbance to the Grey-headed Flying-fox camp and stress to individuals	Medium	1. All site works will be undertaken in accordance with the existing NSW DCCEEW Grey-headed Flying Fox Licences (Appendices L-N). A Threatened Species Licence will be required for Stage 2-4 of the proposed works following Development Approval (if approved). 2. Undertake pre-clearance survey by suitably qualified ecologist. If nests are present, ensure ecologist is on site to supervise clearing 3. Prior to works commencing, a pre-clearance survey specifically targeting the Grey-headed Flying-fox must be completed. The survey will identify the extent of the camp, location, size and numbers. 4. On the first day of clearing, a suitably qualified ecologist must be present to monitor the Grey-headed Flying-fox camp. If the camp becomes distressed and do not settle, works must cease until the camp settles. If the camp continues to become distressed, other mitigation measures such as noise attenuation may be required.	Low	Pre-construction/construction Prior to and during felling of hollow bearing trees	Contractor to engage suitably qualified ecologist

Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
			5. If bats are seen flying consistently during the day, works must cease and the ecologist will be called.			
Damage to native vegetation marked for retention	Construction activities may damage or kill native vegetation marked for retention through accidental clearing.	Medium	1. Clearly demarcate areas for retention with fencing or flagging. Install "no-go" signage around areas to be retained to prevent unauthorised access. 2. Maps showing no go areas to be placed in site offices, all staff briefed during tool box talk or pre-work briefing on the location of important environmental features and control measures in place to protect this area. 3. If native vegetation on or adjacent to the site is damaged, implement ecological restoration, rehabilitation and ongoing maintenance compliant with the draft VMP (ELA 2022).	Low	Prior to, during and after construction	Contractor and all site workers to be aware of no-go areas. Developer to engage suitably qualified ecologist or bush regenerator to prepare and implement the VMP.
Pollution of waterways	Pollution and spread of weeds, rubbish, sediment and/or nutrient runoff into the surrounding environment via drainage lines during high rainfall events.	Low	1. Install and regularly inspect sediment barriers to control the quality of water released from the site into the receiving environment if required. 2. Develop an erosion and sediment control plan.	Low	During bulk earthworks	Contractor and all site workers.

Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Noise disturbance to fauna and neighbouring communities	Noise generated by construction activities can displace native fauna and impact quality of life of communities	Medium	1. All site works will be undertaken in accordance with the existing NSW DCCEEW Grey-headed Flying Fox Licences Appendices L-N. A Threatened Species Licence will be required for Stage 2-4 of the proposed works following Development Approval (if approved). The licences contain noise impact protocols. 2. Install noise barriers or attenuation devices on machinery or daily/seasonal timing of construction and operational activities to reduce impacts of noise if Grey-headed Flying-fox individuals are agitated and do not settle during construction. 3. Only conduct clearing and operation of machinery inside of typical work hours (Monday - Friday 7 am - 5 pm and Saturday 8 am - 1 pm). No work to occur on Sundays 4. Dust must be managed during construction. This includes using a water truck to wet down and suppress dust and covering piles of spoil or stock piles to minimise the movement of dust	Low	During construction	Contractor

Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Light disturbance to nocturnal fauna	Light at night can impact nocturnal fauna's feeding behaviours resulting in displacement from the area	Medium	• Conduct works during daylight hours	Low	During construction	Contractor
Dust generation	intermittent disturbance to neighbouring communities and native fauna from dust	Low	1. Adaptive dust monitoring programs to control air quality and potential indirect impacts to Grey-headed Flying-fox 2. Ensure all stockpiles are covered to prevent dust and sediment mobilisation during dry periods or periods of heavy wind 3. Stage bulk earthworks to prevent extent of bare ground. Use a water truck to wet areas of bare ground. Conduct works outside of hot periods when rainfall is typically lower.	Low	During construction and operation	Contractor
Weed invasion into uninfected areas of native vegetation	Vehicle traffic can spread weeds into areas of uninfected native vegetation.	High	1. Hygiene protocols (e.g. wash down facilities) to prevent the spread of weeds or pathogens between infected areas and uninfected areas 2. Prohibit use of any invasive species in any landscaping	Medium	Prior to and during construction	Contractor and all workers
Vehicle strike	Construction machinery colliding with wildlife and/or people causing injury or death	Low	1. Temporary site fencing to protect significant environmental features such as remnant vegetation and prevent access by people.	Very low	Construction / operation	Contractor and suitably qualified ecologist/ wildlife handler

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Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
			2. A trained ecological or licensed wildlife handler to be present during clearing events. Any fauna injured/separated during construction shall be promptly transported to a veterinarian for treatment.			
Trampling of threatened flora species	Not applicable. No threatened flora species present in the development footprint.	N/A	N/A	N/A	N/A	N/A
Increase in pests and risk of disease	Impacts to adjacent native vegetation associated with edge effects including increased competition and predation, increased risk of disease and invasion by exotic species.	High	1. Vegetation 'no go' zones in place protect adjacent native vegetation. 2. Weed control consistent with the VMP (ELA 2022) 3. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on planting invasive weed species and disturbance to nests and other niche habitats	Low	Construction / operation	Contractor/qualified restoration ecologists
Rubbish dumping	Dumping of rubbish in native vegetation by residential owners post construction	Low	1. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats	Very Low	Construction / operation	Developer

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Hazard	Description	Risk Rating	Mitigation Measures	Residual risk rating	Timing	Responsibility
Bushfire	Bushfire causing damage to residential properties, and injury or death to wildlife and people	High	1. Smoke-free policy during construction. No construction activities on Total Fire Ban days. 2. Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls wood collection and fire management	Low	Construction / operation	Contractor

Table 29: Mitigation measures for prescribed biodiversity impacts

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Scheduling timing of construction activities to avoid critical life cycle events	Moderate	Low	**Stages 2-4 only:** Avoid any bulk earthworks in proximity (within 100 m) to the Grey-headed Flying-fox camp in spring and summer. The majority of works will be scheduled to be undertaken when the flying foxes are absent from the site (winter) where practical.	Timing works near the camp in stages 2-4 when it is known to be empty	Winter	Developer, site supervisor
Instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing, and using a trained ecological or licensed wildlife handler during clearing, construction and maintenance activities for human made structures and non-native vegetation	Moderate	Low	**Demolition DA:** Pre-clearance survey of buildings must be conducted for threatened microbats prior to commencement of works Complete exclusion surveys for the Large Bent-winged bat prior to any demolition of site 5 occurring. If exclusion is unsuccessful, remove the building during breeding season when bats are in maternity caves. **Stage 1 and Stages 2-4:** Pre-clearance survey in areas of native vegetation must be	No harm to resident fauna	Prior to and during clearing	Site supervisor, developer

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			conducted prior to commencement of works to identify nests or hollows **All stages:** All site works will be undertaken in accordance with the existing NSW DCCEEW Grey-headed Flying Fox Licences (Appendices L-N). A Threatened Species Licence will be required for Stage 2-4 of the proposed works following Development Approval (if approved). A key condition of the licence is that the flying fox camp will be monitored during all site works. Pre-clearance survey in ephemeral ponds must be conducted to identify any amphibians present If any fauna is identified in pre-clearance surveys, a suitably qualified ecologist must be present during clearing. A clearing protocol and relocation procedure for fauna identified should be			

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			developed prior to clearing commencing			
Replacing habitat provided by human made structures and non-native vegetation with alternative habitat	Moderate	Low	**Demolition DA:** Humanmade structure – these are not proposed to be replaced. **All stages:** Exotic vegetation – in future development stages, the proposed creek realignment will be fully revegetated with native species	Increase in foraging habitat for the Grey-headed Flying-fox	During demolition and stages 2-4 of the proposed development	Developer
Sediment barriers or sedimentation ponds to control the quality of water released from the site into the receiving environment	Moderate	Low	**All stages:** Prepare Construction Environment Management Plan (CEMP) which details control measures such as sediment barriers to precent runoff into adjacent land	Potential runoff or pollution events controlled	Prior to and during construction	Developer and site supervisor
Staff training and site briefing to communicate environmental features to be protected and measures implemented to protect them	High	Low	**All stages:** Develop site specific environmental induction which outlines key biodiversity values, risks, no-go areas and unexpected finds procedures	On-site staff appropriately trained and educated in biodiversity values present	Prior to commencement of works for all stages, when site conditions change or when new staff are engaged	Developer, site supervisor
Ecological restoration, rehabilitation actions and/or maintenance of retained native vegetation on or adjacent to the subject land	Moderate	Low	Future riparian corridor to be fully revegetated under a Vegetation Management Plan	Future establishment of native vegetation	During and following	Developer and site supervisor

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Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			once the corridor has been reshaped. **All stages:** Installation of fencing and no-go signage to protect retained vegetation in the subject land.	along the future creek and management of indirect impacts during the construction phase	construction of Stages 2-4	

8. Impact summary

Following implementation of the BAM and the BAMC, the following impacts have been determined.

8.1. Serious and Irreversible Impacts (SAII)

The development has candidate Serious and Irreversible Impacts (SAII) values as outlined in Table 30. Detailed consideration of whether impacts on TECs that are serious and irreversible is included in Table 32.

The Large Bent-winged Bat is also an SAII candidate for breeding habitat. Section 5.4.3 of this report provides detail around the breeding requirements of the species and an assessment of how the Large Bent-winged Bat is using the subject land. The subject land is not considered to provide breeding for this species, and therefore it has not been assessed as an SAII candidate entity.

Table 30: Serious and Irreversible Impacts Summary

BDAR stage	Species / Community	Principle	Direct impact individuals / area (ha)	Threshold
Demolition DA	N/A	N/A	N/A	N/A
Stage 1	Illawarra Lowlands Grassy Woodland	1, 2 and 3	0.41	No set threshold.
Stage 2-4	Illawarra Lowlands Grassy Woodland	1, 2 and 3	0.81	No set threshold.

Table 31: Determining which Principles apply to serious and irreversible candidate entities (Clause 6.7 of the BC Regulation)

Determining whether impacts are serious and irreversible	Assessment
Principle 1	
Does the proposal impact on a species, population or ecological community that is a candidate entity because it is in a rapid rate of decline?	Population reduction of >80% in 10 years or three generations
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible?	No threshold set.
Principle 2	
Does the proposal impact on a species that is a candidate entity because it has been identified as having a very small population size?	< 50 individuals or < 250 individuals where threats are known
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible?	No threshold set.
Principle 3	
Does the proposal impact on the habitat of a species or an area of an ecological community that is a candidate entity because it has a very limited geographic distribution?	Known from <=3 locations and / or an AOO < 10 km^2 or EOO < 100 km^2
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible?	No threshold set.

Determining whether impacts are serious and irreversible	Assessment
Principle 4	
Does the proposal impact on a species, a component of species habitat or an ecological community that is a candidate entity because it is irreplaceable?	Not applicable
b. If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible?	Not applicable.

Table 32: Evaluation of an impact on a TEC consistent with 9.1.1 of the BAM for the development

Impact Assessment Provisions	Assessment
1. the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	This has been addressed in Section 6.
2a. evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)	The original geographic distribution of this SAII candidate is unknown due to the amount of clearing that has occurred. It is estimated to have been between 17,700 – 42,700 ha across the Illawarra and Jervis subregions (DotEE 2016). The community is still known to occur in the Illawarra and Jervis subregions, however the estimated extent remaining is between 10 – 24 % (DotEE 2016).
2b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: **i. change in community structure** **ii. change in species composition** **iii. disruption of ecological processes** **iv. invasion and establishment of exotic species** **v. degradation of habitat, and** **vi. fragmentation of habitat**	Due to land clearing for urban development and agriculture, some patches of the community that remain are small in extent, fragmented and subject to edge effects. About 92% of the community exists patches < 10 ha (DotEE 2016). This has changed the community structure and species composition, with patches in agricultural land existing as remnant canopy trees without a typical midstorey or groundcover layer. Disruptions to the ecological processes have been documented in fragmented landscapes where fauna species have also been lost from areas. This is reported to have a negative impact through reduction of pollination, seed dispersal and soil engineering (DptEE 2016).
2c. evidence of restricted geographic distribution (Principle 3, clause 6.7 (2) (c) BC Regulation), based on the TECs geographic range in NSW according to the: **i. extent of occurrence** **ii. area of occupancy, and** **iii. number of threat-defined locations.**	According to the Conservation Advice, the area over which the ecological community occurs is approximately 93 000 ha (analysis of data from Tozer et al, 2010), which is not considered to be limited. It is likely that this number is inaccurate, given the analysis used data from 2010. The area of occupancy is estimated at 4,200 ha based on data from Tozer et al 2010. There are no specific threat defined locations outlined in the Final Determination or the Conservation Advice.
2d. evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7 (2) (d) BC Regulation).	The TEC is likely to respond to management that aims to reduce exotic cover and increase the cover and abundance of native species.
3. Where the TBDC indicated that data is 'unknown' or 'data deficient' for a TEC for a criterion listed in subsection 9.1.1(2), the assessor must record this in the BDAR or BCAR.	N/A.

Impact Assessment Provisions	Assessment
4a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal: **i. in hectares, and** **ii. as a percentage of the current geographic extent of the TEC in NSW.**	The proposed development would remove 1.41 ha of the community. The community is estimated to occupy 4,200 ha. The proposed development forms 0.10% of the estimated area of occupancy.
4b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by: **i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals** **ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:** **• distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and** **• estimated maximum dispersal distance for native flora species characteristic of the TEC, and** **• other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development** **iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.**	According to the State Vegetation Type Map there is 4.05 ha of the community mapped within a 500 m radius of the development footprint and 12.9 ha within a 1,500 m buffer of the development footprint. The closest patch is about 300 m to the east on the corner of Murray Road and Duff Parade. The second closest patch is 450 m to the south, in the subject land. The distance between the Murray Road patch and southern subject land patch is approximately 530 m. These areas are fragmented by existing cokeworks infrastructure, a railway line, residential development and cleared land. Birds and bats would be able to traverse this fragmentation. From reviewing aerial photography, the remaining patches within 500 m of the development footprint appear to exist as small, fragmented patches amongst development or at the edges of parks and other public recreation areas. If the patch in the development footprint was removed, this would not increase fragmentation or distance between the Murray Road patch and southern subject land patch. It would result in a marginal increase in fragmentation of already fragmented patches throughout the locality. Given the fragmentation throughout the locality, it is likely that seed is dispersed mostly by mobile fauna such as birds and bats. The estimated maximum dispersal distance for Grey-headed Flying-fox would be their average nightly foraging range of 20 km. The condition of the community varied throughout the development footprint. Weed invasion and historic land practices have affected the cover and abundance of native species in the midstorey and groundcover layers. Across the patch, sporadic occurrences of a high proportion of native groundcover species were observed, whilst other areas were dominated by exotic species. Some exotic species were prevalent across the entire patch, even where native groundcover was present. The patch of the community was sampled in the area considered to be in best condition and achieved a VI Score of 71.9.

Table 33: Evaluation of an impact on a TEC consistent with 9.1.1 of the BAM for Stage 2-4 of the development

Impact Assessment Provisions	Assessment
1. the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	This has been addressed in Section 6.
2a. evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current	The original geographic distribution of this SAII candidate is unknown due to the amount of clearing that has occurred.

Impact Assessment Provisions	Assessment
total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)	It is estimated to have been between 17,700 – 42,700 ha across the Illawarra and Jervis subregions (DotEE 2016). The community is still known to occur in the Illawarra and Jervis subregions, however the estimated extent remaining is between 10 – 24 % (DotEE 2016).
2b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: **i. change in community structure** **ii. change in species composition** **iii. disruption of ecological processes** **iv. invasion and establishment of exotic species** **v. degradation of habitat, and** **vi. fragmentation of habitat**	Due to land clearing for urban development and agriculture, some patches of the community that remain are small in extent, fragmented and subject to edge effects. About 92% of the community exists patches < 10 ha (DotEE 2016). This has changed the community structure and species composition, with patches in agricultural land existing as remnant canopy trees without a typical midstorey or groundcover layer. Disruptions to the ecological processes have been documented in fragmented landscapes where fauna species have also been lost from areas. This is reported to have a negative impact through reduction of pollination, seed dispersal and soil engineering (DptEE 2016).
2c. evidence of restricted geographic distribution (Principle 3, clause 6.7 (2) (c) BC Regulation), based on the TECs geographic range in NSW according to the: **i. extent of occurrence** **ii. area of occupancy, and** **iii. number of threat-defined locations.**	According to the Conservation Advice, the area over which the ecological community occurs is approximately 93 000 ha (analysis of data from Tozer et al, 2010), which is not considered to be limited. It is likely that this number is inaccurate, given the analysis used data from 2010. The area of occupancy is estimated at 4,200 ha based on data from Tozer et al 2010. There are no specific threat defined locations outlined in the Final Determination or the Conservation Advice.
2d. evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7 (2) (d) BC Regulation).	The TEC is likely to respond to management that aims to reduce exotic cover and increase the cover and abundance of native species.
3. Where the TBDC indicated that data is 'unknown' or 'data deficient' for a TEC for a criterion listed in subsection 9.1.1(2), the assessor must record this in the BDAR or BCAR.	N/A.
4a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal: **i. in hectares, and** **ii. as a percentage of the current geographic extent of the TEC in NSW.**	The development would remove 1.17 ha of the community. The community is estimated to occupy 4,200 ha. The proposed development forms 0.00027% of the estimated area of occupancy.
4b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by: **i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals** **ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:**	According to the State Vegetation Type Map there is 4.05 ha of the community mapped within a 500 m radius of the development footprint and 12.9 ha within a 1,500 m buffer of the development footprint. The closest patch is about 300 m to the east on the corner of Murray Road and Duff Parade. The second closest patch is 450 m to the south, in the subject land. The distance between the Murray Road patch and southern subject land patch is approximately 530 m. These areas are fragmented by existing cokeworks infrastructure, a railway line,

Impact Assessment Provisions	Assessment
• **distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and** • **estimated maximum dispersal distance for native flora species characteristic of the TEC, and** • **other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development** **iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.**	residential development and cleared land. Birds and bats would be able to traverse this fragmentation. From reviewing aerial photography, the remaining patches within 500 m of the development footprint appear to exist as small, fragmented patches amongst development or at the edges of parks and other public recreation areas. If the patch in the development footprint was removed, this would not increase fragmentation or distance between the Murray Road patch and southern subject land patch. It would result in a marginal increase in fragmentation of already fragmented patches throughout the locality. Given the fragmentation throughout the locality, it is likely that seed is dispersed mostly by mobile fauna such as birds and bats. The estimated maximum dispersal distance for Grey-headed Flying-fox would be their average nightly foraging range of 20 km. The condition of the community varied throughout the development footprint, occurring as two different vegetation zones: moderate and regrowth. Weed invasion and historic land practices have affected the cover and abundance of native species in the midstorey and groundcover layers. Across the patch, sporadic occurrences of a high proportion of native groundcover species were observed, whilst other areas were dominated by exotic species. Some exotic species were prevalent across the entire patch, even where native groundcover was present. In regrowth vegetation zone, of the TEC achieved a veg integrity score of 21 and the moderate vegetation zone of the TEC achieved a vegetation integrity score of 71.7.

8.2. Impacts requiring offsets

8.2.1. Ecosystem credit impacts

The impacts of the development requiring offset for native vegetation are outlined in Table 34 and shown on Figure 13.

Table 34: Impacts to native vegetation that require offsets

BDAR stages	Vegetation Zone	PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
Demolition DA	N/A	No PCTs present-	N/A	N/A	N/A	N/A
Stage 1	1, PCT 838 moderate	838	Forest Red Gum – Thin-leaved Stringybark Grassy Woodland	Coastal Valley Grassy Woodland	Grassy Woodland	0.41
Stage 2-4	1, PCT 838 moderate	838	Forest Red Gum – Thin-leaved Stringybark Grassy Woodland	Coastal Valley Grassy Woodland	Grassy Woodland	0.16

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BDAR stages	Vegetation Zone	PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
Stage 2-4	2, PCT 838 degraded	838	Forest Red Gum – Thin-leaved Stringybark Grassy Woodland	Coastal Valley Grassy Woodland	Grassy Woodland	0.65

8.2.2. Species credit impacts

Stage 2-4 of the proposed development will impact 0.10 ha of a known Grey-headed Flying Fox roosting camp (Table 37).

8.3. Impacts not requiring offsets

The impacts of the development not requiring offset for native vegetation are outlined in Table 35 and shown on Figure 14.

Table 35: Impacts to native vegetation that do not require offsets

Stage	Vegetation Zone	PCT ID	PCT Name	Direct impact (ha)	Rationale
Demolition DA and stage 1 DA	-	-	Planted native vegetation	0.59	Assessed using Streamlined Assessment Module: Planted Native
Stages 2-4	-	-	Planted native vegetation	3.59	
			Total	**4.18**	

8.4. Areas not requiring assessment

Areas not requiring assessment are shown on Figure 15. The areas not requiring assessment were areas mapped as exotic and cleared.

8.5. Credit summary

The number of ecosystem credits required for the stages of the development are outlined in Table 36. A biodiversity credit report is included in Appendix D.

Table 36: Ecosystem credits required

Stage	Vegetation Zone	PCT ID	PCT Name	Credit Class	Direct impact (ha)	Credits required
Demolition DA	N/A	No PCTs present-	N/A	N/A	N/A	N/A
Stage 1	1	838	Forest Red Gum - Thin-leaved Stringybark Grassy Woodlands	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion This includes PCT's: 838, 1326	0.41	15

Stage	Vegetation Zone	PCT ID	PCT Name	Credit Class	Direct impact (ha)	Credits required
Stage 2-4	1	838	Forest Red Gum - Thin-leaved Stringybark Grassy Woodlands	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion This includes PCT's: 838, 1326	0.81	15
				Total	**1.22**	**30**

Table 37: Species credits required

Stage	Species	Direct impact	Credits required
Stage 2-4	Grey-headed Flying Fox	0.10	3



Figure 12: Serious and Irreversible Impacts



Figure 13: Impacts requiring offset



Figure 14: Impacts not requiring offset



Figure 15: Impacts not requiring assessment

9. Consistency with legislation and policy

9.1. Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where "Matters of National Environmental Significance" (MNES) may be affected. Under the Act, any action which "has, will have, or is likely to have a significant impact on a matter of MNES" is defined as a "controlled action", and requires approval from the Commonwealth Department of Climate Change, Energy Environment and Water (DCCEEW), which is responsible for administering the EPBC Act.

The process includes conducting an Assessment of Significance for listed threatened species and ecological communities that represent a matter of MNES that will be impacted as a result of the proposed action. Significant impact guidelines (formerly DotEE 2014) that outline a number of criteria have been developed by the Commonwealth, to provide assistance in conducting the Assessment of Significance and help decide whether or not a referral to the Commonwealth is required.

A total of one MNES was assessed consistent with the Significant Impact Guidelines 1.1 based on the removal of marginal foraging habitat and potential indirect impacts. The application of the significant impact criteria with respect to Grey-headed Flying-fox was completed and concluded that a significant impact is unlikely.

9.1.1. Grey-headed Flying-fox 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).

9.1.2. Assessment against critical habitat

The 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, especially those which provide resources in times of food shortage or winter, may also be critical to the survival of the species. The development footprint includes 4.40 ha (PCT 838 and planted native vegetation across all stages of the development) of potential foraging habitat that would be directly affected. A small area of the camp was identified inside the development footprint. The camp on average, contains approximately 200 - 600 bats. There are also four camps within a 20 km radius of the action area:

- Thirroul – surveyed 2020 and contained 2,5000 – 9,999 bats
- Figtree – last surveyed 2019 and contained 500 – 2,499 bats
- West Dapto – last surveyed 2019 and contained 500 – 2,499 bats
- Shellharbour – last surveyed 2020 and contained 1 – 4,99 bats.

There are camps listed on the Flying-fox web viewer at Bulli, Thirroul and Balgownie that do not have any counts recorded (DCCEEW 2022a).

9.1.3. Important populations

The 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 development footprint would support the important population.

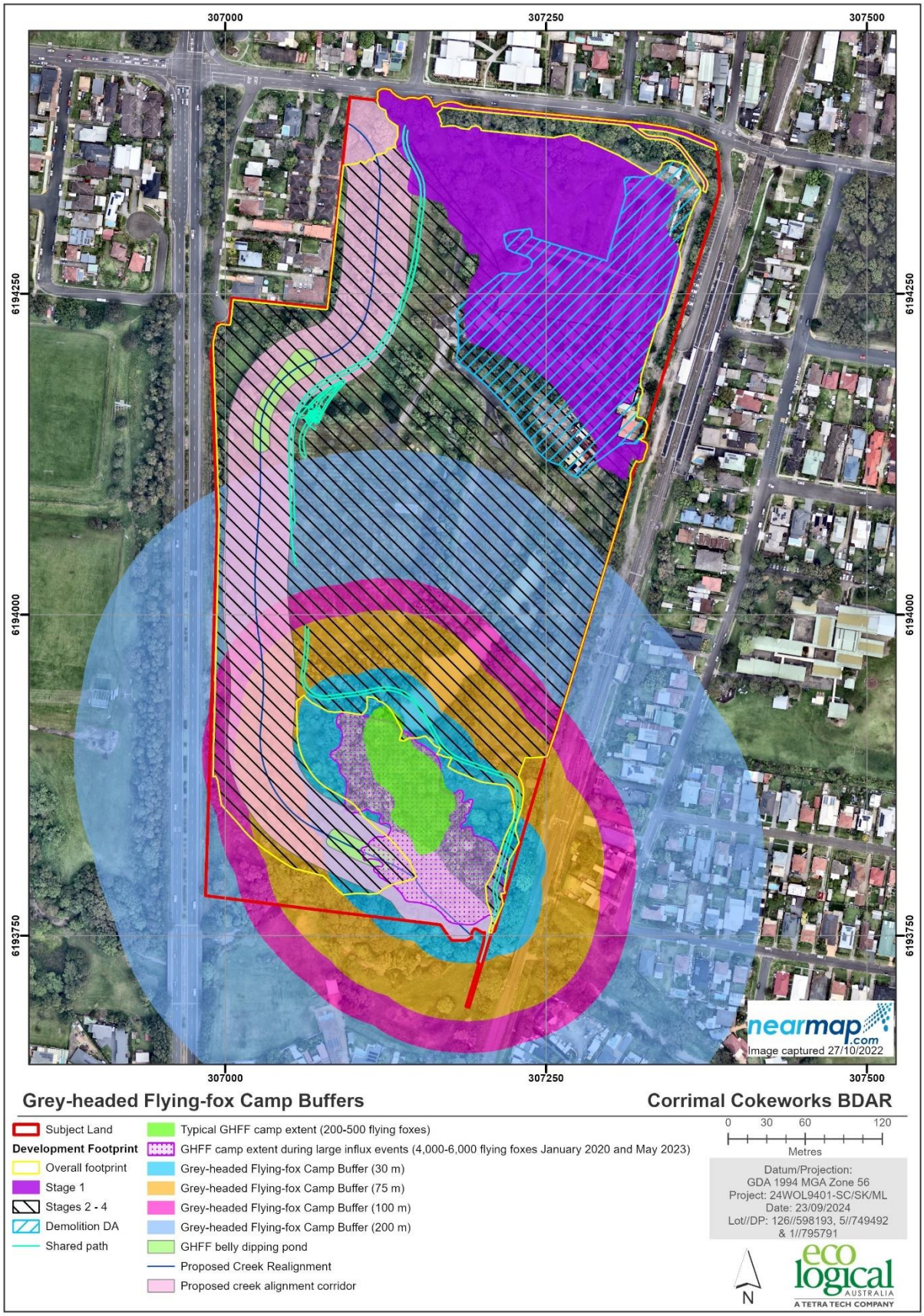


Figure 16 Grey-headed Flying-fox camp buffers

9.1.4. Impact assessment

The proposed action would remove 4.40 ha of potential foraging habitat through vegetation clearing. No breeding habitat in the form of camps would be affected. The significant impact criteria were 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 Table 38.

Table 38: Application of the significant impact criteria with respect to the Grey-headed Flying-fox

Criterion	Assessment
lead to a long-term decrease in the size of an important population of a species	The Grey-headed Flying-fox is comprised of one large interbreeding population (DAWE 2021). The presence of any individuals of this species signals that an important population is present. There is a camp in the south of the site that will be affected by this development proposal. DCCEEW Courtship and mating behaviours has been observed in the flying fox camp. Pups have also been observed once at the camp in November 2019, following a significant period of absence of bats. A precautionary approach has been taken and the camp has been assumed breeding habitat as it is occupied whilst some females may be pregnant. 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 4.40 ha of potential foraging habitat for the Grey-headed Flying-fox which would contribute to habitat loss. Indirect impacts to the camp in the subject land includes noise and dust during the construction phase. 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 forays (up to 20 km from camps (DAWE 2021)). The species is known to utilise a range of foraging resources including vegetation in urban areas. It is likely that the foraging habitat in the action area forms part of a mosaic of foraging resources for this species and would not be solely relied upon. Fly-out counts have shown that the individuals present in the camp use vegetation on the Illawarra Escarpment for foraging purposes. Stages 2-4 BEW of the development proposal will occur adjacent to the Grey-headed Flying-fox camp within the subject land. This will result in impacts including the removal of potential roost trees within the camp extent. Furthermore, it is likely that noise and dust would travel from the action footprint to the camp. These impacts are expected to be mitigated. Legacy Property are required to apply for a NSW DCCEEW Threatened Species Licence following DA approval (if approved) DCCEEW and a Grey-headed Flying-fox Plan of Management (PoM) has been prepared to accompany this DA (Appendix G). Mitigation measures outlined in the Threatened Species Licence and the PoM will be implemented throughout all phases of the development. Legacy currently hold Threatened Species licences for the impacts to the flying foxes for other stages of the development including proposed Sewer lead-in works. Sewer lead-in works have similar impacts to proposed Stage 2-4 bulk earthworks works, including the removal of mapped potential roost habitat. The conditions of the future Stage 2-4 bulk earthworks licence are expected to be similar to the conditions of the sewer lead in works licence (Appendix C of PoM – Appendix G). Among other measures, the camp is required to be continuously monitored for signs of stress during all works within the development site. Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery. Therefore, if the mitigation measures recommended in the PoM and Threatened Species Licence are implemented, the proposed development is unlikely to lead to a long-term decrease in the important population. Although the proposed action would result in habitat loss and potential indirect impacts, there will be no significant impacts on this camp if the mitigation measures outlined in the relevant

Criterion	Assessment
	Threatened Species Licence from the NSW DCCEEW and the Grey-headed Flying-fox Plan of Management written by ELA are followed. As such, the proposed development is unlikely to lead to a long-term decrease in the size of an important population of the Grey-headed Flying-fox.
reduce the area of occupancy of an important population	The Grey-headed Flying-fox is comprised of one large interbreeding population. The presence of any individuals of this species signals that an important population is present. The proposed action would reduce the area of occupancy by 4.40 ha through the removal of marginal foraging habitat.
fragment an existing important population into two or more populations	The Grey-headed Flying-fox is comprised of one large interbreeding population. The presence of any individuals of this species signals that an important population is present. The proposed development will remove 4.40 ha of potential foraging habitat and some minor encroachment into known roosting habitat. As this is a highly mobile species, works on the subject land will not fragment any populations within the wider area. Furthermore, a patch of vegetation comprising the majority of the existing roosting vegetation will be retained for the ongoing use as roosting habitat for the flying foxes on site. Monthly surveys over the past three years have identified that the species utilises vegetation along the Illawarra Escarpment for foraging. The vegetation in the development footprint is used as an intermittent roost (camp is unoccupied around winter – early spring), however is unlikely to sustain the species foraging needs although would be used on occasion. About 7.00 ha of habitat will be rehabilitated along a future riparian corridor and large amounts of foraging habitat remain present along the Illawarra Escarpment. The removal of this foraging and minor encroachment into potential roosting habitat would not fragment the camp from other areas of foraging habitat within the species' nightly foraging range, or separate the camp from another camp. Camp monitoring has not identified breeding females, a creche or pups over the past three years. Courtship and mating activity has been observed in the flying fox camp. As such, it is likely that this camp acts as a temporary roost for individuals on foraging forays. Breeding signs will be monitored by a qualified ecologist throughout the development process as per the PoM and future Threatened Species licence. If signs of breeding are observed, there are triggers within the PoM that outline procedures to mitigate potential impacts of the development on breeding individuals. Given the highly mobile nature of this species, removing 4.40 ha of marginal foraging habitat will not fragment two population within the region. Furthermore, the development proposal will retain a majority of the trees that are utilised as roost trees. The extent of the camp at its largest extent (2,000-6,000 flying foxes was mapped (Figure 16). About 0.10 ha of mapped flying fox camp roosting habitat will be removed by Stage 2-4 of the proposed works. If mitigation measures outlined in the relevant Threatened Species Licence from the NSW DCCEEW and the Grey-headed Flying-fox Plan of Management (PoM) written by ELA are followed, the proposed development is unlikely to fragment the population into two or more.
Adversely affect habitat critical to the survival of a species	The development footprint contains 4.40 ha of potential foraging habitat and includes some minor encroachment into potential roosting habitat which met the definition of critical habitat. This habitat is proposed for removal. Actions that would adversely affect habitat critical to the survival of the species includes loss of foraging habitat, disturbance to camps, increased changes of electrocution and climate change. Loss of foraging habitat and impacts to camps are 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 development footprint is marginal and forms part of a wider network of resources that extend into the locality. Nightly observations show that the species preference foraging habitat along the escarpment which suggests foraging habitat in the development footprint may be used on an occasional basis and not relied upon.

Criterion	Assessment
	The camp is currently positioned downstream of a human-made dam that was used as a settling pond during the operation of the cokeworks facility. As part of the construction process, the dam will be dewatered which may temporarily affect the water resources adjacent to the camp. To ensure that a water resource remains in proximity to the camp, a new pond of similar proportions will be constructed within the future riparian corridor. The pond will be constructed and filled prior to the dewatering of the human-made dam. As stated above, the realignment of the dam within 75 m of the GHFF would be undertaken when the GHFF camp is empty. If the camp returns before works are completed, or the camp does not empty, then a stop works procedure will take effect. The current PoM would be amended to include additional measures and strategies under the guidance of the conditions of this licence to ensure the camp is not harmed. The removal of 4.40 ha of marginal foraging habitat is unlikely to adversely affect habitat critical to the survival of this species.
disrupt the breeding cycle of an important population	Actions that may disrupt the breeding cycle can include a significant reduction of foraging habitat, consistent disturbance to a breeding camp, impacts to breeding or pregnant females, disturbance of a creche or pups. A camp is present in close proximity to the development footprint. Monthly observations of the camp from 2019 – present have not identified breeding females, pups or a creche. It was assessed as unlikely to be used for breeding. As such, it is likely that this camp acts as a temporary roost for individuals on foraging forays. Breeding signs will be monitored by a qualified ecologist throughout the development process as a pre-clearance survey as per section 5.1.1 of the PoM. The PoM also contains triggers that outline procedures to mitigate potential impacts of the development on breeding individuals if breeding individuals are observed. This includes the cessation of works within 75 m of the camp if it is occupied during breeding season (spring - summer). Therefore, significant impacts to breeding females, pups or a creche through noise, dust or habitat removal are unlikely. The proposed action would remove 4.40 ha of marginal foraging habitat. Monthly surveys over the past three years have identified that the species utilises vegetation along the Illawarra Escarpment for foraging. The vegetation in the development footprint is marginal foraging habitat and used intermittently as a temporary roost for foraging forays. Due to the mobile nature of this species the removal of this foraging habitat would not fragment the camp from other areas of foraging habitat within the species' nightly foraging range, or separate the camp from another camp that could be used for breeding. The removal of 4.40 ha of marginal foraging habitat is unlikely to disrupt the breeding cycle of an important population of Grey-headed Flying-fox. if the mitigation measures and triggers outlined in the relevant Threatened Species Licence from the NSW DCCEEW and the Grey-headed Flying-fox Plan of Management written by ELA are followed.
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 and minor encroachment into potential roosting 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 proposed development will remove 4.40 ha of potential foraging habitat and some minor encroachment into known roosting habitat. A patch of vegetation comprising the majority of the existing roosting vegetation will be retained for the ongoing use as roosting habitat for the flying foxes. About 6.85 ha of habitat will be rehabilitated along a future riparian corridor and large amounts of foraging habitat remain present along the Illawarra Escarpment. As part of the construction process, the existing dam will be dewatered which may temporarily affect the water resources adjacent to the camp. To ensure that a water resource remains in proximity to the camp, a new pond of similar proportions will be constructed within the future

Criterion	Assessment
	riparian corridor. The pond will be constructed and filled prior to the dewatering of the human-made dam. As stated above, the realignment of the dam within 75 m of the GHFF would be undertaken when the GHFF camp is empty. If the camp returns before works are completed, or the camp does not empty, then a stop works procedure will take effect. The current PoM would be amended to include additional measures and strategies under the guidance of the conditions of this licence to ensure the camp is not harmed. This species has a large foraging range. There is a vast amount of foraging habitat in the locality along Illawarra Escarpment. The foraging habitat and resources within the action area are marginal and would form a mosaic of foraging resources. The resources 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. Invasive weeds will be managed under a Vegetation Management Plan which is proposed for vegetation in the southern section of the site within the camp extent.
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. Noise generated by the works has the potential to be a source of stress for the Grey-headed Flying-fox. Pre-clearance surveys will be conducted by a suitably qualified ecologist to ensure the camp is not occupied prior to the commencement of bulk earthworks as per the PoM. Signs of stress will also be monitored by a suitably qualified ecologist throughout the development. Section 5.2.4 of the PoM identifies the signs of stress that would trigger the cessation of works until the evidence of undue stress ceases. If the bats don't settle after this action is taken, additional mitigation measures such as sound attenuation may be required and determined to be effective before works recommence. The action area provides limited foraging habitat that is a component of the mosaic of resources that are utilised in the region by this species. There is a vast amount of foraging habitat in the locality along Illawarra Escarpment. The removal of 4.40 ha of marginal foraging habitat and indirect impacts such as noise and dust are 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: • the action will adhere to conditions within the Threatened Species Licence and the Plan of Management • the proposed action would remove 4.40 ha of marginal habitat and retain the trees most-used by this species for roosting within the site • preferred foraging habitat is present along the Illawarra Escarpment • the proposed action would not isolate or fragment areas of breeding habitat, or areas of breeding habitat from foraging habitat • potential indirect impacts of noise and dust are considered minor if mitigation measures outlined in the PoM and the Threatened Species Licence are implemented. • the breeding cycle for this species is unlikely to be disrupted.

9.2. *Biodiversity Conservation Act 2016* – Flying Fox Management

Flying-foxes are protected in New South Wales by the Biodiversity Conservation Act 2016. It is an offence under the Act to harm or attempt to harm a native animal unless authorised by a biodiversity conservation licence or approved code of practice, or an exemption under the Biodiversity Conservation Regulation 2017.

Saving our Species is the NSW Government's statewide program that aims to secure threatened plants and animals in the wild in New South Wales. Under this program, the grey-headed flying-fox is assigned to the Landscape species management stream. Landscape-managed species are best helped by addressing threats such as habitat loss or degradation within a landscape.

The conservation project for the Grey-headed Flying-Fox includes an action toolbox of priority actions to address key threats that a range of stakeholders could undertake.

A flying Fox camp is present on the site and the proposed works include the removal of foraging vegetation surrounding the camp. A Grey-headed Flying Fox Management Plan (Appendix G) will be implemented to support the proposed development. Furthermore, a Threatened Species Licence will be obtained which would provide conditions to minimise potential harm to the flying foxes on the site.

9.3. SEPP (Resilience and Hazards) 2021

A small area in the south-east corner of the development footprint falls within the *coastal environment area* layer (at the spatial extent) under Division 3 of the Coastal Management SEPP. Accordingly, the aims and objectives of the policy should be considered in relation to the area of the development footprint (Figure 17).

Consistent with Clause 2.10 of the SEPP the following requires consideration with respect to development proposed on land within the coastal environment area:

> *(1) Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following—*
>
> > *(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,*
> >
> > *(b) coastal environmental values and natural coastal processes,*
> >
> > *(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,*
> >
> > *(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,*
> >
> > *(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,*
> >
> > *(f) Aboriginal cultural heritage, practices and places,*

(g) the use of the surf zone.

The portion of the coastal environment area that overlaps with the development footprint contains existing hardstand infrastructure and exotic and planted native vegetation. The landform and landuse has been significantly modified for the establishment and operation of the cokeworks facility. The ecological, biophysical and hydrological integrity of this area was substantially modified and is not in its natural form. There are no observed coastal environmental values, processes, marine estates, headlands, rock platforms, a surf zone or marine vegetation present and / or remaining. Native vegetation for fauna and flora is present, and impacts have been assessed throughout this BDAR.

There are no known aboriginal cultural heritage practices or places in the coastal environment area where it overlaps with the development footprint.

The proposed development is unlikely to impact the ecological, biophysical and hydrological integrity of the area.

(2) Development consent must not be granted to development on land to which this section applies unless the consent authority is satisfied that—

(a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subsection (1), or

(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or

(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

Given that a vast majority of the values identified in (1) are not present in the development footprint, the development is unlikely to have an adverse impact on coastal environmental values.

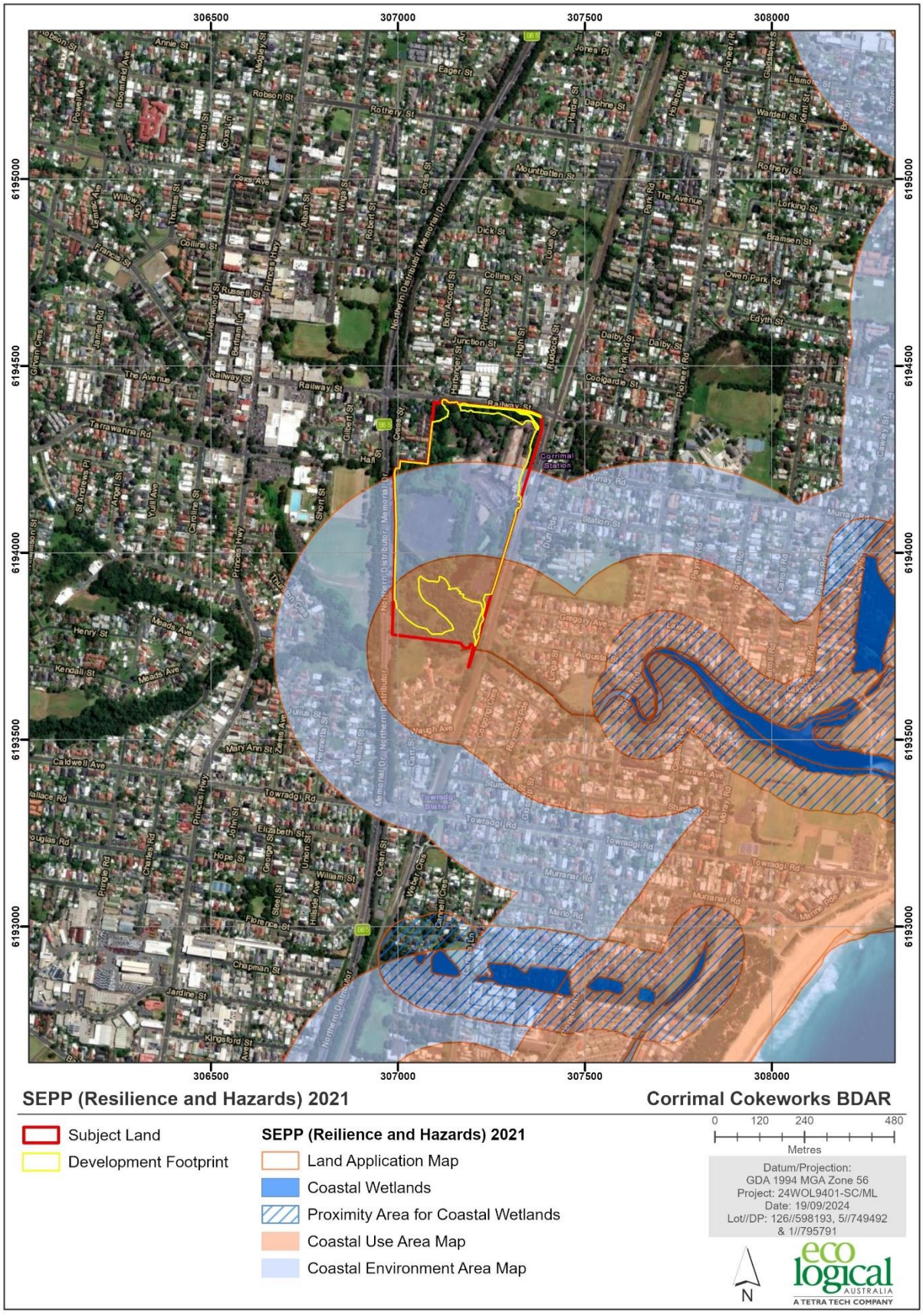


Figure 17: resilience and Hazards SEPP in relation to the Development Site

9.4. Wollongong site specific DCP

The site-specific Development Control Plan (Chapter D19) includes provisions related to the riparian corridor and the preparation of a Grey-headed Flying-fox Management Plan. This BDAR seeks approval for impacts associated with the proposed creek realignment. Chapter 19, Section 5.15 of the DCP outlines development controls for the protection of the Grey-headed Flying Fox camp on the site. These development controls are as follows:

- *A minimum 100 metre buffer is to be maintained between the core mapped Grey-headed Flying-fox camp and any future development.*

During the rezoning process, a 100 m buffer from the core extent of the Grey-headed Flying-fox was established. The intention of the buffer is to provide an area that does not contain foraging resources for the Grey-headed Flying-fox, or human infrastructure, that together will minimise potential interactions between the flying-foxes and humans. The DCP includes provisions for the inner 50% of the buffer (closest to the camp) to be void of any structures that would encourage human use. The buffer may involve planting low-growing or spiky plants between the residential subdivision and the camp. The plantings could create a visual buffer between the camp and residences and make access to the camp difficult.

The DCP includes provisions for the outer 50 m of the buffer to include recreational structures such as play equipment.

To facilitate the establishment of the buffer, it is recommended that the current vegetation and dam are removed using a staged approach and when the camp is not occupied (i.e. winter and early spring). A clearing program must be established and appended to this plan to ensure that any clearing is conducted to minimise direct and indirect harm to any resident Grey-headed Flying-fox.

- *Buildings in the vicinity of the Grey-headed Flying-fox camp are to be designed to reduce the level of potential disturbance, including orientation of buildings, material selection and noise attenuation.*
- *A final Camp Management Plan is to be submitted to Council for approval at the time the initial Development Application is submitted proposing earthworks associated with the realignment of the riparian corridor and/or at the time a Development Application is submitted that proposes earthworks within the 100m buffer area of the Grey-headed Flying-fox Camp. This is to ensure the protection of the Grey-headed Flying-fox camp and shall address ongoing management and protection outcomes, including (but not limited to) –*
    - *Vegetation outcomes and management within the buffer area.*
    - *Community education.*
    - *Provision of aquatic habitat within the riparian corridor.*
    - *Any proposal for supplementary habitat to support expansion of the camp away from the residential development.*
    - *Construction management measures to minimise potential disturbance to the Grey-headed Flying-fox camp.*

A draft management plan has been prepared by ELA, 2021 (Appendix G). Following consultation with NSW DCCEEW, a biodiversity conservation license will be obtained in conjunction with the plan to support the completion of the works.

- *A Vegetation Management Plan is to be submitted to Council for approval at the time the initial Development Application is submitted proposing earthworks associated with the realignment of the riparian corridor, to achieve the ecological restoration of the entire length of the realigned corridor. Landscaping and vegetation species selection must be designed to prevent the expansion of the Grey-headed Flying-fox camp further north near future planned residential development. The Illawarra Lowlands Grassy Woodland Endangered Ecological Community in the southern part of the Site and other native plant communities are to be conserved and enhanced.*

As part of the proposed development, the future riparian corridor will be constructed and revegetated with native vegetation that will form part of Plant Community Type (PCT) 838 – Forest Red Gum Thin-leaved Stringybark Grassy Woodlands. This PCT is consistent with the PCT that the camp is currently occupying in the subject land. The vegetation densities will decrease along the outer edges of the riparian corridor, to decrease potential conflicts with humans and land use. The planting list is undergoing finalisation, however indicatively it would include a range of native *Eucalyptus* sp. and midstorey species that would provide foraging and roosting habitat for the species where it is close to the current camp extent.

- The realigned riparian corridor design is to incorporate a “belly dip” area in the south to enhance the protection of the Grey-headed Flying-fox camp.

The proposed revegetation occurs along the western extent of the proposed subdivision and ties into the existing creekline near Towradgi Creek. The camp is currently positioned downstream of a human-made dam that was used a settling pond during the operation of the cokeworks facility. As part of the construction process, the dam will be dewatered which may temporarily affect the water resources adjacent to the camp. It is expected that the realignment of the watercourse that runs throughout the subject land would provide water resources in the long-term and should be designed to include pools that can be used for belly dipping.

10. Conclusion

Eco Logical Australia Pty Ltd (ELA) has been engaged by Legacy Property Pty Ltd to prepare this Biodiversity Development Assessment Report (BDAR) to assess impacts associated with all proposed stages of the development at 27 Railway Street Corrimal at Corrimal Cokeworks. The impact calculations have been broken down into each respective stage, including the Demolition DA, Stage 1 and Stages 2-4.

This BDAR will be submitted to Wollongong City Council to support a development application for Stages 2-4 of the development. The DA will be submitted for approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This BDAR outlines the measures taken to avoid, minimise and mitigate impacts on the vegetation and species habitat present within the subject land and measures to minimise impacts during construction and operation of the development. Following consideration of the below aspects, the residual unavoidable impacts of the project were calculated consistent with BAM by utilising the Biodiversity Assessment Method Credit Calculator (BAM-C).

The development footprint comprises one native Plant Community Type (PCT):

- PCT 838 *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*.

This PCT can conform to *Illawarra Lowlands Grassy Woodland* which is listed as endangered under the *Biodiversity Conservation Act 2016* (BC Act). This PCT can also form part of *Illawarra and South Coast Lowland Forest and Woodland* which is listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), however the patches of the PCT in the development footprint did not meet the minimum native groundcover requirements.

Illawarra Lowlands Grassy Woodland is also a candidate Serious and Irreversible Impact (SAII) entity. This BDAR has assessed the proposed impacts against the SAII criteria consistent with the BAM. It is noted that the threshold for what is considered a SAII is yet to be published by NSW Department of Planning and Environment (DCCEEW). The determination of SAII on biodiversity values is to be made by the approval authority.

The development footprint also contained the following values:

- Planted native vegetation
- Exotic cover
- Existing hardstand surfaces, including concrete and cokeworks infrastructure.

The Streamlined Assessment Module – Planted Native was used to assess impacts to planted native vegetation across the development footprint.

Two species credit species have been identified in the subject land during survey:

- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat).

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The subject land contains a known *Pteropus poliocephalus* (Grey-headed Flying-fox) camp. Stage 2-4 of the development will slightly encroach on the flying fox camp roosting habitat. The vegetation in the development footprint may provide foraging habitat for this species. Mitigation measures have been included in this BDAR and more extensively in the Grey-headed Flying Fox Management Plan (ELA 2021) (Appendix G) to minimise potential of indirect impacts to the Grey-headed Flying-fox camp.

The Large Bent-winged Bat was identified via echolocation surveys and roost emergence surveys emerging from a building on the subject land.

A summary of credit requirements to offset impacts to PCT 838 are shown in Table 1. Impacts to planted native vegetation do not require offsets, consistent with the application of the Streamlined Assessment Module: Planted Native Vegetation.

Table 39: Summary of ecosystem and species credits required to offset the residual impacts for each stage of the proposed development

BDAR stage	Vegetation Zone	PCT ID	PCT Name	Credit Class	Direct impact (ha)	Credits required
Ecosystem credits						
Demolition DA	N/A	No PCTs present	N/A	N/A	N/A	N/A
Stage 1 bulk earthworks	1	838	Forest Red Gum - Thin-leaved Stringybark Grassy Woodlands	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion This includes PCTs: 838, 1326	0.41	15
Stage 2-4 bulk earthworks	1	838	Forest Red Gum - Thin-leaved Stringybark Grassy Woodlands	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion This includes PCTs: 838, 1326	0.81	15
Species credits						
Stage 2-4 bulk earthworks	-	-	Grey-headed Flying Fox	-	0.10	3
				Total	**1.37**	**33**

Mitigation measures for each stage have been proposed to manage specific indirect impacts / prescribed impacts relevant to each stage. There are overarching control measures that relate to all stages which include:

- Pre-clearance and clearance supervision by a suitably qualified ecologist
- Ensuring retained native vegetation is not indirectly affected
- Management of noise
- Dust suppression

- Minimising risk of vehicle strike and bushfire
- Preventing rubbish dumping.

In addition, all site works will be undertaken in accordance with the existing NSW DCCEEW Grey-headed Flying Fox Licences (Appendices L-N). A Threatened Species Licence will also be required for Stage 2-4 of the proposed works following Development Approval (if approved).

With respect to the **Demolition DA,** the microbat management plan must be implemented, specifically the exclusion techniques proposed for Site 5 where microbats were observed flying out from. All works must be undertaken in accordance with the Threatened Species Licence (Appendix B of PoM – Appendix G))

With respect to **Stage 1 bulk earthworks,** all works must be undertaken in accordance with he Threatened Species Licence (Appendix B of PoM – Appendix G).

With respect to **Stages 2-4 bulk earthworks,** the Grey-headed Flying-fox Management Plan must be implemented. A plan will be submitted with this development application and a biodiversity conservation license will be obtained to support the completion of the works.

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Appendix A Definitions

The following terminology has been used throughout this report for the purposes of describing the impacts of the proposal in the context of a biodiversity assessment in accordance with the NSW Biodiversity Assessment Method 2020. This terminology may or may not align with other technical documents associated with the proposed development.

Terminology	Definition
Biodiversity credit report	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development footprint, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
BioNet Atlas	The BioNet Atlas (formerly known as the NSW Wildlife Atlas) is the OEH database of flora and fauna records. The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails) and some fish
Broad condition state:	Areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
Connectivity	The measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Credit Calculator	The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Development	Has the same meaning as development at section 4 of the EP&A Act, or an activity in Part 5 of the EP&A Act. It also includes development as defined in section 115T of the EP&A Act.
Development footprint	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
Development footprint	An area of land that is subject to a proposed development that is under the EP&A Act.
Ecosystem credits	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development footprint and the gain in biodiversity values at a biodiversity stewardship site.
Extent of occurrence (EOO)	Measures the spatial spread of a taxon to determine the degree to which risks from threatening factors could impact an entire population, and is not intended to be an estimate of the amount of occupied or potential habitat.
High threat exotic plant cover	Plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species.
Hollow bearing tree	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1 m above the ground. Trees must be examined from all angles.
Important wetland	A wetland that is listed in the Directory of Important Wetlands of Australia (DIWA) and SEPP 14 Coastal Wetlands
Linear shaped development	Development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length
Local population	The population that occurs in the subject land. In cases where multiple populations occur in the subject land or a population occupies part of the subject land, impacts on each subpopulation must be assessed separately.
Local wetland	Any wetland that is not identified as an important wetland (refer to definition of Important wetland).
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.

Terminology	Definition
Multiple fragmentation impact development	Developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines and a network of associated development including roads, tracks, gathering systems/flow lines, transmission lines
Operational Manual	The Operational Manual published from time to time by DPIE, which is a guide to assist assessors when using the BAM
Patch size	An area of intact native vegetation that: a) occurs on the development footprint or biodiversity stewardship site, and b) includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development footprint or stewardship site..
Proponent	A person who intends to apply for consent to carry out development or for approval for an activity.
Reference sites	The relatively unmodified sites that are assessed to obtain local benchmark information when benchmarks in the Vegetation Benchmarks Database are too broad or otherwise incorrect for the PCT and/or local situation. Benchmarks can also be obtained from published sources.
Regeneration	The proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height <5 cm within a vegetation zone.
Residual impact	An impact on biodiversity values after all reasonable measures have been taken to avoid, minimise or mitigate the impacts of development. Under the BAM, an offset requirement is determined for the remaining impacts on biodiversity values.
Retirement of credits	The purchase and retirement of biodiversity credits from an already-established biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.
Riparian buffer	Riparian buffers applied to water bodies in accordance with the BAM
Sensitive biodiversity values land map	Development within an area identified on the map requires assessment using the BAM.
Site attributes	The matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
Site-based development	a development other than a linear shaped development, or a multiple fragmentation impact development
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Subject land	Is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a development footprint, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
Threatened Biodiversity Data Collection	Part of the BioNet database, published by DPIE and accessible from the BioNet website.
Threatened species	Critically Endangered, Endangered or Vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as Critically Endangered, Endangered or Vulnerable.

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Terminology	Definition
Vegetation Benchmarks Database	A database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by OEH and is part of the BioNet Vegetation Classification.
Vegetation zone	A relatively homogenous area of native vegetation on a development footprint, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
Wetland	An area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water
Woody native vegetation	Native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs

Appendix B Vegetation Floristic Plot Data

Scientific name	Stratum & Layer	Cover	Abundance	Cover	Abundance
		Plot 1 (BAM01 27/06/22)		Plot 2 (coz_01 11/07/19)	
Acacia longifolia subsp. longifolia	M	0.1	1	3	2
Acacia longifolia subsp. sophorae				3	2
Acacia maidenii	U	4	20	10	7
Acacia mearnsii	M	0.1	4		
Ageratina adenophora	G	0.1	10	0.1	1
Andropogon virginicus				0.1	10
Araujia sericifera	G	0.1	10	0.1	10
Asparagus aethiopicus	G	3	100	1	500
Bidens pilosa var. pilosa	G	0.5	100	1	500
Billardiera scandens	G	0.1	10		
Briza subaristata				0.1	50
Callistemon spp.	M	0.1	1	0.1	2
Carex inversa	G	0.1	10	0.1	100
Cenchrus clandestinus	G	5	500		
Cenchrus pennisetiformis				10	1000
Centella asiatica				0.1	1000
Chloris gayana	G	0.5	50	0.5	500
Chrysanthemoides monilifera subsp. *rotundata*	G	0.1	1		
Cinnamomum camphora	U	5	3	5	1
Commelina cyanea	G	0.1	50	0.1	100
Conium maculatum	G	0.1	1		

Scientific name	Stratum & Layer	Cover	Abundance	Cover	Abundance
Conyza spp.	G	0.1	10		
Cynodon dactylon				0.5	500
Cyperus gracilis				0.2	500
Desmodium brachypodum				0.5	1000
Desmodium rhytidophyllum				0.1	500
Desmodium varians	G	0.3	20	0.2	1000
Dianella longifolia var. *longifolia*	G	0.1	1		
Dichondra repens	G	2	1000	0.2	1000
Echinopogon caespitosus var. *caespitosus*	G	0.2	50		
Echinopogon ovatus				0.5	100
Ehrharta erecta	G	15	1000	0.5	500
Entolasia marginata	G	5	1000		
Entolasia stricta				1	1000
Eragrostis brownii				5	1000
Eragrostis curvula				0.1	10
Eragrostis leptocarpa	G	0.1	10		
Eragrostis leptostachya				10	1000
Eucalyptus botryoides	U	10	4		
Eucalyptus pilularis	U	10	2	10	10
Eucalyptus tereticornis	U	30	6	3	5
Eustrephus latifolius				0.1	100
Genista monspessulana				0.1	10
Geranium homeanum				0.1	500
Geranium solanderi var. *solanderi*	G	5	1000		

Scientific name	Stratum & Layer	Cover	Abundance	Cover	Abundance
Glycine clandestina				1	1000
Glycine tabacina	G	0.1	20	0.1	50
Gomphocarpus fruticosus	G	0.1	1	0.1	10
Grevillea robusta	G	0.1	2		
Grevillea spp.				3	5
Hardenbergia violacea	G	1	50		
Hypochaeris radicata	G	0.1	10	0.1	50
Juncus usitatis				0.2	100
Kennedia rubicunda	G	1	50		
Lantana camara	M	0.2	50	0.5	3
Ligustrum sinense	M	0.1	2	0.1	1
Microlaena stipoides var. *stipoides*	G	5	1000	1	500
Nandina domestica	M	0.1	2		
Ochna serrulata	G	0.1	10	0.1	1
Olea europaea subsp. *cuspidata*	M	0.1	10	0.1	1
Oplismenus aemulus	G	15	1000	0.1	500
Oxalis corniculata	G	0.1	10		
Oxalis perennans				0.1	50
Oxalis spp.				0.1	500
Pandorea pandorana subsp. *pandorana*	M	0.1	2	0.1	1
Paronychia brasiliana				0.1	100
Paspalum dilatatum				3	1000
Paspalum urvillei				0.2	500
Passiflora subpeltata	G	0.1	1		

Scientific name	Stratum & Layer	Cover	Abundance	Cover	Abundance
Pittosporum revolutum	M	4	50		
Pittosporum undulatum	M	2	3	3	2
Plantago lanceolata	G	0.2	50	0.1	100
Poa labillardierei var. *labillardierei*	G	0.1	5		
Polygonum spp.				0.1	50
Rubus parvifolius	G	2	100		
Rubus anglocandicans	G	0.1	10		
Rumex crispus	G	0.1	10		
Rumex spp.				0.1	50
Senecio madagascariensis				0.1	50
Setaria parviflora				0.2	100
Sida rhombifolia	G	0.1	50	0.2	100
Solanum pseudocapsicum	G	0.1	10	0.1	1
Sonchus oleraceus	G	0.1	10	0.1	50
Sporobolus africanus				0.1	50
Stellaria media				0.1	100
Syagrus spp.	U	0.1	2		
Tagetes minuta	G	0.1	1		
Taraxacum officinale	G	0.1	10	0.1	50
Trifolium spp.				0.1	100
Verbena bonariensis	G	0.1	10	0.1	100
Vicia sativa subsp. *sativa*				0.2	1000

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Appendix C Vegetation Integrity Plot Data

Table 40: Composition data

Plot	PCT	Condition	Easting	Northing	Bearing	Tree	Shrub	Grass	Forbs	Ferns	Other
1 (BAM01 27/06/22)	838	Moderate	307191	6194364	255	5	6	7	4	0	6
2 (coz_01 11/07/19)	838	Degraded	307174	6194376	270	3	4	10	10	0	5

Table 41: Structure data

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
1 (BAM01 27/06/22)	54.1	8.3	25.5	7.2	0.0	2.6
2 (coz_01 11/07/19)	23.0	9.1	18.6	1.5	0.0	1.5

Table 42: Function data

Plot	Large Trees	Hollows	Litter Cover	Fallen logs	Stem 5-9	Stem10 - 19	Stem 20-29	Stem 30-49	Stem 50 - 79	Regen	High threat exotic
1 (BAM01 27/06/22)	5	2	97	9	1	1	1	1	1	1	29.3
2 (coz_01 11/07/19)	4	0	36	12	0	1	1	1	1	1	21.4

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Appendix D Staff CVs

Alex Gorey **SENIOR ECOLOGIST**

Alex is a Senior Ecologist who joined Eco Logical in 2016. Alex has 6 years' experience in ecological impact assessments, Biodiversity Certification, Biodiversity Assessment Method, EPBC Act approvals and compliance and ecological surveys. She has also completed the Biodiversity Assessment Method (BAM) training and is a BAM Accredited Assessor (BAAS#22003). Alex has experience in completing field survey consistent with the BAM and other survey guidelines, including vegetation stratification, full vegetation integrity plots and targeted survey for threatened fauna and flora.

Alex has extensive experience in liaising with a range of stakeholders and clients, and providing risk based and ecological advice for a range of projects, including assessments under the EPBC Act, Biodiversity Assessment Reports (Biodiversity Certification, Biodiversity Development Assessment Reports and Biodiversity Stewardship Agreement Sites). Alex is passionate about using technical field skills and knowledge to keep her clients well informed to encourage positive environmental outcomes.

QUALIFICATIONS

- Master of Sustainability: University of Sydney – 2015.
- Bachelor of Science: Double major in Environmental Science and Geography, University of Sydney – 2012.
- National OHS Construction Induction Training (White Card) – 2016.
- Lyssavirus Vaccinated December 2016.

PROJECT EXPERIENCE

IMPACT ASSESSMENTS AND BIODIVERSITY STEWARDSHIP AGREEMENT SITES

- Bingara Gorge Residential Subdivision – EPBC Act Assessment, BDAR and ongoing post approvals work including management of offset areas (Developer)
- Sussex Inlet Golf Village Residential Subdivision – Biodiversity Certification, Proposed Biodiversity Stewardship Agreement Site and numerous BDARs (Sheargold)
- Callala Bay Residential Subdivision – Biodiversity Certification Assessment (Sealark)
- Calderwood Valley Residential Subdivision – EPBC Act approval (Developer)
- Mt Gilead Residential Subdivision – EPBC Act approval, Biodiversity Certification Assessment, Biodiversity Stewardship Agreement (Developer)
- Berrigan Windfarm – EPBC referral and BDAR (CWP Renewables)
- Jeremiah Windfarm – EPBC referral (CWP renewables)
- Woodlands Estate Residential Subdivision – EPBC Referral, BDAR and Biodiversity Stewardship Agreement site (Jojeni Investment)
- Eastern Creek Business Hub – EPBC Referral, State Significant Development, post approvals management and VMP implementation (Frasers Property)
- Kellyville State Significant Development – EPBC Act referral (Landcom)
- Horsley Park Biodiversity Stewardship Agreement Site (CSR Building Products)
- Barkers Mill - Biodiversity and Riparian Assessment (Macarthur Developments)

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- Canyonleigh – Flora and Fauna Assessment (Highlands Heavy Industries)
- Coalcliff - Flora and Fauna Assessment (Ingham Planning)
- Cromer – Flora and Fauna Assessment (Brewster Murray Architects)
- Elizabeth Macarthur Creek – Flora and Fauna Assessment (AECOM)
- Freemans Reach – Vegetation validation and targeted flora and fauna surveys (Celestino)
- Kingswood – Ecological Constraints Analysis
- Delhi Road Upgrade – Flora and Fauna Assessment
- Jacaranda Ponds – Rezoning Planning Proposal
- Oakdale – Constraints Analysis (Michael Brown Planning)
- Quakers Hill – Constraints Analysis (AECOM)
- Western Sydney Parklands Trust – Ecological Constraints Analysis
- Wollongong LGA– Review of Environmental Factors (Wollongong City Council)
- Calderwood Valley – Flora and Fauna Assessments and Ecological Constraints Analysis (Developer)
- Gregory Hills Sewer Pipeline - REF (Dart West Developments)
- Kogarah Sewer Pipeline - REF (Rose Atkins Rimmer Infrastructure)
- Camden Road Sewer Pipeline - REF (Rose Atkins Rimmer Infrastructure)
- Riverstone Sewer Pipeline – REF (Rose Atkins Rimmer Infrastructure)

FAUNA HANDLING AND CLEARANCE SUPERVISION

- Kellyville Residential subdivision – Dam Dewatering
- Mt Carmel – Hollow bearing tree clearance supervision (Western Earthmoving)
- Schofields – Hollow bearing tree clearance supervision (North Western Surveys)
- El Cabello Blanco Cumberland Plain Land Snail clearance survey (Cardno)
- Glenmore Park Cumberland Plain Land Snail clearance survey (CCL Developments)

THREATENED FAUNA MANAGEMENT PLANS

- Manooka Valley – Hollow Bearing Tree Assessment and Nest Box Installation Plan (Green Fields Development Company)
- Warrawong Green and Golden Bell Frog Management Plan (Kennards Self Storage)
- Riverstone Green and Golden Bell Frog Management Plan (Rose Atkins Rimmer Infrastructure)

TARGETED FAUNA SURVEY

- Mt Gilead – Targeted Microchiropteran bat surveys, frog surveys and squirrel glider surveys (Lend Lease)
- Glenarra - Targeted Squirrel Glider surveys
- Helensburgh – Targeted microbat surveys
- Jacaranda Ponds – Targeted Koala, microbat and forest owl survey
- Sydney Science Park – targeted migratory bird survey

PLOT DATA COLLECTION AND VEGETATION MONITORING

- Mt Gilead BioBanking Assessment

- Mt Brown BioBanking Assessment
- South Campbelltown Residential Subdivision
- Cawdor BioBanking Assessment
- Wambo Coalmine Peabody – Hunter Valley
- Rickards Road, Castlereagh – BioBanking Assessment

OTHER RELEVANT SKILLS

- Participated in 4-day Advanced Plant Identification Skills for Research and Environmental Assessment Course run by Belinda Pellow and David Keith, 2016.



Dr Meredith Henderson

SENIOR PRINCIPAL ECOLOGIST AND NATIONAL ECOLOGY AND IMPACT ASSESSMENT LEAD

Meredith is an ecologist with over 30 years of survey and research experience and is Principal Ecologist in Eco Logical Australia's Wollongong Office. Meredith has worked in a range of sectors including state government, University, non-government organisations and the private sector. She has a PhD and Honours degree in terrestrial ecology. Meredith has well developed capabilities in terrestrial plant ecology and environmental assessment. She is experienced in the design and completion of ecological surveys, environmental impact assessment, monitoring impacts of land management change, literature reviews and synthesis. Meredith has highly developed skills in government and client liaison. Meredith has managed many large and complex projects. She is an accredited BioBanking and BAM assessor and has led biodiversity certification projects, BAM assessments and application of the major projects assessment and offsetting requirements. She is one of the lead ecologists for large infrastructure projects in ELA, specialising in road impact assessments and large linear infrastructure. Meredith is also National Lead for the Ecology and Assessment Team.

QUALIFICATIONS

- PhD, Victoria University, Melbourne. Vegetation dynamics in response to fire and slashing in remnants of Western Basalt Plains grasslands and the implications for conservation management
- Bachelor of Science (Honours), University of Wollongong
- Accredited BAM Assessor (AAS 17001)
- Construction Industry White Card.

PROJECT EXPERIENCE

ECOLOGICAL SURVEY

- Full floristics vegetation surveys for vegetation mapping in Bega Valley, Illawarra and South Coast (NSW NPWS)
- Vegetation mapping of the Holsworthy Military Area (Janet Cosh Herbarium for Department of Defence)
- Vegetation assessment for bushfire planning and assessment in Lower Snowy area of Kosciuszko National Park (Gary Leonard & Associates for NSW NPWS)
- Monitoring *Trachymene saniculifolia* plant populations in Kanangra Boyd NP (NSW NPWS)
- Camden Council Reserves Vegetation Assessment (Camden Council)
- Full floristics, vegetation validation, biobanking plots, and culvert assessments for NorthConnex EIA (Transurban/RMS)
- Full floristics and biobanking plots for proposed Biodiversity Certification (Hardwicke)
- Targeted threatened fauna surveys (incl. Koala, Eastern Bristlebird, Eastern Ground Parrot, Powerful Owl, Green and Golden Bell Frog) for a range of infrastructure and residential development clients

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- Targeted survey for Eastern Bristlebird and eastern Ground Parrot in HMAS Creswell and Beecroft Weapons Range
- Threatened plant surveys for a range of species for impact assessment, conservation assessment and preparation of NSW Recovery Plans. Species included *Acacia bynoeana*, *Acacia pubescens*, *Acrophyllum australe*, *Chorizema parviflorum*, *Cynanchum elegans, Darwinia biflora*, *Dillwynia tenuifolia*, *Epacris purpurascens* var. *purpurascens*, *Genoplesium baueri*, *Grevillea juniperina* subsp. *juniperina*, *Grevillea parviflora* subsp. *parviflora*, *Hibbertia superans*, *Melaleuca deanei*, *Micromyrtus minutiflora*, *Persoonia bargoensis*, *Persoonia nutans*, *Pomaderris cotoneaster*, *Pomaderris prunifolia* (endangered population), *Pterostylis gibbosa*, *Solanum celatum*, *Trachymene saniculifolia* and *Triplarina nowraensis*.

ECOLOGICAL IMPACT ASSESSMENT

- Rezoning in rural residential area in Dural, NSW (Brown Consulting)
- Flora and fauna assessment for outdoor education facility, Wolgan Valley, NSW (Cranbrook School)
- Flora and Fauna Assessments for residential development, Church Point, Bayview, Balgowlah Heights, North Turramurra (variety of clients)
- Ecological Constraints in Sydney Metropolitan (UrbanGrowth NSW)
- NorthConnex ecological assessment EIS (RMS/Transurban)
- WestConnex the New M5 biodiversity technical report for the EIS (RMS/Sydney Motorway Corporation)
- EPBC Act strategic assessment of procedures and guidelines for works on NSW roads (RMS)
- F6 Extension stage 1 ecological assessment and Biodiversity Assessment Report (RMS/Sydney Motorway Corporation)
- Numerous Biodiversity Development Assessment Reports to Developer Communities as part of the Calderwood Urban Development Project
- Ecological constraints assessment for Snowy Region for replacement conductor fittings (Transgrid)
- Humelink ecological impact assessment for 600 km of transmission lines (Transgrid)

RESEARCH

- Vegetation survey and assessment following experimental burning and grazing exclusion in Guy Fawkes River Wilderness Area (NSW NPWS)
- Vegetation assessment and monitoring in mallee following experimental burning and bushfires – design and conduct full floristics and habitat assessment (SA Department of Environment & Heritage)
- Vegetation fuel hazard assessments and joint project leader for Project FuSE in SA MDB Region (SA DEH and Bushfire CRC)
- Review of environmental information required for impact assessment and approvals (SA Department of Environment, Water and Natural Resources)

KEY ROAD INFRASTRUCTURE PROJECTS

- M6 Extension Stage 1, AECOM, 2017-2019. Meredith led the biodiversity assessment team for this project. Meredith was responsible for assessing impacts of the project on biodiversity

values consistent with the newly established Biodiversity Assessment Method under the BC Act. Meredith managed the preparation and delivery of the Biodiversity Development Assessment Report, prepared part of the Preferred Infrastructure Report, responded to submissions and liaised with the proponent and planning personnel. Key achievements were delivering all reports on time or ahead of schedule, providing clear and succinct biodiversity advice. The project achieved an approval in 2019.

- WestConnex the New M5, AECOM, October 2014-September 2016. Meredith led the biodiversity assessment team for this project. Meredith was responsible for assessing impacts of the project on biodiversity values in accordance with the Framework for Biodiversity assessment (FBA). Meredith managed the preparation and delivery of the Biodiversity Assessment Report, the Biodiversity Offset Strategy, responded to submissions and developed species specific management plans. Key achievements were delivering all reports on time or ahead of schedule, providing clear and succinct biodiversity advice and achieving successful assessment for Commonwealth matters under the assessment bilateral.
- F6 Extension Scoping, AECOM, December 2015- November 2016 As lead biodiversity adviser, Meredith led a team of biodiversity specialists examining project risks for the extension of the F6. Meredith prepared technical memos on biodiversity values, biodiversity offsetting, potential impacts to aquatic values and implications for revocation of land managed under the National Parks and Wildlife Act 1974. She met with the Roads and Maritime design team to provide a briefing on key risks associated with the proposed design.
- NorthConnex: Hornsby Quarry Spoil Emplacement, AECOM, 2013-2015 Meredith was Project Manager and Lead Ecologist on this project for Roads and Maritime and Transurban. Meredith led the assessment of impacts of the proposed deposition of spoil as a result of the construction of the NorthConnex project. This was assessed as a major project using the FBA. Meredith delivered the Biodiversity Assessment Report and responded to submissions.
- NorthConnex: Linking the M1 and M2, AECOM, 2013-2015 This project was another major project undertaken for Roads and Maritime and Transurban. Meredith's role was to lead the design and execution of field work, writing and responding to comments and submissions.
- M9 Outer Sydney Orbital, AECOM, May 2015 – July 2016 Meredith was lead ecologist for this project. It was to deliver key project risks for several route options for a new proposed Motorway in western Sydney. Risks highlighted included matters that would need to be assessed under Commonwealth legislation, volume and type of biodiversity offsets and revocation of lands managed under the National Parks and Wildlife Act 1974.
- Metropolitan Coal Vegetation Monitoring, Metropolitan Collieries Pty Ltd, 2013 - current This project is to examine the potential impacts of long wall mining on vegetation in the Metropolitan Catchment special area. Meredith participates as a regular field botanist for this project. Meredith has current WaterNSW Induction to allow access to sensitive sites managed by Water NSW.
- Roads & Maritime EPBC Act Strategic Assessment, Jacobs Group, 2015 Meredith was a Specialist Technical Adviser. This project provided specialist ecological advice to Roads and Maritime for their strategic assessment under the EPBC Act. The strategic assessment negates the need to refer Part 5 projects to the Commonwealth if they are assessed in accordance with the guidelines.

- Ecological Risk Assessment, Government Property NSW, 2015-2016 Meredith was project manager and technical QA for this project. As client liaison, Meredith delivered to Government Property advice on the risks to divesting certain land parcels in NSW. In this confidential project, risks to future development were identified and novel solutions sought. For example, whether the sites could support BioBanking Agreements as an alternative income stream.
- M12 Options Analysis, Roads and Maritime Services, 2014-2015 Meredith was lead ecologist and provided technical QA. This project was to provide high level technical advice on the long and short list options for the proposed M12 Motorway.
- Southern Access Motorway, AECOM, 2014 This project described biodiversity values along corridor options. Meredith was the lead ecologist and writer.
- The Bays Precinct ecological constraints, Urban Growth NSW, October 2014-January 2015 Meredith was lead ecologist, writer and project manager on this confidential project. Meredith carried out field work on Sydney Harbour and provided high quality ecological risk advice. This advice informed precinct planning for the largest urban renewal program in Australian history.
- Shoalhaven River alternate crossing: Nowra Bridge, AECOM, 2013-2014 Meredith was project manager and lead ecologist for this project. It examined the ecological constraints for five options for an alternate crossing of the Shoalhaven River at Nowra.

Frank Lemckert **PRINCIPAL SCIENTIFIC ECOLOGIST**

Frank has been a professional scientist since 1992, specialising in understanding and managing the ecology and management of threatened species. Frank has conducted ecological work throughout eastern Australia (NSW, Victoria, Queensland), establishing long-term research and monitoring programs into the management of fauna and developing strategies to mitigate the impacts of human disturbances. He has worked extensively with the NSW state and federal Governments on varying issues of fauna and flora management including the preparation of a draft NSW/National recovery plan for the Giant Burrowing Frog (*Heleioporus australiacus*) and recent expert review roles on fauna management plans and monitoring strategies for the NSW Natural Resources Commission. Frank is an accredited expert under the NSW Biodiversity Assessment Method (BAM) for a range of threatened frogs and is writing the BAM survey guidelines for NSW's threatened frogs. Frank has prepared reports on endemism and representation in reserves of flora and fauna for the Commonwealth, represented the NSW Forestry Commission in license negotiations for the Comprehensive Regional Assessment process (2000), been a member of a state regulators advisory group for the management of Cane Toads across Australia and the Taren Point Cane Toad Advisory Group, and provided expert ecological advice on illegal land clearing for the NSW and Commonwealth Governments. He has authored over 100 peer-reviewed publications. Frank is a research associate with the Australian Museum and University of Newcastle and convenor of the NSW Declining Frog Working Group. He is a recognised expert in frog ecology and management, but has completed management related projects and works on a range of terrestrial vertebrate fauna.

Frank's primary role as a consultant has been to use his expertise and experience in technical writing and threatened species legislation to develop and maintain quality assurance in projects including:

- Two Species Impact Statements.
- >100 flora and fauna reports and assessments of significance using the EP&A Act and EPBC Act.
- Biodiversity Assessment Reports for Warragamba Dam Raising, Nowra Bridge, Golden Highway and Eurobodalla Dam.
- Manager for the Oxley Highway to Kempsey and Frederickton to Eungai ecological monitoring program.
- Construction and Environmental Management Plans, Monitoring Plans and Vegetation Management Plans for roads at Port Macquarie, Berry to Bomaderry and South Nowra.
- Nest Box, microbat and Green and Golden Bell Frog management plans for the Berry to Bomaderry and Oxley Highway to Kempsey Highway Upgrades.
- Review of monitoring strategies for the Woolgoolga to Ballina and Warrell Creek to Nambucca Heads programs for the Pacific Highway Upgrade.
- Review of two proposed Coal Seam Gas Impact Assessment methods for Matters of National Environmental Significance (contracted by the Commonwealth Government).
- Provision of species credit species expert reports for the Warragamba Dam raising project and Western Sydney Growth Centres Biocertification.
- Roadside mapping, survey and management strategies for the Wallum Froglet and Mahony's Toadlet.

QUALIFICATIONS

- Bachelor of Science, University of Sydney, 1984 (Terrestrial Ecology and Marine Management)
- Master of Science, University of Sydney, 1991 (Population biology of the Common Froglet)
- PhD, University of Newcastle, 2009 (Management of forest frogs in timber production forests of NSW)

PROJECT EXPERIENCE

ECOLOGICAL IMPACT ASSESSMENT

- Monitoring of bat populations and assessment of potential impacts of the proposed Jeremiah Windfarm at Adjungbilly, NSW (2019-present).
- Management of impacts on Green and Golden Bell Frogs for the KIWEF project at Kooragang Island, NSW for Daracon (2019-present).
- Impact assessments for housing developments on Koalas in the Campbelltown area (private development and Campbelltown Council)
- Expert report on the Green and Golden Bell Frog for two Western Sydney Growth Areas BioCertification Project (2018-present)
- Warragamba Dam Raising Project target surveys, impact assessments, expert reporting (six species) and Q/A for Water NSW (2018-19)
- Granite Hills Windfarm Bird and Bat Strike Modelling and Ecological Impact Assessment, Nimmitabel, Akuo Energy (2018) and Elysian Windfarm, Nimmitabel, Akuo Energy (2018)
- Vegetation removal and threatened frog management strategies, New Intercity Fleet Management Facility, John Holland Group (2018-present)
- Eurobodalla Dam Biodiversity Assessment Report, Eurobodalla Shire Council (2017-18)
- Nowra Bridge EIS ecological assessments, NSW RMS (2018)
- Heathcote Road Upgrade impact assessment and review of mitigation measures, NSW RMS (2018-2019)

GOVERNMENT REVIEWS/REPORTS

- Biodiversity Assessment Method Frog Survey Guidelines for Species Credit Species and Reptile Survey Guidelines for Species Credit Species (2019-current)
- Expert workshop to develop a NSW-wide nil-tenure fauna monitoring program, NSW Natural Resources Commission (2020)
- Review of species management plans for the Yellow-bellied Glider, Giant Burrowing Frog, Eastern Bristlebird and Southern Brown Bandicoot prepared under the NSW Threatened Species License for Forestry Operations, NSW Natural Resources Commission (2019)
- Provision of information as the basis for the development of six threatened flora species management plans to be prepared under the NSW Threatened Species License for Forestry Operations, NSW Natural Resources Commission (2019)
- Expert review of Biodiversity Impact Assessment Report for the Hornsby Quarry rehabilitation project (2019)
- Review of impact assessment pathways for two LPNG projects, Commonwealth Government (2013)
- Expert advice on impacts of illegal land clearing at Somersby, Commonwealth Government (2015)
- Expert advice on impacts of illegal land clearing at Evans Head, NSW State Government (2016)
- Review of threatened species modelling in forestry areas, Vic Forests (2012)
- Review impacts to threatened reptiles and amphibians in the Southern Brigalow Belt, for WPS (2008)
- Review of monitoring strategies for the Woolgoolga to Ballina and Warrell Creek to Nambucca Heads programs for the Pacific Highway Upgrade, NSW RMS (2014)

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- Hornsby Council expert witness for development impacts at Dural, Hornsby Shire Council (2016)
- Expert representing Forests NSW in the Comprehensive Reginal Assessment Program for the Regional Forest Agreement program (1999-2001)
- Review of threatened species modelling in forestry areas, Vic Forests (2012)
- Flora and fauna representation in the Australian Reserve system, Commonwealth Government (2010)
- Flora and fauna endemism patterns across Australia, Commonwealth Government (2009)
- Review impacts to threatened reptiles and amphibians in the Southern Brigalow Belt, for WPS (2008)
- Expert review of fauna and flora impacts for 13 NSW Forestry Commission EIS reports (1992-94).

EPBC REFERRALS

- Green and Golden Bell Frog (Litoria aurea) referrals for the Princes Highway Upgrade at South Nowra, NSW RMS
- Austen Quarry (Eucalyptus pulverulenta), Hartley, Hy-Tec Industries (2014-15)
- Marys Mount Koala (Phascolarctos cinereus) referral, Gunnedah Quarry Products (2015).

MONITORING PROGRAMS

- Nil-tenure feral management and monitoring strategy for the Narrabri Coal Seam Gas Project, Santos (2019).
- Threatened fauna monitoring Hume Highway, Kapooka, NSW RMS (2018).
- Oxley Highway to Kempsey threatened biodiversity monitoring, NSW RMS (2013-2017)
- Green and Golden Bell Frog baseline monitoring program at Meroo Lakes, NSW OEH (2016-17)
- FCNSW state-wide ecological monitoring program, Forestry Corporation of NSW (2009-10)

PLANS OF MANAGEMENT / STRATEGIES

- Review of species management plans for the Yellow-bellied Glider, Giant Burrowing Frog, Eastern Bristlebird and Southern Brown Bandicoot prepared under the NSW Threatened Species License for Forestry Operations, NSW Natural Resources Commission (2019)
- Provision of information as the basis for the development of six threatened flora species management plans to be prepared under the NSW Threatened Species License for Forestry Operations, NSW Natural Resources Commission (2019)
- Commonwealth/NSW Giant Burrowing Frog Recovery Plan, DEWHA/DECC (2012)
- Eastern Bentwing-bat Management Plan, Gerringong, NSW RMS (2014)
- Nestbox, Microbat and Green and Golden Bell Frog Management Plans, Berry to Bomaderry Upgrade of the Princes Highway, NSW RMS (2017)
- Green and Golden Bell Frog surveys and monitoring, Princes Highway Upgrades at South Nowra and Berry to Bomaderry, NSW RMS (2012-2017)
- Green and Golden Bell Frog Management Strategy, Princes Highway Upgrade, NSW RMS (2012-2014)
- Green and Golden Bell Frog pre-clearing works Kooragang Island (Daracon 2016 & current)
- Microbat Management Plan for Clarencetown Bridge, NSW RMS (2016)
- Expert review of Threatened Frog Management Plan - Woolgoolga to Ballina Upgrade, NSW RMS (2014)
- Threatened Microbat Management Plan for Warringah Mall, Northern Beaches Council (2014)
- Threatened Frog modelled habitat requirements, Hornsby Shire Council (2016)
- NSW DPI representative for the National Advisory Group on Cane Toad management (2009-2011)
- Taren Point Cane Toad management advisory group (207-2008).

TRAINING

- Lead instructor > 50 wildlife training schools run in NSW, ACT and Victoria providing presentations on the survey, identification and management of all flora and fauna. This included detailed instruction on the management of threatened wading and aquatic birds and other aquatic species presented to Queensland, Victorian, NSW and Commonwealth Government staff (1993-2017)
- Private forestry survey requirements, Victorian Timber (2016).

PUBLICATIONS

Book Chapters

Hecnar S. J., & Lemckert, F.L. 2012. Habitat Protection: Refuges and Reserves. Pp 3636-3675 In Biology of the Amphibia Volume 10 - Conservation and Decline of Amphibians: Ecology, Effects of Humans, and Management. H. Heatwole (Ed.). Surrey-Beattey and Sons, Sydney.

Lemckert, F.L., & Mahony, M.J. 2018. The status of Decline and Conservation of Frogs in Temperate Coastal South-eastern Australia. Pp 59-72 In Amphibian Biology Volume 11 - Conservation and Decline of Amphibians: Eastern Hemisphere (Australia, New Zealand and Pacific Islands). H. Heatwole and J. Rowley (Eds.). CSIRO Publishing, Melbourne.

Mahony, M.J., Hines, H.B., Lemckert, F., Newell, D., Roberts, J.D., Rowley, J.J.L., Scheele, B.C., & West, M. 2022. The impacts of the 2019-20 wildfires on Australian frogs. In Australia's 2019-20 megafires: biodiversity impacts and lessons for the future. S. Legge (Ed.).

Lemckert, F.L., Hecnar S.J., & Pilliod, D.S. 2012. Habitat Destruction and Modification. Pp 3291-3342 In Biology of the Amphibia Volume 10 - Conservation and Decline of Amphibians: Ecology, Effects of Humans, and Management. H. Heatwole (Ed.). Surrey-Beattey and Sons, Sydney.

Lemckert, F.L. & Penman, T. 2012. Climate Change and Australia's frogs: how much do we need to worry? Pp 92-98 In: Wildlife and Climate Change: towards robust conservation strategies for Australian fauna. D. Lunney & P. Hutchings (Eds.). Royal Zoological Society of NSW, Mosman, NSW, Australia.

Hero, J-M, Richards, S, Alford, R., Allison, A., Bishop, P., Gunther, R., Iskandar, D., Kraus, F., Lemckert, F., Menzies, J., Roberts, D. & Tyler, M. 2008. Amphibians of the Australasian Realm. Pp 65-73 In: Threatened Amphibians of the World. S. N. Stuart, M. Hoffman, J. S., Chanson, N. A. Cox, R. J. Berridge, P. J. Ramani & B. E. Young (Eds.). Lynx Edicions, Barcelona.

Green, M., Thompson, M.B. & Lemckert, F.L. 2004. The effects of suspended sediments on the tadpoles of two stream-breeding and forest dwelling frogs, *Mixophyes balbus* and *Heleioporus australiacus*. Pp 713-720 In Conservation of Australia's Forest Fauna, Second Edition. D. Lunney (Ed.). Royal Zoological Society of NSW, Sydney.

Lemckert, F.L. & Slatyer, C. 2004. Herps in forests: schools to educate land managers in their conservation. Pp 1055-1058 In Conservation of Australia's Forest Fauna, Second Edition. D Lunney (Ed.). Royal Zoological Society of NSW, Sydney.

Lemckert, F. & Morse, R. 1999. Frogs in the timber production forests of the Dorrigo escarpment in northern NSW: an inventory of species present and the conservation of threatened species. Pp 72-80 In Declines and Disappearances of Australian Frogs. A. Campbell (Ed.). Environment Australia, Canberra.

Scientific Papers

Henle, K., Osborne, W., & Lemckert, F. 2014. The herpetofauna of Kioloa, New South Wales: baseline observational data collected 30 years ago and inspired by R. E. Barwick. Australian Journal of Zoology 62:100–107.

Mahony, M.J., Hamer, A.J., Pickett, E.J., McKenzie, D.J., Stockwell, M.P., Garnham, J.I., Keely, C.C., Deboo, M., O'Meara, J., Pollard, C.J., Clulow, S., Lemckert, F.L., Bower, D.S., & Clulow, J. 2013. Identifying conservation and research priorities in the face of uncertainty: a review of the threatened bell frog complex in eastern Australia. Herpetological Conservation and Biology 8:519-538.

Daly, G. and Lemckert, F.L. 2012. Herpetofauna of the Tenterfield area. Australian Zoologist.

Lemckert, F.L. 2011. Managing pond breeding anurans in the selectively harvested forests of coastal New South Wales, Australia. Forest Ecology and Management 262:1199–1204.

Lemckert, F.L., Penman, T. & Haywood, A. 2011. Adaptive monitoring using the endangered northern corroboree frog (*Pseudophryne pengilleyi*) as a case study. Proceedings of the International Academy of Ecology and Environmental Sciences 1:87-96.

Hamer, R., Lemckert, F.L. & Banks, P.B. 2011. Adult frogs are sensitive to the predation risks of olfactory communication. Biology Letters 7:361-363.

Lemckert, F & Mahony, M.J. 2010. The relationship among multiple-scale habitat variables and pond use by anurans in northern New South Wales, Australia. Herpetological Conservation and Biology 5:537–547.

Lemckert, F.L. 2010. The rich early history of frog research in Sydney. Australian Zoologist 36:102-106.

Lemckert, F. 2010. Habitat relationships and presence of the threatened heath frog *Litoria littlejohni* (Anura: Hylidae) in central New South Wales, Australia. Endangered Species Research 11:271-278.

Lemckert, F. & Grigg, G. 2010. Living in the 80s – seasonality and phenology of frog calling activity at Darkes Forest from 1987-1989. Australian Zoologist 35:245-250.

Lemckert, F., Rosauer D. & Slatyer, C. 2009. A comparison of Australia's anuran records against the reserve system. Biodiversity and Conservation 18:1233-1246.

Penman, T.D., Lemckert, F.L. & Mahony, M.J. 2008. Applied conservation management of a threatened forest dependent frog, *Heleioporus australiacus*. Endangered Species Research 5:45-53.

Penman, T.D, Lemckert, F.L. & Mahony, M.J. 2008. Spatial ecology of the giant burrowing frog (*Heleioporus australiacus*): implications for conservation prescriptions. Australian Journal of Zoology 56:179–186.

Lemckert, F.L. & Mahony, M.J. 2008. Core calling periods of the frogs of temperate New South Wales, Australia. Herpetological Conservation and Biology 3:71-76.

Penman, T. D. & Lemckert F. L. 2008. Monitoring the green and golden bell frog: current problems and an alternative approach. Australian Zoologist 34:373-378.

Penman, T., Mahony, M., Towerton, A. & Lemckert, F. 2007. Spatial models of giant burrowing frog distributions. Endangered Species Research 3:115-124.

Phillot, A.D., Skerratt, L.F., McDonald, K.R., Lemckert, F.L., Hines, H.B., Clarke, J.M., Alford, R.A. & Speare, R. 2007. Toe-clipping as an acceptable method of identifying individual anurans in mark recapture studies. Herpetological Review 38:305-308.

Semeniuk, M., Lemckert, F.L. & Shine, R. 2007. Breeding-site selection by cane toads (*Bufo marinus*) and native frogs in northern New South Wales, Australia. Wildlife Research 34:59-66.

Slatyer, C., Rosauer, D. & Lemckert, F. 2007. An assessment of endemism and species richness patterns in the Australian Anura. Journal of Biogeography 34:583-596.

Hero, J-M., Morrison, C., Gillespie, G., Roberts, J.D., Newell, D., Meyer, E., McDonald, K., Lemckert, F., Mahony, M., Osborne, W., Hines, H., Richards, S., Hoskin, C., Clarke, J., Doak, N. & Shoo, L. 2006. Overview of the conservation status of Australian Frogs. Pacific Conservation Biology 12:313-320.

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Lemckert, F., Haywood, A., Brassil, T. & Mahony, M. 2006. Correlations between frogs and pond attributes in central New South Wales, Australia: What makes a good pond? Applied Herpetology 3:67-82.

Lemckert, F., Mahony, M., Brassil, T. & Slatyer, C. 2006. The biology of the threatened Green-thighed Frog *Litoria brevipalmata* (Anura: Hylidae) in the central and mid-north coastal areas of New South Wales. Australian Zoologist 33:337-344.

Lemckert, F., Brassil, T., Kavanagh, R. & Law, B. 2006. Trapping small mammals for research and management: how many die and why? Australian Mammalogy 28:201-208.

Penman, T.D., Lemckert, F.L. & Mahony, M.J. 2006. Meteorological effects on the activity of the giant burrowing frog, *Heleioporus australiacus*, in south-eastern Australia. Wildlife Research 33:35-40.

Penman, T., Lemckert, F. & Mahony, M. (2006). A preliminary investigation into the potential impacts of fire on a forest dependent burrowing frog species. Pacific Conservation Biology 12:78-83.

Penman, T., Lemckert, F., Slade, C. & Mahony, M. 2006. Non-breeding habitat requirements of the giant burrowing frog (*Heleioporus australiacus*) in south-eastern Australia. Australian Zoologist 33:251-257.

Fitzgerald, F., Shine, R., Lemckert, F. & Towerton, A. 2005. Habitat requirements of the threatened snake species *Hoplocephalus stephensii* (Elapidae) in eastern Australia. Austral Ecology 30:465-474.

Lemckert, F.L. 2005. Body size of male common eastern froglets *Crinia signifera* does not appear to influence mating success during explosive breeding events. Acta Zoologica Sinica 51:232-236.

Lemckert, F.L. 2005. Population structure, individual growth and survival of an Australian frog *Crinia signifera* at a pond. Acta Zoologica Sinica 51:393-400.

Penman, T., Mahony, M. & Lemckert, F. 2005. Soil disturbance in integrated logging operations. Applied Herpetology 2:415-424

Penman, T.D., Mahony, M.J., Towerton, A.L. & Lemckert, F.L. 2005. Bioclimatic analysis of disjunct populations of the giant burrowing Frog, *Heleioporus australiacus*. Journal of Biogeography 32:397-405.

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Joseph Gleeson ENVIRONMENTAL SCIENTIST

Joseph is an Environmental Scientist with 5 years experience in environmental science and land management. He has worked in both local government and private sectors. Joseph has experience in conducting a range of multi-discipline projects including ecological assessments and surveys, bushfire and contamination assessment reports, salinity and wastewater management investigations and geotechnical surveys. Joseph gained experience in land management in relation to bushfire mitigation during his role at Shoalhaven City Council. Joseph's strengths include an understanding of technical issues across a wide range of disciplines, strong written and verbal communication skills and project and client management.

QUALIFICATIONS

Bachelor of Environmental Science and Management (Ecosystems and Biodiversity) - University of Newcastle - 2017

PROJECT EXPERIENCE

Impact assessment

- Due Diligence Biodiversity Constraints Assessments at 200 Marshall Mount Road and Elm Park. Esker Pty Ltd and Woodcote Developments Pty Ltd.
- Biodiversity Development assessment Report (BDAR) Calderwood Sporting Fields. Developer Pty Ltd.
- BDAR for Ryde Hospital redevelopment. Health Infrastructure.
- BDAR for residential development a Bong Bong Road, Horsley. Stockland development Pty Ltd.
- BDAR for Edmondson Square Residential Precinct East. Frasers Property Pty Ltd.
- BDAR for residential development at 40 Memorial Dr, Bella Vista. Landen Developments Pty Ltd.
- Flora and Fauna Assessment (FFA) for proposed residential subdivision at Fairleys Rd Picton: Ironstone Developments Pty Ltd
- FFA for residential development at 144 Cleveland Road, Cleveland. Cleveland Road Developments Pty Ltd.
- Biodiversity Assessment Report (BAR) for Picton Road at Macarthur exit Wilton. Transport for NSW.
- Review of Environmental Factors (REF) for recreation park upgrades in the City of Canterbury-Bankstown Council.
- REFs for flood damaged roads. Bellingen Shire Council.
- REFs for Fire Recovery Program and Improving Access to National Parks at various national parks along the Sapphire Coast. National Parks Wildlife Service (NPWS).
- REFs for proposed upgrades to FAFTs within the Raspberry and Western Fire Management Units. NPWS
- Koala plan of management and Weed eradication management Plan (WEMP) for a residential subdivision on Harkness Road Oakville NSW.
- Riparian validation assessments within he Shellharbour City Council LGA.

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- Vegetation management Plans (VMPs) for various stages of the Calderwood residential subdivision. Developer Pty Ltd.
- VMP for Greenvalley Mountain Bike Park, Illawarra Highway, Tongarra NSW.
- Threatened species targeted surveys for Shellharbour Hospital. NSW Health Infrastructure.
- Fauna and herpetofauna monitoring surveys for Dargues Gold Mine.
- On-site Wastewater Management Assessments for dwellings, subdivisions and commercial developments
- SEPP 55 Preliminary and Detailed Contamination Assessments, Remediation Action Plans and Site Validation Reports for residential and commercial subdivisions

Soil and waste material

- Waste Classifications for stockpiled material
- Groundwater well installation and monitoring for Underground Petroleum Storage Systems (UPSS).
- Preliminary Salinity Assessments for rural-residential subdivisions
- Geotechnical Site Classification reports for dwellings and subdivisions
- Laboratory testing of soil samples for geotechnical properties including soil compaction and density in accordance with AS1289
- Asbestos Clearance certificates
- Asbestos air monitoring and fibre counting in NATA accredited laboratory

Bushfire Protection

- Bushfire Protection Assessments for subdivisions and dwellings in the Central West region
- Audit of all Council managed land within the Shoalhaven LGA to determine bushfire risk and appropriate mitigation activities
- Streamlined environmental assessment (Hazard Reduction Certificates) for bushfire hazard reduction activities on Council managed land in the Shoalhaven LGA



Melaina Chapman **GRADUATE ECOLOGIST**

Melaina joined ELA in May 2021, starting out in the Land Management Team as a Bush Regenerator and then moving into a Graduate Ecologist role in November 2021. In June 2021, she completed a Graduate Certificate of Environmental Science with a High Distinction average from the University of New England. Melaina also holds a Bachelor of Communication and Media Studies (Digital Media) and Bachelor of Creative Arts (Graphic Design from the University of Wollongong.

Prior to working with ELA, Melaina participated in floristic and biodiversity monitoring for Ecological Outcome Verification (EOV) certification for Land to Market Australia, along with assisting in designing, mapping, surveying and constructing Yoeman's Keyline dams, irrigation channels and diversion channels in Central West NSW. Melaina has extensive experience in the outdoors and physically demanding environments – she is comfortable in isolated and challenging landscapes and possesses remote access and rock-climbing experience.

Since being with ELA, Melaina has been involved in numerous field-based projects, including vegetation validation and mapping, targeted threatened flora surveys, long-term vegetation monitoring, assisting with Biodiversity Assessment Method plots, vegetation clearance surveys, threatened species habitat assessment and on ground bush regeneration works. As an enthusiastic graduate ecologist, Melaina is eager to broaden her skillset across a range of ecological related expertise – both flora and fauna and in both aquatic and terrestrial habitats.

QUALIFICATIONS

- Graduate Certificate of Environmental Science, University of New England (2021)
- Bachelor of Communication and Media Studies (Digital Media), University of Wollongong (2015)
- Bachelor of Creative Arts (Graphic Design), University of Wollongong (2013)
- Senior First Aid (HLTAID009, HLTAID010 & HLTAID011)
- White Card (Work Safely in Construction Industry - CPCCOHS1001)
- C Class Drivers License – manual vehicle
- PADI scuba diver certificate

PROJECT EXPERIENCE

- Vegetation validation and BAM plots (North Ryde and Vincentia NSW)
- Targeted threatened flora surveys (Deerubbin Land Council, Guula Ngurra National Park)
- Vegetation clearance surveys (Wilton NSW)
- Habitat assessment and hollow-bearing tree surveys (Guula Ngurra National Park)
- Floristic surveys and population monitoring of long-term monitoring plots within upland swamps and riparian communities (Metropolitan Colliery, Helensburgh)

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- VMP implementation works (primary and secondary weed control, maintenance works, seed collection and revegetation) across a variety of ecological communities – including Critically Endangered Cumberland Plain Woodland and Elderslie Banksia Scrub Forest (Greater Western Sydney)

Stacey Wilson **SENIOR ECOLOGIST**

Stacey is a Senior Ecologist, with over 7 years' experience in Biodiversity Assessments, ecological impact assessment, and ecological surveys. She has a thorough understanding of the Biodiversity Assessment Method (BAM). Stacey has completed the Biodiversity Assessment Method (BAM) training course and is a BAM Accredited Assessor under the *NSW Biodiversity Conservation Act 2016.* Stacey is an experienced project manager with skills in field surveys, vegetation stratification, data analysis, mapping, ecological assessments and reporting. She has mentored junior staff on biodiversity assessment using the BAM. Projects Stacey is involved with include Biodiversity Development Assessment Reports, Biodiversity Stewardship Assessments, impact assessments, ecological monitoring, preparation of vegetation management plans and providing ecological, due diligence advice.

QUALIFICATIONS

- Master of Environment (Environmental Science) – Macquarie University (2015)
- Bachelor of Biodiversity and Conservation – Macquarie University (2013)
- Certificate III Conservation Land Management – Ryde TAFE (2015)
- BAM Accredited Assessor (BAAS #22030)

PROJECT EXPERIENCE

VEGETATION SURVEY AND BAM ASSESSMENT

- Putty Valley Road Biodiversity Stewardship Site Assessment. Role: collection of BAM plot data and preparation of report
- Berrigan Wind Farm Biodiversity Surveys. Role: Supervise and undertake targeted threatened flora and surveys, undertake vegetation validation and BAM plots. Collate and analyse data and prepare reports.
- 2022 – 767A-769 Merrylands Road, Greystanes BAM Assessment
- HumeLink transmission line corridor biodiversity assessment, regional NSW. Role: undertake threatened flora survey across three survey seasons, targeting over 40 species across over 500 km of corridor. In addition, undertook vegetation validation surveys and collection of BAM plot data between Wagga Wagga, Tumbarumba, Tumut, Gundagai and Goulburn.
- Maroota Sand Mine Project. Role: BAM plot data collection, targeted threatened flora and fauna surveys
- East Kurrajong Biodiversity Stewardship Agreements. Role: collection of BAM data, targeted threatened fauna surveys, data collation and preparation of reports.
- Deerubbin Local Aboriginal Land Council, Castlereagh: BAM data for inclusion in the Cumberland Plain Strategic Biodiversity Certification Assessment and Cumberland Plain Conservation Plan. Role: undertake threatened species surveys.
- Lawson residential subdivision – Biodiversity Development Assessment Report. Role: Supervise and undertake Koala SAT surveys and targeted threatened fauna surveys.

- The Gables Precinct – Biodiversity Development Assessment Report (multiple). Role: Vegetation validation and BAM data collection. Collate and analyse data and prepare reports.
- Mount Vernon Road, Mount Vernon - Biodiversity Development Assessment Report. Role: Vegetation validation and BAM data collection. Collate and analyse data and prepare report.
- The Kings School – Biodiversity Development Assessment Report. Role: Vegetation validation and BAM data collection. Collate and analyse data and prepare report.
- The Northern Gateway – Biodiversity Development Assessment Report. Role: Supervise and undertake vegetation validation and BAM data collection. Collate and analyse data and prepare reports.
- Sackville North Boat Ramp and Track Access Upgrade. Role: Vegetation validation and BAM data collection. Collate and analyse data and prepare report.
- Mount Tootie Road, Bilpin Biodiversity Stewardship Feasibility. Role: Vegetation validation and BAM data collection. Collate and analyse data and prepare report.
- The Maltings, Mittagong – Flora and Fauna Assessment and Vegetation Management Plan. Undertake vegetation validation, assess rehabilitation potential and prepare reports.
- Campbelltown Hospital Stage 2 Redevelopment Biodiversity Development Assessment. Role Manage and undertake vegetation validation, Bam plots, collate data and prepare report.
- Leewood Irrigation Scheme Vegetation Bassline Monitoring. Role: undertake monitoring plot survey and prepare report.
- M4 – M5 Rozelle Rail Yards Review of Environmental Factors. Role: Undertake vegetation plots, targeted fauna surveys and reporting
- Vegetation Management Plan for Transurban – Update to M2 Vegetation Management Plan. Role: undertake assessment of vegetation condition, density of weeds and prepare updated management plan.

ECOLOGICAL MONITORING

- Rehabilitation monitoring Tahmoor Coal, Tahmoor, NSW. Role: annual fieldwork involving botanical surveys of long term monitoring plots, threatened species population monitoring, walkover inspection of the rehabilitation area and assessment against closure criteria, collation, and analysis of data; and preparation of assessment reports.

Claire Plunkett **GRADUATE ECOLOGIST**

Claire is a Graduate Ecologist with over 2 years' experience conducting ecological surveys and undertaking on-ground restoration works. With a background in Animal Science and Conservation Biology, Claire has a solid foundational understanding of wildlife biology, animal behaviour and scientific research methods, as well as experience in fauna handling, identification, and relocation. Through her previous work as a Bush Regenerator and through ongoing floristic monitoring in the WaterNSW Woronora Catchment, she has also developed plant identification skills and an ability to assess plant community health and resilience. She has highly developed communication skills and attention to detail gained through her previous work as a graphic designer and communications officer and has a demonstrated ability to work both independently and as part of a team, effectively following instructions and procedures, often taking initiative to go above and beyond the responsibilities of the role. Claire is hands-on and has an established history of manual handling and safe plant operation, including 8 years of 4WD experience. She is confident working in remote areas and values the importance of adequate planning and preparation prior to entering the field.

QUALIFICATIONS

- Master of Conservation Biology, Macquarie University, 2022
- Fauna Handling Course, Eco Logical Australia, 2022
- Bachelor of Natural Science (Animal Science), Western Sydney University, 2018
- Initial Assessment and Management of Wildlife, Dr Howard Ralph, 2018
- Rescue and Immediate Care Course, WIRES, 2016

PROJECT EXPERIENCE

FAUNA SURVEYS

Claire has experience conducting fauna surveys in accordance with the BAM survey methodologies; assisting with fieldwork preparation, on-ground survey implementation and data analysis.

Werrington Campus Biodiversity Assessment (Western Sydney University) 2023

- Targeted surveys for the Endangered Green and golden bell frog and Cumberland Plain Land Snail using spotlighting, call-playback and ground search methods

Maroota Sand Mine Biodiversity Assessment (Deerubbin Local Aboriginal Land Council) 2022-2023

- Targeted surveys for a range of threatened fauna including the Powerful Owl, Barking Owl, Masked Owl, Dural Land Snail and Brush-tailed Phascogale
- Survey methods included stag watching, spotlighting, ground searches and trail camera deployment/image analysis

Euston Project Biodiversity Assessment (Iluka Resources Limited) 2022-2023

- Targeted surveys for a range of threatened fauna including the Desert Mouse, Hairy-Nosed Wombat and Crowned Gecko using pitfall trapping, spotlighting and trail camera deployment/image analysis

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- Timed bird surveys, using both calls and visual observation

ANIMAL WELFARE

Claire has conducted pre-clearance surveys, clearance supervision and fauna relocation for several new developments across the Greater Western Sydney region and supervised the implementation of construction works in Centennial Parklands, executing works in accordance with the *Biodiversity Conservation Act 2016* under a Biodiversity Conservation Licence and Animal Ethics Permit from the Department of Planning, Industry and Environment.

Pre-clearance surveys and clearance supervision (Hawkesbury, Hills Shire and Wollondilly Councils) 2022-2023

- Conduct site surveys to identify and map all hollow-bearing trees and other suitable habitat features
- Supervise and maintain communication with machine operators during tree clearance, stopping works when required
- Inspect felled trees and relocate fauna to a suitable location
- Provide clients with pre-clearance and clearance reports

Lachlan Swamp Platform Construction (Centennial Parklands and DPIE) 2022

- Assess and monitor the impact of construction works on a nationally significant colony of Black Flying-foxes and Grey-headed Flying-foxes
- Evaluate welfare of colony, including the condition of pregnant females throughout duration of project
- Liase with construction crew to minimise the impact of works on Flying-foxes
- Provide summary report of all works to the client

FLORA AND HABITAT SURVEYS

Claire has assisted Senior Ecologists with on-ground vegetation validation, targeted flora, BAM plots and hollow-bearing tree surveys for several projects across Greater Western Sydney, and rural NSW.

Oven Mountain Pumped Hydro Energy Bushfire Risk Assessment (EMM Consulting) 2022

- Assist a Senior Bushfire Consultant with GIS data collection and vegetation and slope validation at a remote site along the Macleay River, NSW

Woronora Catchment Floristic Monitoring (Peabody Coal Metropolitan Mine) 2022-ongoing

- Assess the environmental impacts of longwall mining subsidence and seepage in WaterNSW Woronora catchment area
- Identification of native plant species; recording health, cover, abundance and stratum
- Data collection and management

Uungula Wind Farm Biodiversity Assessment (CWP Renewables) 2021

- Targeted flora surveys and mapping of hollow-bearing trees
- GIS data collection and weed mapping

RESTORATION ECOLOGY

Claire has experience implementing on-ground restoration ecology practices at a range of sites, combining her knowledge of plants and restoration ecology with her ability to safely operate a range of plant and equipment including chainsaws, brushcutters, tractors and high-volume herbicide sprayers.

Bush Regeneration and Land Management; Taralga Wind Farm 2021-2022

- On-gound vegetation and land management of a Biodiverstiy Stewardship Site
- Four-wheel driving and remote site access, tree frilling, herbicide application and fence removal
- GIS data collection for mapping of significant features within the site
- Supervision of junior team members

Bush Regeneration and Land Management (Camden, Fairfield, Blacktown and Wollondilly Councils) 2021-2022

- On-gound vegetation and land management of multiple sites across the Greater Western Sydney area containing Critically Endangered Cumberland Plain Woodland and Elderslie Banksia Scrub ecological communities

METROPOLITAN MINE Land Management **(PEABODY COAL) 2021-2022**

- Revegetation of coal slopes including jute mat and irrigation installation
- Clearing of piezo tracks through heath and woodland within the WaterNSW Woronora catchment area
- Woody and herbaceous weed control

ACADEMIC RESEARCH & TUTORING

Researcher at Macquarie University (on behalf of the NSW Environmental Trust) 2022

- Independent laboratory work and data analysis to assess the role of mycorrhizal fungal colonisation in susceptibility of Eucalupts to Bell-Miner Associated Dieback

Academic Tutor (Western Sydney University) 2019

- Assisted in the delivery of BNatSc Animal Science units, including the practical components of Animal Nutrition and Feeding, and Human-Animal Interactions

Researcher at Western Sydney University (on behalf of the DPI, NSW Game Licensing Unit) 2017-2018

- Independent laboratory work to develop an in-house method of aging wild deer based on unique characteristics of dental tissue

Appendix E Biodiversity credit report

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BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00039438/BAAS22003/23/00039446

Proposal Name

BAM data last updated *
14/03/2024

Assessor Name
Alexandra Gorey

Assessor Number
BAAS22003

BAM Data version *
67

Proponent Names
Adrian Kilburn, Adrian Kilburn

Report Created
25/09/2024

BAM Case Status
Finalised

Assessment Revision
2

Assessment Type
Part 4 Developments (General)

Date Finalised
25/09/2024

BOS entry trigger
BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
838-Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Illawarra and south coast lowland forest and woodland ecological community	0.8	7	8	15

BAM Biodiversity Credit Report (Like for like)

838-Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Illawarra and south coast lowland forest and woodland ecological community This includes PCT's: 838, 1326, 3269, 3327, 3330, 4052	-	838_good	Yes	7	Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Illawarra and south coast lowland forest and woodland ecological community This includes PCT's: 838, 1326, 3269, 3327, 3330, 4052	-	838_degraded	No	8	Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Pteropus poliocephalus / Grey-headed Flying-fox	**838_good, 838_degraded**	0.1	3.00

BAM Biodiversity Credit Report (Like for like)

Credit Retirement Options

Like-for-like credit retirement options

Pteropus poliocephalus / Grey-headed Flying-fox	Spp	IBRA subregion
	Pteropus poliocephalus / Grey-headed Flying-fox	Any in NSW

Appendix F Threatened microbat habitat assessment letter

Provided as a separate document.

Level 3
101 Sussex Street
Sydney NSW 2000
t: (02) 9259 3800

22July 2019

Our ref: 18WOL - 10492

Legacy Property
Level 45 MLC Centre
19 Martin Place
Sydney NSW 2000

Attention: Mike Williams

Dear Mike,

Microchiropteran bat habitat assessment at 27 Railway Street, Corrimal Cokeworks

Background

Eco Logical Australia Pty Ltd (ELA) was engaged by Legacy Property to undertake a site inspection of all buildings at 27 Railway Street Corrimal (Corrimal Cokeworks; the site) in response to a request from Wollongong City Council. Wollongong City Council have requested further information regarding the microchiropteran bat (microbat) habitat assessment previously undertaken as part of the planning proposal prepared by ELA (2019) for the site. The following letter addresses the field survey and results of an additional habitat assessment undertaken by Dr Frank Lemckert. Frank's CV is provided at the end of this report.

Site Inspection

An inspection was carried out by Dr Frank Lemckert and covered all buildings present in the site to determine their use by microbats or suitability as microbat habitat. The inspection involved walking through each building, as far as it was practical and safe to do so, to locate and inspect any cavities or spaces in the walls or ceilings that could be used by microbats as roosting sites. A spotlight was used to light up these spaces and maximise the chance of seeing any microbats in small crevices or spaces. The floors of each building and areas below any potential cavities were also inspected to look for evidence of microbat roosts in the form of obvious deposits of microbat droppings (these look like mice droppings in piles), staining of the floor and skeletons or remains of microbats. Roost sites used for periods of time or by large numbers of microbats build up obvious areas of droppings that are easily seen.

Results

The structures on site were divided into three categories for the inspection. The majority were constructed from bricks, steel and corrugated iron. Reasonable access was available to these buildings and so the inspection was reasonably thorough. No clear evidence was found of any microbats roosting in any of the buildings. There were no suitable cavities in the roof of any buildings covered with straight

sheet metal (Figure 1) as no spaces were developed leaving only very open areas. Some of the administration buildings had proper ceilings installed, but they again did not provide suitable roosting sites. Most ceilings were intact. Where there were some holes created by breaks to the ceiling lining material (Figure 2) the inspection found no microbats or signs of microbats and indicated that the cavities created did not provide adequate spacing to provide good roost sites. On that basis, there was no evidence found for any microbats roosting in the buildings on site in this category.

The second category of structures were the two rows of coke ovens present (Figure 3). The two rows of ovens were made of bricks with steel doors and ports that provided for what looked to be a "cave-like" environment (Figure 3) where there was reasonable access through doors being left open or holes being created in the brickwork. The brick walls and enclosed spacing meant that these ovens represented the best potential habitat on site and were inspected wherever there were openings that allowed viewing with a torch. However, none showed any sign of being used by microbats. Not all areas could be viewed and there were square cavities in the top of each oven that could not be looked in, but there were no evident deposits of droppings under any that could be observed (>70%) and if being used by microbats the conditions should have made droppings obvious to see.

There were occasional points of staining on the ground (Figure 4) that occurred below the previously noted cavities in the ceilings of each oven, however it appeared highly likely that this was a result of water filtering through these points. The internal walls of the ovens tended to be coated with old slag material and this may also have rendered them unsuitable for use by microbats. There could possibly still be microbats present if there were access points at the top of ovens without open doors that were not evident through the inspection, but the absence of records from the ultrasonic detections conducted previously by ELA (ELA 2019) coupled with the lack of any evidence in the ovens (where inspection was possible) strongly indicates that they are not being used by microbats.

The third type of structure present were the brick chimneys on site (Figure 5). These were not able to be inspected as they were sealed up. They could represent roosting habitat, but there were no obvious locations that microbats could enter the chimneys. Given the lack of any ultrasonic detection of microbat calls to indicate microbats (ELA 2019) are present on the site and the lack of access points into the chimneys it is most likely that they are not being used.

Discussion and conclusion

There was no evidence found of microbats using any of the structures present on the subject site. No microbats were seen or any clear evidence found of microbats having used the buildings at any time. The structures were generally able to be inspected. In areas where thorough inspection occurred, it was concluded that the buildings were not being used by microbats, nor were there any signs of microbats. However, some areas of the site were inaccessible and it cannot be concluded that they were not being used by microbats at the time of survey. These areas were generally considered unsuitable microbat habitat. It is possible that there may be occasional use of buildings by individual microbats in other seasons of the year. The lack of suitable habitat, absence of signs of use or occupation and the lack of records from previous ultrasonic detection surveys, would indicate that microbats rarely if ever use the structures and, if they ever do, it is only very occasionally and in small numbers (just occasional individuals at best).

Recommendations

It is recommended that an ecologist with demonstrated experience in locating microbats inspects the base of the towers and within each coke oven immediately prior to demolition and be present during demolition to respond to the presence of any microbats.

Regards,



Alex Gorey
Ecologist



Figure 1: Open, corrugated iron and sheet metal structures in the site



Figure 2: Openings into roof cavities in the site



Figure 3: Coke ovens in the site



Figure 4: Water staining in the site



Figure 5: Inaccessible stacks within the site



Frank Lemckert **PRINCIPAL SCIENTIFIC ECOLOGIST**

Frank has been a professional scientist since 1992, specialising in understanding and managing the ecology and management of threatened species. Frank has conducted ecological work throughout eastern Australia (NSW, Victoria, Queensland), establishing long-term research and monitoring programs into the management of fauna and developing strategies to mitigate the impacts of human disturbances. He has worked extensively with the NSW state and federal Governments on varying issues of fauna and flora management including the preparation of a draft NSW/National recovery plan for *Heleioporus australiacus*. Frank has prepared reports on endemism and representation in reserves of flora and fauna for the Commonwealth, represented the NSW Forestry Commission in license negotiations for the Comprehensive Regional Assessment process (2000), provided expert ecological advice on illegal land clearing for the NSW and Commonwealth Governments. He has authored over 90 peer-reviewed publications. Frank is a research associate with the Australian Museum and University of Newcastle. He is a recognised expert in frog ecology and management, but has completed a range of works on terrestrial fauna and has skills and experience in working with any of the vertebrate groups.

Frank's primary role as a consultant has been to use his expertise and experience in technical writing and threatened species legislation to develop and maintain quality assurance in project reporting including:

- Production of Microbat Management Plans for the Gerringong By-pass and Berry to Bomaderry Upgrade of the Princes Highway.
- Microbat and nest box management plans for the Berry to Bomaderry and Oxley Highway to Kempsey Highway Upgrades.
- Co-author for a Species Impact Statement for impacts on the Common Bentwing-bat for Warringah Mall.
- Expert surveys for cave roosting bats for the Warragamba Dam raising project and Spur Hill Coal Mine.
- >100 flora and fauna reports and assessments of significance using the EP&A Act and EPBC Act.
- Review of two proposed Coal Seam Gas Impact Assessment methods for Matters of National Environmental Significance (contracted by the Commonwealth Government) including considerations of Long-eared Bats.

QUALIFICATIONS

- Bachelor of Science, University of Sydney, 1984 (Terrestrial Ecology and Marine Management)
- Master of Science, University of Sydney, 1991 (Population biology of the Common Froglet)
- PhD, University of Newcastle, 2009 (Management of forest frogs in timber production forests of NSW).

PROJECT EXPERIENCE

BAT PLANS OF MANAGEMENT / STRATEGIES

- Eastern Bentwing-bat Management Plan, Gerringong, NSW RMS (2014) – completion of an initial assessment of impacts, followed by the development of a bat exclusion program for the old bridge, roost offset strategy for the new bridge and a monitoring plan to record success of the management actions. The bats were successfully relocated to the new bridge.
- Species Impact Statement and Microbat Management Plan for Culvert Upgrades for Warringah Mall, Mirvac and Warringah Council (2015-2016) – completion of assessments of impacts on bats roosting in a culvert due for upgrade works, production of a Species Impact Statement and management plan to manage impacts during the works process. The works also included surveys to establish the importance of the colony and monitoring to manage impacts during upgrade works. Bats remained present and unaffected through the works.
- Microbat and Nest box Management Plans, Berry to Bomaderry Upgrade of the Princes Highway, NSW RMS (2017) – completion of management plans to manage impacts on bats during upgrade works as a result of the loss of hollows and roosting sites in culverts and bridges. Included designing new roost structures, determining locations of offset roost habitats and surveys to confirm the presence of roosting bats.
- Microbat Management Plan for Clarence Town Bridge, NSW RMS (2016) – undertake assessments of the presence/location of bats in a bridge subject to upgrade works. This was followed by the development of a management plan and monitoring strategy to manage any impacts to roosting bats as a result of noise, vibration and the presence of workers. The bats remained in place through the works.

ECOLOGICAL IMPACT ASSESSMENT

- Warragamba Dam Raising Project impact assessments, Water NSW (2018-19) – complete surveys for cave roosting bats and undertake tests of expected impacts resulting from the additional flooding.
- Granite Hills Windfarm Bird and Bat Strike Modelling and Ecological Impact Assessment, Nimmitabel, Akuo Energy (2018) – review survey results for bats and assess potential impacts to bats as part of modelling process.
- Elysian Windfarm Ecological Impact Assessment, Nimmitabel, Akuo Energy (2018) – develop survey program to obtain data for use in strike assessment modelling.
- Eurobodalla Dam Biodiversity Assessment Report, Eurobodalla Shire Council (2017-18) – review impact assessments for Southern Myotis resulting from tree loss through with construction of the new dam.
- Heathcote Road Upgrade impact assessment and review of mitigation measures, NSW RMS (2018-2019) – undertake assessments of impacts on bats of proposed new bridge upgrades along the road. This required additional ultrasonic detection and bridge surveys to confirm the presence/absence of bats and writing in mitigation requirements (new roost sites) for bats associated with the bridges.

GOVERNMENT REVIEWS/REPORTS

- Flora and fauna representation in the Australian Reserve system, Commonwealth Government (2010)
- Flora and fauna endemism patterns across Australia, Commonwealth Government (2009)
- Expert review of fauna and flora impacts for 13 NSW Forestry Commission EIS reports (1992-94).

TRAINING

- Lead instructor > 50 wildlife training schools run in NSW, ACT and Victoria providing presentations on the survey, identification and management of fauna. Included 12 specialist bat management courses. This included detailed instruction presented to Queensland, Victorian, NSW and Commonwealth Government staff (1993-2017)

Relevant Publications

Lemckert, F. and Brassil, T. 2009. Focusing on the Landscape Biodiversity in Australia's National Reserve System Part A: Fauna. A Report for Caring for Our Country through the Australian Biological Resources Study. Available at http://www.bushblitz.org.au/reports.php.

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Appendix G Corrimal Residential Development Grey-headed Flying-fox Management Plan (ELA 2022)

Provided as a separate document.

Corrimal Residential Development Grey-headed Flying-fox Management Plan

Prepared for Legacy Property Pty Ltd.

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Template 2.8.1

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1. Overview

1.1. Objectives

The objectives of this Camp Management Plan (the Plan) are to:

- minimise impacts to the proposed residential community, while conserving flying-foxes and their habitat
- provide a reasonable level of amenity for the surrounding community
- manage public health and safety risks
- clearly define roles and responsibilities
- enable land managers and other stakeholders to use a range of suitable management responses to sustainably manage flying-foxes
- effectively communicate with stakeholders during planning and implementation of management activities
- enable long-term conservation of flying-foxes in appropriate locations. This Management Plan is for the construction and establishment phase of the development site and is valid for 10 years or for the duration of the site redevelopment.
- ensure management is sympathetic to flying-fox behaviours and requirements
- improve community understanding and appreciation of flying-foxes, including their critical ecological role
- ensure flying-fox welfare is a priority during all works
- ensure camp management is consistent with broader conservation management strategies that may be developed to protect threatened species/communities
- ensure camp management does not contribute to loss of biodiversity or increase threats to threatened species/communities
- clearly outline the camp management actions that will be utilised at the camp
- ensure management activities are consistent with the NSW Flying-fox Camp Management Policy (OEH 2018)
- facilitate license approval and follow issued Threatened Species Licence conditions to mitigate actions that may impact the camp
- implement an adaptive management approach to camp management based on evidence collected.

This PoM has also been updated following initial submission to address comments made from Council in a request for Information (RFI) issued 4 April 2024.

The PoM was amended in response to Council comment number B1.7 (H). .

1.2. Terminology

The terminology used in this plan relates to specific stages of the proposed development.

- **Bulk earthworks phase** – relates to site preparation which facilitates the construction of dwelling and ancillary infrastructure. This phase includes actions required to cut and fill, vegetation removal, spoil stockpiling and use of earth moving equipment, chainsaws, chippers and other machinery.
- **Embellishment and soft works** – relates to revegetation and landscaping and replanting of the future riparian corridor
- **Operational phase** – relates to the period following completion of bulk earthworks, construction and initial embellishment and soft works phase. This phase relates to the ongoing operation and management of the completed subdivision, and does not cover construction or bulk earthworks.
- **Threatened Species License** – Three Threatened Species Licenses have been issued by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW, each of which provides specific requirements for the management of the Grey-headed Flying-fox in relation to the proposed development. NSW DCCEEW have issued the following licences:
    - Licence DOC24/644921-3 for Stage 1 Bulk Earthworks DA, DA-2023/166 (Appendix A).
    - Licence DOC24/536883-5 for Demolition DA, DA22/1249 (Appendix B).
    - Licence DOC24/537230-3 for Sewer Lead-in works (Approved activity under Part 5 of the Environmental Planning and Assessment Act 1979) (Appendix C).
    - A licence will be sought following approval of Stage 2-4 Bulk Earthworks DA.

- **Unsuitable habitat** – street trees, exotic vegetation that can present a choking hazard to the environment (e.g. Cocos Palms) and the 100 m buffer.
- **Loss of condition** – evidenced by trees stripped of fruits and leaves in the camp or in foraging habitat surrounding the camp.
- **Suitably qualified ecologist** – an ecologist (or other acceptable person) with at least 5 years' experience who can confidently identify a Grey-headed Flying-fox and basic camp dynamics, including whether there are adults and pups and whether there is a creche present. They must have undertaken an induction into the site and the presence of the colony.
- **Flying-fox expert –** a person with at demonstrated experience in the survey and monitoring of Grey-headed Flying-foxes who can distinguish Grey-headed Flying-foxes from other flying-foxes and who can adequately assess the signs of stress in the species and who has vaccinations against the bat Lyssavirus. Such a person should be submitted for approval to DCCEEW for approval.

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2. Context

2.1. Camp area

The study area is located on Railway Street, Corrimal and consists of four lots (Lot 11 DP749492, Lot 5 DP749492, Lot 126 DP598190 and Lot 1 DP 795791) with a combined area of 18.16 ha. The study area is within the Wollongong Local Government Area (LGA) and is located approximately 5 km north of the Wollongong city centre (Figure 1). The approved rezoning covers land zoned as R3 Medium Density Residential and RE1 – Public Recreation.

The study area is bounded by Memorial Drive on the western side, Railway Street and residential housing to the north, the railway line and residential housing to the east, and the vegetated riparian area of Towradgi Creek to the south. The study area is generally flat with a gentle slope towards Towradgi Creek in the south east. A large portion of the study area represents cleared and landscaped land as part of the previous use of the study area by Illawarra Coke Company as a cokeworks facility.

The camp is located at the southern extent of the study area, between the old settling pond and Towradgi Creek. The flying-fox numbers at the camp typically fluctuates from between <50 and 600 individuals, but with occasional influx periods of where 2,000-6,000 individuals can be present. Typical "core" camp extents of 200-600 (as at December 2019 and October 2022) and influx camp extents are shown in Figure 2 and Figure 5. The typical camp extent of 200-600 flying-foxes covers around 0.16 ha with approximately 0.28 ha of additional suitable contiguous potential and previously used camp habitat remaining adjacent to and connected with the core camp.

2.2. History of the camp

The camp was first recorded in 2017 and is seasonally occupied during late spring and summer by *Pteropus poliocephalus* (Grey-headed Flying-fox). Monthly camp monitoring has occurred since July 2019 and is ongoing. Monitoring has observed that the camp empties generally empties during Winter, although low numbers remained present through the Winter of 2021. Flying-foxes generally starting to return in mid Spring, and occupying the camp through late spring and Summer. The core camp extent is consistently located near the dam wall, where water spills into Towradgi Creek, with larger camp extents previously recorded further south of the dam (Figure 5). Figure 4 provides an illustration of the changes in camp extent from April-June 2024, when flying-foxes leave the area, compared to the typical core camp extent. All available monitoring data can be found in Appendix D.

Mating and courtship behaviour has been observed within the flying fox camp, most recently in April – May 2024. Pups have also been observed once at the camp in November 2019, following a significant period of absence of bats. flying foxes. The flyout watch conducted on 19 February 2020 also recorded flying-foxes using the dam for belly dipping immediately prior to flying out for their nightly forage. Based off the results of monitoring of the camp in 2024, with 200-600 bats present, the resident flying-foxes prefer to roost in *Acacia maidenii* (Maiden's wattle), *Cinnamomum camphora* (Camphor laurel) and *Ligustrum lucidum* (Privet).

The maximum total number of flying-foxes ever recorded at the camp was between 4,000 – 6,000 individuals in January 2020. This count occurred after the 2019 / 2020 bushfires where camps and potential foraging habitat within the south coast region was significantly affected. Numbers prior to and after the 2019 / 2020 bushfire season stabilised and have consistently remained around 200 – 500 flying-foxes during Spring and Summer. Therefore, it is anticipated that the sharp and temporary increase in numbers was likely a result of a severe food and refuge habitat throughout the broader South Coast region and such rapid increases would not occur again without another set of unusual circumstances. No other species of flying-fox has been identified in the camp.

2.3. Land tenure

The land is in private tenure and is currently owned by Illawarra Coal Company. The camp occurs on land zoned RE1 – Public Recreation and is adjacent to land zoned R3 – Medium Density Residential. The land surrounding the camp will be used as public recreation, with any community use limited to the outer edges of the zoning. Where native vegetation exists immediately adjacent to the camp, this will be retained in situ. The native vegetation to the west will be cleared to allow for the construction of a 40 m wide riparian corridor that will be revegetated.

2.4. Reported issues related to the camp

There have been no issues of flying-fox management previously reported in relation to the camp, which has remained relatively isolated from human activities by the closed Corrimal Cokeworks grounds. This plan has been developed to minimise potential conflict between future residents and the camp and to follow Threatened Species Licenses issued for all phases of the work.

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Figure 1: Location of the study area

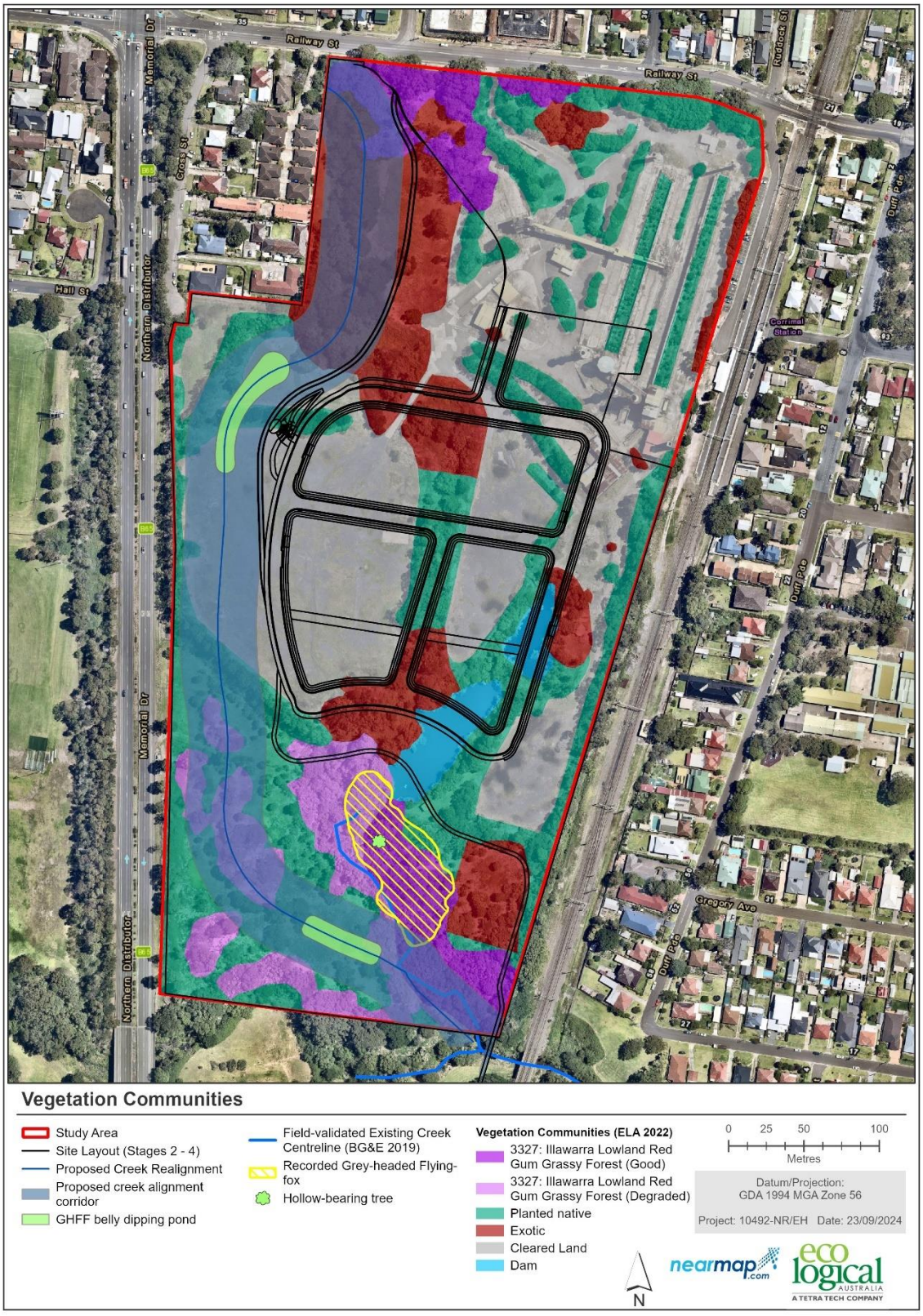


Figure 2: Development footprint, ecological values, potential belly dipping pond and core camp extent in the study area



Figure 3: Grey-headed Flying-foxes in the study area



Figure 4: Mapped changes in the flying camp extent

3. Legislation and policy

3.1. State

3.1.1. Flying-fox Camp Management Policy

The Flying-fox Camp Management Policy 2015 (the Policy) has been developed to empower land managers, principally local councils, to work with their communities to manage flying-fox camps effectively. It provides the framework within which the Department will make regulatory decisions. In particular, the Policy strongly encourages local councils and other land managers to prepare Camp Management Plans for sites where the local community is affected.

3.1.2. Biodiversity Conservation Act 2016

The purpose of the *Biodiversity Conservation Act 2016* (BC Act) includes to conserve biodiversity at the bioregional and state scales. Under this Act, a person who harms or attempts to harm an animal of a threatened species, an animal that is part of a threatened ecological community, or a protected animal, is guilty of an offence.

The Grey-headed Flying-fox is listed as threatened under the BC Act. This plan has considered whether a biodiversity conservation licence under Part 2 of the BC Act may be required. A licence is required if the proposed action is likely to result in one or more of the following:

a. harm to an animal that is a threatened species, or part of a threatened population.

The implementation of the proposed works may potentially harm the Grey-headed Flying-fox and therefore, a licence under the BC Act is required. The Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) has advised that Threatened Species Licence applications will only be assessed on development applications (DAs) that have been approved. The Corrimal Cokeworks DAs have been submitted in separate stages. Therefore, Legacy Property have sought separate licences for impacts to the flying fox camp following approved development consent of each stage of development. Legacy Property hold the following licences for approved development stages:

- Licence DOC24/644921-3 for Stage 1 Bulk Earthworks DA, DA-2023/166 (Appendix A).
- Licence DOC24/536883-5 for Demolition DA, DA22/1249 (Appendix B).
- Licence DOC24/537230-3 for Sewer Lead-in works (Approved activity under Part 5 of the Environmental Planning and Assessment Act 1979) (Appendix C).

Licence conditions must be adhered to for each stage of works. If any changes to the plan are proposed or there is an incidental occurrence of harm, amendments to the licence will be required. A Threatened Species License to allow completion of the Sewer Lead-in Works was issued in July 2024 (Appendix A) and all conditions of that license must be adhered to for that component of the works.

A fourth licence will be required for the Stage 2-4 Bulk Earthworks DA. A licence application will be submitted following approval of the DA.

3.1.3. Prevention of Cruelty to Animals Act 1979

It may be an offence under this Act if there is evidence of unreasonable/unnecessary torment associated with management activities. Adhering to welfare and conservation measures provided in Section 10.3 will ensure compliance with this Act.

3.1.4. Environmental Planning and Assessment Act 1979

The objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act) are to encourage the proper management, development and conservation of resources, for the purpose of the social and economic welfare of the community and a better environment. It also aims to share responsibility for environmental planning between different levels of government and promote public participation in environmental planning and assessment.

The EP&A Act is administered by the Department of Planning and Environment. Consistent with the Act, development under Part 4 of the Act does not require licensing under the BC Act. The proponent is proposing to submit a development application to Wollongong Shire Council for assessment and approval under Part 4 of the EP&A Act. As the consent authority, Wollongong Council will be responsible for reviewing and approving this plan.

3.2. Commonwealth

3.2.1. Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection for the environment, specifically matters of national environmental significance (MNES). A referral to the Commonwealth Department of Climate Change, Energy the Environment and Water (DCCEEW) is required under the EPBC Act for any action that is likely to significantly impact on an MNES. MNES under the EPBC Act that relate to flying-foxes include:

- world heritage sites (where those sites contain flying-fox camps or foraging habitat)
- wetlands of international importance (where those wetlands contain flying-fox camps or foraging habitat)
- nationally threatened species and ecological communities.

The subject land does not contain a world heritage site or a wetland of international importance that contains a Grey-headed Flying-fox Camp. The subject land does contain a known camp which contains, on average 300 individuals. The proposed action was also considered against the referral guidelines for Grey-headed Flying-fox which specifically relate to impacts on a nationally important camp. A national important camp is a camp that has either:

- contained ≥10,000 GHFF in more than one year in the last 10 years
- been occupied by more than 2500 GHFF permanently or seasonally every year for the last 10 years.

Since camp monitoring commenced, the camp has not held >10,000 flying-foxes for more than 1 year or been occupied by >2,500 flying-foxes permanently or seasonally for the last 10 years. Therefore, the

camp does not meet the definition of a nationally important camp. In addition, the camp management actions are being conducted to minimise any potential for a significant impact to the camp and a referral has not been recommended. A referral may be required if the camp is consistently disturbed, or this plan is not adhered to.

4. Flying-fox ecology and behaviour

The information in this chapter has been developed with the use of the Flying-fox Camp Management Plan Template (DPIE 2019).

4.1. Ecological role

Flying-foxes make a substantial contribution to ecosystem health through their ability to move seeds and pollen over long distances (Southerton et al. 2004). This directly assists gene movement in native plants, improving the reproduction, regeneration and viability of forest ecosystems (DEE 2019b). Some plants, particularly *Corymbia* spp., have adaptations suggesting they rely more heavily on nocturnal visitors such as flying-foxes for pollination than daytime pollinators (Southerton et al. 2004).

Grey-headed flying-foxes may travel 100 km in a single night with a foraging radius of up to 50 km from their camp (McConkey et al. 2012) and have been recorded travelling over 500 km in two days between camps (Roberts et al. 2012). The average nightly foraging distance has been estimated at 20 km (DAWE 2021).

Long-distance seed dispersal and pollination make flying-foxes critical to the long-term persistence of many plant communities (Westcott et al. 2008; McConkey et al. 2012), including eucalypt forests, rainforests, woodlands and wetlands (Roberts et al. 2006). Seeds that can germinate away from their parent plant have a greater chance of growing into a mature plant (DES 2018). Long-distance dispersal also allows genetic material to be spread between forest patches that would normally be geographically isolated (Parry-Jones & Augee 1992; Eby 1991; Roberts 2006). This genetic diversity allows species to adapt to environmental change and respond to disease pathogens. Transfer of genetic material between forest patches is particularly important in the context of contemporary fragmented landscapes.

Flying-foxes are considered 'keystone' species given their contribution to the health, longevity and diversity among and between vegetation communities. These ecological services ultimately protect the long-term health and biodiversity of Australia's bushland and wetlands. In turn, native forests act as carbon sinks (Roxburgh et al. 2006), provide habitat for other animals and plants, stabilise river systems and catchments, add value to production of hardwood timber, honey and fruit (e.g. bananas and mangoes; Fujita 1991), and provide recreational and tourism opportunities worth millions of dollars each year (DES 2018).

4.2. Flying-foxes in urban areas

Flying-foxes appear to be roosting and foraging in urban areas more frequently. There are many possible drivers for this, as summarised by Tait et al. (2014):

- loss of native habitat and urban expansion
- opportunities presented by year-round food availability from native and exotic species found in expanding urban areas

- disturbance events such as drought, fires, cyclones
- human disturbance at non-urban roosts or culling at orchards
- urban effects on local climate
- refuge from predation
- movement advantages, e.g. ease of manoeuvring in flight due to the open nature of the habitat or ease of navigation due to landmarks and lighting.

4.3. Under threat

Flying-foxes roosting and foraging in urban areas more frequently can give the impression that their populations are increasing; however, the Grey-headed Flying-fox is in decline across its range and in 2001 was listed as vulnerable by the NSW Government through the *Threatened Species Conservation Act 1995* (now BC Act).

At the time of listing, the species was considered eligible for listing as vulnerable, as counts of flying-foxes over the previous decade suggested the national population had declined by up to 30%. It was also estimated the population would continue to decrease by at least 20% in the next three generations given the continuation of the current rate of habitat loss, culling and other threats.

The main threat to grey-headed flying-foxes in New South Wales is clearing or modification of native vegetation. This removes appropriate roosting and breeding sites and limits the availability of natural food resources, particularly winter–spring feeding habitat in north-eastern NSW. The urbanisation of the coastal plains of south-eastern Queensland and northern NSW has seen the removal of annually-reliable winter feeding sites, which is continuing.

There are a wide range of ongoing threats to the survival of the Grey-headed Flying-fox, including:

- habitat loss and degradation
- conflict with humans (including culling at orchards)
- infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.)
- exposure to extreme natural events such as cyclones, drought and heatwaves.

Flying-foxes have limited capacity to respond to these threats and recover from large population losses due to their slow sexual maturation, low reproductive output, long gestation and extended maternal dependence (McIlwee & Martin 2002).

4.4. Typical camp characteristics

All flying-foxes are nocturnal, typically roosting during the day in communal camps. These camps may range in number from a few to hundreds of thousands, with individual animals frequently moving between camps within their range. Typically, the abundance of resources within a 20 to 50-km radius of a camp site will be a key determinant of the size of a camp (SEQ Catchments 2012). Many flying-fox camps are temporary and seasonal, tightly tied to the flowering of their preferred food trees; however, understanding the availability of feeding resources is difficult because flowering and fruiting are not

reliable every year, and can vary between localities (SEQ Catchments 2012). These are important aspects of camp preference and movement between camps and have implications for long-term management strategies.

Little is known about flying-fox camp preferences; however, research indicates that apart from being in proximity to food sources, flying-foxes choose to roost in vegetation with at least some of the following general characteristics (SEQ Catchments 2012; Eco Logical Australia 2018):

- closed canopy >5 metres high
- dense vegetation with complex structure (upper, mid- and understorey layers)
- within 500 metres of permanent water source
- within 50 kilometres of the coastline or at an elevation <65 metres above sea level
- level topography (<5° incline)
- greater than 1 ha to accommodate and sustain large numbers of flying-foxes.

Optimal vegetation available for flying-foxes must allow movement between preferred areas of the camp. Specifically, it is recommended that the size of a patch be approximately three times the area occupied by flying-foxes at any one time (SEQ Catchments 2012).

4.5. Grey-headed flying-fox (*Pteropus poliocephalus*) species profile

The Grey-headed Flying-fox is found throughout eastern Australia, generally within 200 km of the coast, from Finch Hatton in Queensland to Melbourne, Victoria (DPIE 2019c). This species now ranges into South Australia and individual flying-foxes have been reported on the Bass Islands and mainland Tasmania (Driessen et al. 2011). It requires foraging resources and camp sites within rainforests, open forests, closed and open woodlands (including melaleuca swamps and banksia woodlands). This species is also found throughout urban and agricultural areas where food trees exist and will feed in orchards at times, especially when other food is scarce (DPIE 2019a).

GHFF generally show a high level of fidelity to camp sites, returning year after year to the same site, and have been recorded returning to the same branch of a particular tree (SEQ Catchments 2012). This may be one of the reasons flying-foxes continue to return to small urban bushland blocks that may be remnants of historically used larger tracts of vegetation.

The GHFF population has a generally annual southerly movement in spring and summer, with their return to the coastal forests of north-east NSW and south-east Queensland in winter (Ratcliffe 1932; Eby 1991; Parry-Jones & Augee 1992; Roberts et al. 2012). This results in large fluctuations in the number of GHFF in New South Wales, ranging from as few as 20% of the total population in winter up to around 75% of the total population in summer (Eby 2000). They are widespread throughout their range during summer, but in Spring and Winter are uncommon in the south. In Autumn they occupy primarily coastal lowland camps and are uncommon inland and on the south coast of New South Wales (DECCW 2009).

There is evidence the GHFF population declined by up to 30% between 1989 and 2000 (Birt 2000; Richards 2000 cited in DPIE 2019a). There are a wide range of ongoing threats to the survival of the

GHFF, including habitat loss and degradation, culling in orchards, conflict with humans, infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, and power line electrocution) and competition and hybridisation with the Black Flying Fox (*Pteropus alecto* – BFF) (DECCW 2009).

5. Management measures for on-ground works – Bulk earthworks phase

The following management measures have been designed for implementation during the construction phase of the works. The management measures have been designated to the relevant construction phase of bulk earthworks and split into measures relative to proximity to the camp. This protocol will be incorporated in safe work method statements and induction materials for staff and contractors working near the camp.

In additional to the measures outlined below, works are to adhere to the following Threatened Species Licences that are relevant for each stage of works:

- Licence DOC24/644921-3 for Stage 1 Bulk Earthworks DA, DA-2023/166 (Appendix A).
- Licence DOC24/536883-5 for Demolition DA, DA22/1249 (Appendix B).
- Licence DOC24/537230-3 for Sewer Lead-in works (Approved activity under Part 5 of the Environmental Planning and Assessment Act 1979) (Appendix C).
- A licence will be sought following approval of Stage 2-4 Bulk Earthworks DA.

The mitigation measures in the following sections are consistent with the licence conditions, which are very similar across all three licences except for the Sewer-lead in works Licence that includes an additional condition, Condition 10, which provides measures around the removal of habitat trees within the potential flying fox area. Condition 7 of the Stage 1 Bulk Earthworks Licence also includes an additional provision for continuous supervision for stockpiling materials within 75-200 m of the camp. The conditions outlined in Chapter 5 include all conditions across all licences.

5.1. Pre-construction

The Threatened Species Licences allows works to be undertaken within 75m of the flying fox camp while the flying foxes are present. However, as far as possible, works within 75 m of the flying fox camp should be scheduled/planned to be done while the flying foxes are absent from the site. The flying foxes are generally absent or in low numbers in winter. If the flying foxes do not vacate the site, or return much earlier than expected, works within 75m of the camp are to be done in accordance with the licence.

5.1.1. Pre-construction conditions across all licences

Condition 3: At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).

Condition 4: If the camp is deemed empty of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert

Condition 5: When the grey-headed flying-fox camp is occupied and on-site actions are planned:

a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for

- Grey-headed flying-fox numbers
- The camp footprint
- The distance of on-site actions to the camp
- General health of flying-foxes (including signs of malnourishment)
- Signs of breeding including
- The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant
- Birthing or lactating females
- Females carrying young
- Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
- Courtship and/or mating behaviours

Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps

b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site works have commenced

    i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request.

A preliminary survey to confirm if flying-foxes are present must be conducted by a qualified flying-fox ecologist in the week prior to works commencing and must be repeated if works cease for a period of longer than three weeks. Otherwise inspections will be required daily by a suitably qualified and skilled person to determine if the camp has flying-foxes in it. If so, then monitoring will be required as detailed in the following sections.

5.1.2. Inductions

All staff and contractors are to undertake environmental inductions regarding management of the camp and identification of the Grey-headed Flying-fox, disease risks associated with flying-foxes and the stop work triggers (Table 7; Appendix B). A designated experienced flying-fox ecologist should be available to contact at any time if there are concerns for the welfare of GHFF at the camp. Any stop work decision would be made by the relevant land manager.

Once the development is in the operational phase, the public and land users need to know who to contact (e.g. WIRES or Sydney Wildlife) if dead or injured flying foxes are found. A range of communication and messaging methods will be employed to facilitate this, but must be initiated by the developer prior to the operational phase. It is the responsibility of the land manager and contractors to conduct a risk assessment and determine workplace health and safety requirements; however minimum requirements are provided below.

5.1.3. Preparation of replacement habitat plan

Prior to the commencement of bulk earthworks, a plan to de-water the dam closest to the camp and the creation of a replacement water body must be prepared and will be appended to this Management Plan. The replacement water body is required to be in a position where it can be used by the Flying-foxes for belly dipping and where it can provide relief from heat stress. The belly dipping pond must be free of debris and have a clear flypath for the flying foxes to perform belly dipping safely. The plan should outline protocols to de-water the dam whilst the camp is empty and create the replacement dam before the flying foxes return to the camp. If the dam cannot be dewatered when the camp is empty, strict mitigation and monitoring measures are required to be developed to ensure no indirect harm or increased risk of heat stress would occur and the new water body must be in place prior to dam de-watering occurring of the original dam. The current proposed alternative water body is Towradgi Creek, which is to be re-aligned and rehabilitated from its current highly disturbed state and will include a section that will form a permanent pool at point adjacent to the GHFF roost. Alternative locations for the dam could include existing water bodies outside the boundary of the subject land, provided they meet the requirements of the replacement habitat. This must be detailed in the plan and these measures approved by the project ecologist and Council before work can proceed. The proposed location for the new belly dipping pond is shown on Figure 2.

5.2. During construction

5.2.1. Creation of supplementary aquatic habitat

Prior to the commencement of bulk earthworks across the subject land, the supplementary aquatic habitat must be created. The supplementary habitat should be prepared consistent with the plan submitted at the relevant DA stage.

5.2.2. Supervision works in accordance with the current active Threatened Species Licences.

The holder of the certificate must ensure that:

Condition 1: Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated.

Condition 2: Any incident/s of harmed/dead grey-headed flying-foxes

a. Must be reported immediately to a local wildlife carer group for welfare response and collection
b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes.

Condition 6: Signs of stress in the grey-headed flying-foxes are defined as any of the following

- More than 30% of the camp takes flight and remains in flight for more than 20 minutes
- Saliva spreading (i.e. licking themselves other than for grooming)

- Grey-headed flying-foxes located on or within two metres of the ground
- Aborting young
- Dependant young abandoned for greater than 20 minutes during the day
- An increase in the number of flying-foxes being taken into local care
- Harmed/dead flying-fox/es found under or adjacent to the camp
- New grey-headed flying-fox camps forming within 5 km of the on-site actions.

Condition 7: If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken.** Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery. This also includes the stockpiling of materials within the future Stage 2 area of the site (refer to Condition 8 for works 75-200 m from the edge of the camp).

Condition 8: If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp,**

a. In addition to on-site personnel continuous monitoring requirements (Condition 7), a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au.
b. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

    i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)
    ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be onsite to monitor for signs of stress and advise site-managers on response.

c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

    i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress
    ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert
    iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence
    iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW.

Condition 9: If the grey-headed flying-fox camp is occupied, for any works within **75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au
b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted
c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

    i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress
    ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence
    iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day
    iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works causing the signs of stress are appropriate to continue or should be deferred to a later date.
    v. All signs of stress incidents and responses for works within 75 m of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au.

d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 m of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.
e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately.

Condition 10: In the area denoted as the potential extent (typical camp extent) of the flying-fox camp as shown in Figure 5

a. Vegetation/trees providing habitat for the flying-fox camp must not be felled, lopped or have large branches removed if it has not been identified in the Sewer lead-in Works, Stage 1 and 2-4 Bulk Earthworks and Demolition works for alteration (as per Figure 5 and Figure 6).

b. Vegetation/trees that are within the area identified in the Sewer lead-in Works, Stage 1 and 2-4 Bulk Earthworks and demolition works (within the development footprint and Construction Buffer area identified in Figure 5 and Figure 6) must not be felled, lopped or have large branches removed when flying foxes are in them or within 30 m of the vegetation/tree being felled, lopped or modified, or when flying-foxes are within a distance where they are likely to be harmed by the vegetation/tree that is being felled, lopped or modified (which may include a distance >30 m).

Condition 11: When temperatures are predicted to be above 35°C

a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including

   - Panting
   - Saliva spreading (i.e. licking themselves other than for grooming)
   - Grey-headed flying-foxes located on or within 2 m of the ground
   - Grey-headed flying-foxes clumping around tree trunks
   - Grey-headed flying-foxes on the ground
   - Grey-headed flying-foxes dying.

b. b. Should any signs of heat-stress be noted,

   i. On-site actions that cause any disturbance to the camp must cease immediately
   ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately.

Condition 12: When temperatures are predicted to be above 38°C

a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 m of the camp must cease
b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress
c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately.

Condition 13: A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage

a. a. Minimise disturbance within 200 m of the grey-headed flying-fox camp
b. b. Monitor for signs of stress
c. c. Cease actions should the grey-headed flying-foxes show signs of stress.

Condition 14. New grey-headed flying-fox camps that establish within 5 km of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these

camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.

Condition 15. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including

- Information about camp occupation dates
- Grey-headed flying-fox numbers
- The camp footprint (providing maps to show any temporal and spatial changes)
- The distance from on-site actions to the camp
- Signs of breeding (providing details on what signs were observed)
- General health of flying-foxes (including signs of malnourishment)
- Any stress incidents and responses
- Feedback on flying-fox responses to any works undertaken within 75 metres of
- the edge of the camp (including details on what the works were, and what the
- immediate and short-term responses were)
- Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management.

Documentation by the suitably qualified ecologist should be prepared to demonstrate that the protocols have been followed in all situations. This will take the form of weekly emails and monthly reports to be provided to Council and DCCEEW.

Works must be staged to preference works within 75 m of the flying fox camp to be conducted when the flying foxes are absent from the site.

Table 1 below shows a summary of the triggers and associated actions.

Table 1: Triggers and actions to mitigate impacts

Welfare trigger	Signs	Actions
Signs of stress	• more than 30% of the camp takes flight and individuals are in flight for more than 20 minutes • saliva spreading • located on or within 2 m of the ground • aborting young (if young present).	Temporarily cease works until the flying foxes settle. If flying foxes settle works can recommence. Contact an ecologist to monitor stress levels if the activity needs to be done the following day/s.
Evidence of maternity roost is identified (pups present)	• Camp generally empty during winter and early Spring. The camp is not known to be a maternity roost, however it possibly may be used for such, most likely during late Spring and summer during the typical maternity season. ELA notes that the maternity season for the GHFF in NSW is no longer clearly defined by DCCEEW.	Works to proceed if camp is empty. If camp is not empty and pups are identified: ○ Noise-generating activities (e.g. building demolition, tree removal, woodchipping) within 75 m of the camp to be avoided ○ Continuous monitoring of flying foxes to determine if they become stressed as per above

Welfare trigger	Signs	Actions
		○ Works to follow protocols in this plan.
Gale force wind	• inability to forage • located on or within 2 m of the ground.	Minimise disturbance within 200 m of the camp and monitor animal welfare.
Heat stress	• panting • saliva spreading • located on or within 2 m of the ground.	Monitor weather conditions and prepare teams to respond to heat stress - refer to Section 4.6 for details. Works within 200 m of the camp must cease when temperatures exceed 38°C.
Food shortage	• loss of condition evident.	Minimise disturbance within 200 m of the camp and monitor animal welfare.
Injury/death	• a flying-fox appears to have been injured/killed due to non-natural causes.	Contact an ecologist or wildlife carer. Investigate possible cause and cease action that was a factor, if relevant, and revise management strategy as needed. Obtain approval to proceed under the revised management plan.

5.2.3. Personal health measures when in contact with flying foxes

- All personnel working within 200 m of the camp will wear protective clothing including long sleeves and pants. Additional items such as eye protection and a hat are also recommended. Appropriate hygiene practices will be adopted such as washing hands with soap and water before eating/smoking.
- A wash station will be available along with an anti-viral antiseptic (e.g. Betadine) should someone be bitten or scratched. If a person is bitten or scratched by a FF they should:
    - wash the wound with soap and water for at least five minutes (do not scrub)
    - contact their doctor immediately to arrange for post-exposure vaccinations.
    - If flying-fox saliva contacts the eyes, nose, mouth or an open wound, flush thoroughly with water and seek immediate medical advice.
    - Details of the nearest hospital or doctor who can provide post-exposure prophylaxis will be kept on site.
- Only trained and vaccinated personnel are allowed to handle injured or dead flying-foxes.

If at any time it is identified that ongoing disruption or harm occurs to any Grey-headed Flying-foxes, then works must cease and consideration give as to whether a referral to the Commonwealth DCCEEW is recommended.

5.2.4. General measures

The following protocols must be followed where machinery is used in the subject land:

- Ensure all plant and equipment is maintained to Australian Standards to minimise noise generation. This includes:
  - no more than eight hours of exposure to noise measured at 85 decibels
  - no noise which exceeds 140 decibels, unless the camp is empty
  - if noise exceeds 85 decibels, than the exposure time must decrease, consistent with the Australian Standards.
- Position plant and equipment as far from the camp as possible.
- Shield noise at its source, where possible.
- Modify equipment to produce less noise or use alternative construction techniques to minimise noise.
- Avoid construction or noise activities during hours when the GHFF are most settled in the camp.
- Avoid shining lights toward the GHFF camp.
- Stop works procedure if flying-fox disturbance occurs in absence of ecologist.
- Monthly monitoring to continue.
- Do not stockpile materials within 75 m of the camp when the camp is occupied.
- Works are not undertaken during times of extreme heat evens (> 38°C).

If actions cannot comply with these mitigation measures, a referral to the NSW Department of Climate Change, Energy, Environment and Water (DCCEEW) is required.

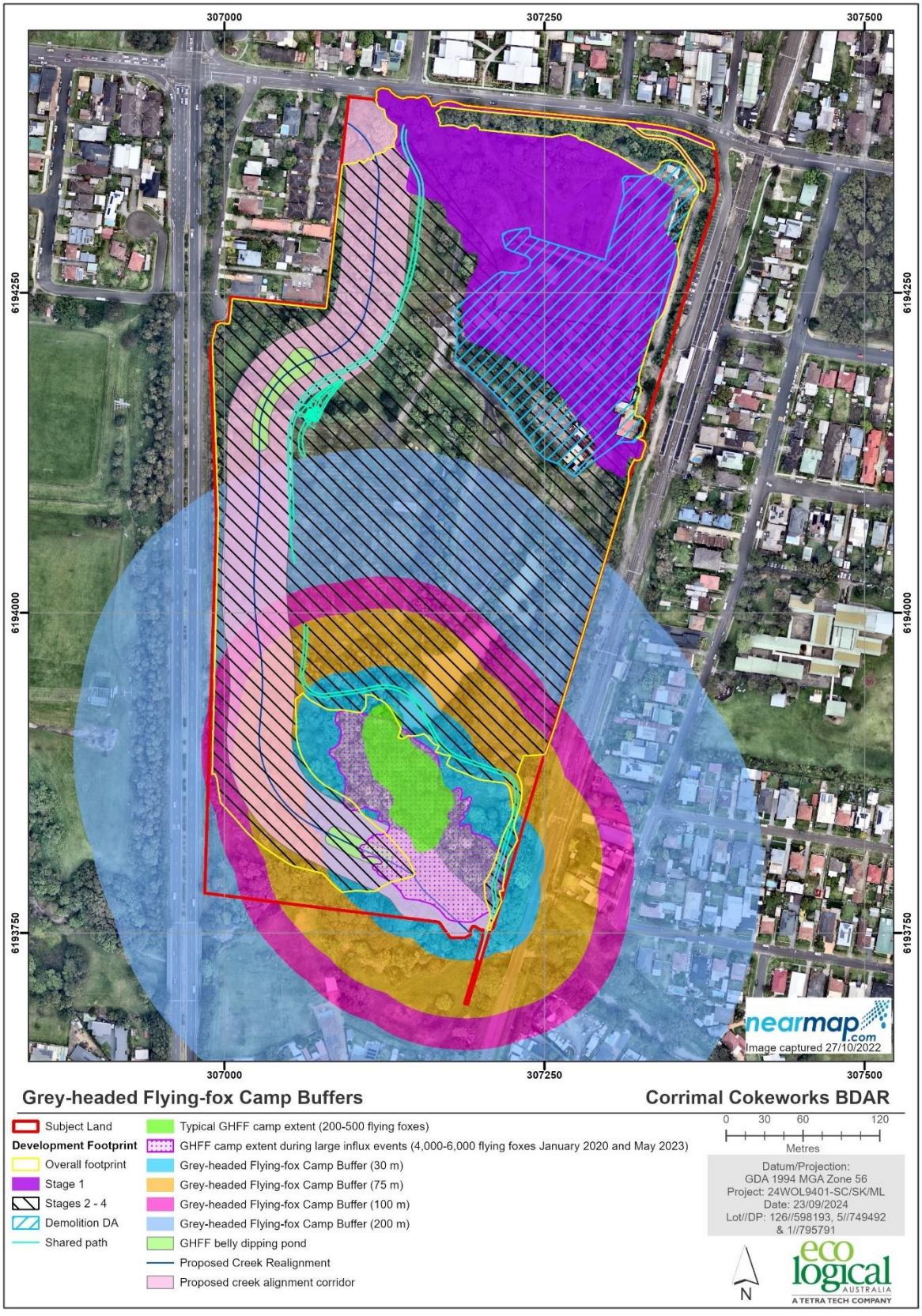


Figure 5: Construction buffers relative to the Grey-headed Flying-fox camp.

**Please note, this figure shows a 100 m buffer off the Stage 1 Bulk Earthworks development footprint. This buffer was used in the Biodiversity Development Assessment Report (ELA 2022) to assess potential impacts to the GHFF Camp. It has been used in this report for context, and information only. It does not relate to any prescribed management actions or mitigation measures described in this plan.

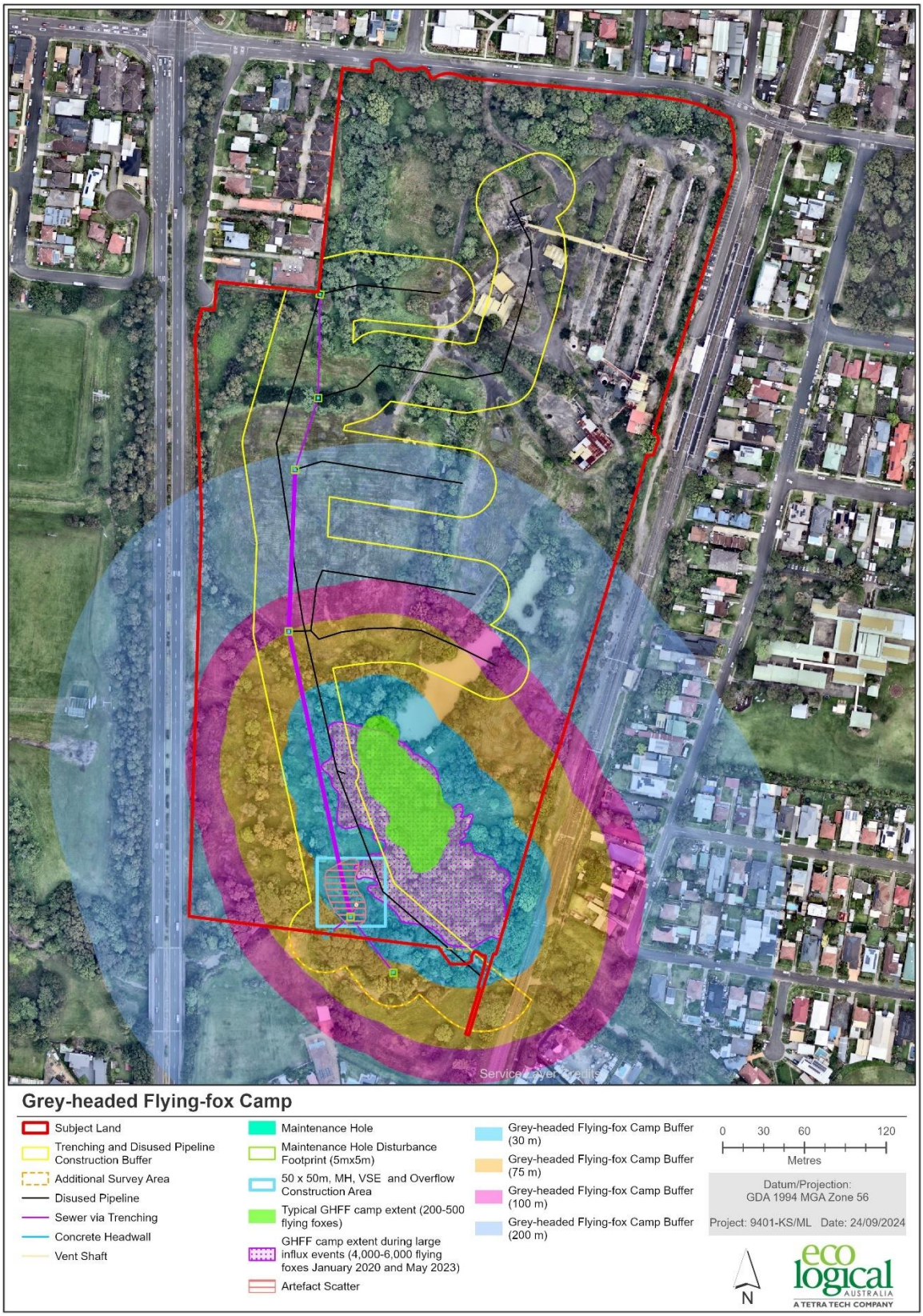


Figure 6: Sewer-lead in works impact areas

6. Management measures for on-ground works – embellishment and soft works

6.1. Revegetation and land management to create alternative habitat

As part of the proposed development, the future riparian corridor will be constructed and revegetated with native vegetation that will form part of Plant Community Type (PCT) 838 – Forest Red Gum Thin-leaved Stringybark Grassy Woodlands. This PCT is consistent with the vegetation that the camp is currently occupying in the subject land. The vegetation densities will decrease along the outer edges of the riparian corridor, to decrease potential conflicts with humans and land use.

NSW Department of Environment and Climate Change conducted a study ranking the importance of different species of trees in providing a feeding resource for Grey-headed Flying Foxes for Conservation Management (DCCEW 2008). The study found the following list to trees to be considered significant food plants for flying foxes:

Table 4.1. Species in the blossom diet of Grey-headed flying foxes and their flower scores. Where more than one score was assigned to the species, the range is given. No scores are given for species that were not identified in descriptions of vegetation types. Species with high (≥0.65) wt p*r scores are indicated by shading. These are considered significant food plants for the animals.

Family	Species	Common name	Prod	Relia	Wt p*r
Fabaceae	*Castanospermum australe*	Black bean	0.77	1	0.83
Proteaceae	*Banksia integrifolia v. int*	Coast Banksia	0.77	1	0.83
	B. serrata	Old Man Banksia	0.54	0.30	0.45
	Grevillea robusta	Silky Oak	1	1	1
Myrtaceae	*Angophora costata*	Smooth-barked Apple	0.37	0.30	0.35
	A. floribunda	Rough-barked Apple	0.54	0.30	0.45
	A. leiocarpa		0.37	0.30	0.35
	Corymbia citriodora citriodora	Lemon-scented Gum	0.91	0.30	0.65
	C. eximia	Yellow Bloodwood	0.70	0.30	0.54
	C. gummifera	Red Bloodwood	0.91	0.30	0.65
	C. henryi	Large-lved Spotted Gum	0.70	0.30	0.54
	C. intermedia	Pink Bloodwood	1	0.60	0.86
	C. maculata	Spotted Gum	0.91	0.30	0.65
	C. tessellaris	Carbeen	0.61	0.15	0.40
	C. trachyphloia	Brown Bloodwood	0.54	0.30	0.45
	C. variegata	Northern Spotted Gum	0.91	0.30	0.65
	Eucalyptus acmenoides	White Mahogany	0.37	0.60	0.43
	E. albens	White Box	0.70	0.30	0.54
	E. amplifolia	Cabbage Gum	0.70	0.15	0.44
	E. andrewsii	New England Blackbutt	0.59	0.80	0.65
	E. bancrofti	Orange Gum	0.70	0.30	0.54
	E. botryoides	Southern Mahogany	0.54	0.45	0.51
	E. camaldulensis	River Red Gum	0.70	0.60	0.67
	E. campanulata	New England Blackbutt	0.37-0.54	0.30-0.45	0.39-0.45
	E. cloeziana	Gympie Messmate	0.47	0.15	0.34
	E. deanei	Mtn Blue Gum	0.70	0.80	0.73
	E. fibrosa	Broad-leaved Ironbark	0.70	0.30	0.54
	E. grandis	Flooded Gum	0.54	0.60	0.56
	E. longirostrata	Grey Gum	0.54	0.15	0.37
	E. maidenii	Maiden's Gum	0.54	0.30	0.45
	E. major	Grey Gum	0.54	0.15	0.37
	E. melanophloia	Silver-leaved Ironbark	0.54-0.70	0.30	0.45-0.54
	E. melliodora	Yellow Box	0.32	0.60	0.39
	E. moluccana	Grey Box	0.37-0.59	0.30-0.80	0.35-0.65
	E. muelleriana	Yellow Stringybark	0.47	0.30	0.41
	E. paniculata	Grey Ironbark	0.61	0.30	0.49
	E. parramattensis	Parramatta Red Gum	0.54	0.30	0.45
	E. pilularis	Blackbutt	0.54-0.80	0.45	0.51-0.67
	E. piperita	Sydney Peppermint	0.59	0.45	0.55
	E. planchoniana	Needlebark	0.70	0.30	0.54
	E. propinqua	Small-fruited Grey Gum	0.47	0.15	0.34
	E. punctata	Large-fruited Grey Gum	0.54	0.60	0.56
	E. pyrocarpa	Large-fruited Blackbutt	0.70	0.30	0.54
	E. resinifera	Red Mahogany	0.54	0.15	0.37
	E. robusta	Swamp Mahogany	1	1	1
	E. rummeryi	Steel Box	0.70	0.30	0.54
	E. saligna	Sydney Blue Gum	0.70	0.80	0.73
	E. seeana	Narrow-leaved Red Gum	0.77	0.80	0.78
	E. siderophloia	Grey Ironbark	0.91	0.60	0.81
	E. sideroxylon	Mugga Ironbark	0.70	0.30	0.54
	E. tereticornis	Forest Red Gum	0.54-0.91	0.15-0.60	0.37-0.88
	E. tricarpa	Red Ironbark	0.47	0.15	0.34
	Lophostemon confertus	Brush box	0.41	0.63-0.80	0.46
	M. quinquenervia	Five-veined Paperbark	0.91	0.80	0.88
	Syncarpia glomulifera	Turpentine	0.54-0.59	0.60-0.80	0.56-0.65

Figure 7: Significant blossom food plants for flying foxes. Source - DCCEW 2008 Ranking the feeding habitats for Grey-headed Flying Foxes (DCCEW 2008).

Table 4.3. Species in the fruit diet of Grey-headed flying foxes and an estimate of the southern limit to their range (decimal degrees). Species on this list have been confirmed by observations of feeding animals or by identification of faecal or spat material.

Family	Species	Common name	Latitude of southern limit
GYMNOSPERMAE			
Podocarpaceae	*Podocarpus elatus*	Plum Pine	35.7
ANGIOSPERMAE			
Anonaceae	*Rauwenhoffia leichardtii*	Zig Zag Vine	30.3
Apocynaceae	*Melodinus australis*	Southern Melodinus	34.5
Arecaceae	*Livistona australis*	Cabbage Palm	37.8
	Archontophoenix cunninghamiana	Bangalow Palm	35.7
Avicenniaceae	*Avicennia marina*	Grey Mangrove	39
Caprifoliaceae	*Sambucus australasica*	Yellow Elderberry	37.8
Chenopodiaceae	*Rhagodia candolleana*	Seaberry Saltbush	Tasmania
Cunoniaceae	*Schizomeria ovata*	Crabapple	36.2
Davidsoniaceae	*Davidsonia* spp.	Davidson's Plum	28.8
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony	35.5
Ehretiaceae	*Ehretia acuminata*	Koda	36.7
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong	33.3
	E. reticulatus	Blueberry Ash	Tasmania
	E. grandis	Blue Fig	30.7
Escalloniacae	*Polyosma cunninghamii*	Featherwood	35.5
Euphorbiaceae	*Mallotus discolor*	White Kamala	29.7
Icacinaceae	*Pennantia cunninghamii*	Brown Beech	35.7
Meliaceae	*Melia azedarach*	White Cedar	34.9
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry	Tasmania
Moraceae	*Ficus coronata*	Creek Sandpaper Fig	37.8
	F. fraseri	Sandpaper Fig	33.3
	F. macrophylla	Moreton Bay Fig	34.9
	F. obliqua	Small-leaved Fig	36.2
	F. rubiginosa	Rusty Fig	37
	F. superba	Deciduous Fig	35.3
	F. virens	White Fig	29.7
	F. watkinsiana	Strangler Fig	32.4
	Maclura cochinchinensis	Cockspur Thorn	35.3
Myrtaceae	*Acmena hemilampra*	Broad-leaved Lilly Pilly	29.4
	A. ingens	Red Apple	28.9
	A. smithii	Lilly Pilly	39
	Rhodamnia argentea	Malletwood	31.4
	Syzygium australe	Brush Cherry	35.7
	S. corynanthum	Sour Cherry	31.6
	S. crebrinerve	Purple Cherry	31.6
	S. luehmanii	Riberry	31

Family	Species	Common name	Latitude of southern limit
	S. oleosum	Blue Lilly Pilly	34.4
Passifloraceae	*Passiflora herbertiana*	Native Passionfruit sp.	36.2
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	38.3
Rhamnaceae	*Alphitonia excelsa*	Red Ash	36.2
Rosaceae	*Rubus rosifolius*	Native Raspberry	38.1
Rubiaceae	*Morinda jasminoides*	Morinda	38.3
Sapindaceae	*Diploglottis australis*	Native Tamarind	34.6
Sapotaceae	*Planchonella australis*	Black Apple	34.4
Solanaceae	*Solanum aviculare*	Kangaroo Apple	Tasmania
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree	36.7
	D. photinophylla	Shining-leaved Stinging Tree	33.5
Viscaceae	*Notothixos cornifolius*	Kurrajong Mistletoe	33.5
Vitidaceae	*Cissus hypoglauca*	Five-leaf Water Vine	38.2

Figure 8: Observed fruit bearing trees used as feeding trees for flying foxes. Source: Ranking the feeding habitats of Grey-headed flying foxes for conservation management (DCCEW 2008).

ELA have recommended that the above listed trees and shrubs are not to be used as in the landscaping in and immediately around the proposed built areas in an effort to discourage the flying foxes from foraging in close proximity to the future urban areas. This is in response to the SOFAC comment B1.7 (vi) from Wollongong City Council.

Of the above listed preferred flying fox feed trees, the following species are characteristic of the remnant vegetation community recorded within the development site.

- *Angophora floribunda*
- *Corymbia maculata*
- *Eucalyptus amplifolia*
- *Eucalyptus botryoides <–> saligna*
- *Eucalyptus paniculata*
- *Eucalyptus pilularis*
- *Eucalyptus tereticornis*
- *Alphitonia excelsa*
- *Diospyros pentamera*
- *Ficus macrophylla subsp. macrophylla*
- *Ficus obliqua*
- *Melia azedarach*
- *Pittosporum undulatum*
- *Syzygium australe*
- *Livistona australis*

- *Maclura cochinchinensis*
- *Melodinus australis*
- *Passiflora herbertiana subsp. herbertiana*

The Vegetation Management Plan (VMP) (ELA 2024) for the development site will prioritise these preferred flying fox feed species for revegetation works where this does not encourage direct interactions of flying-foxes with the residents. Exotic trees such as Privet and Camphor laurel may present roosting habitat for GHFF and as such established exotic trees over 8 m high should be staged in their removal or potentially retained if that retention does not impede implementation of the VMP programme. Staging of removal may require some proportion of revegetation be moved into the maintenance period.

Similarly, the species listed in Figures 6 and 7 have been sent to the project landscaping consultants with the instruction to avoid planting these species in development areas outside of the VMP area. This precaution would be implemented to discourage flying foxes using vegetation in proposed built up areas to reduce human/flying fox interaction and prevent harm to the flying foxes.

The proposed revegetation occurs along the western extent of the proposed subdivision and ties into the existing creekline near Towradgi Creek. The camp is currently positioned downstream of a human-made dam that was used a settling pond during the operation of the cokeworks facility. As part of the construction process, the dam will be dewatered. The current proposed alternative water body is Towradgi Creek, which is to be re-aligned and rehabilitated from its current highly disturbed state and will include a section that will form a permanent pool at point adjacent to the GHFF roost (Figure 2). The realigned water body must be in place prior to dam de-watering occurring of the original dam.

6.2. Additional vegetation management measures

- All vegetation management works are to be conducted in line with current and future flying fox Threatened Species Licences.
- **Condition 10** of the Sewer Lead in works licence states: In the area denoted as the typical camp extent of the flying-fox camp as shown in Figure 5

    i. Vegetation/trees providing habitat for the flying-fox camp must not be felled, lopped or have large branches removed if it has not been identified in the Sewer lead-in Works, Stage 1 and 2-4 Bulk Earthworks and Demolition works for alteration (as per Figure 5 and Figure 6).

    ii. Vegetation/trees that are within the area identified in the Sewer lead-in Works, Stage 1 and 2-4 Bulk Earthworks and demolition works (within the development footprint and Construction Buffer area identified in Figure 5 and Figure 6) must not be felled, lopped or have large branches removed when flying foxes are in them or within 30 m of the vegetation/tree being felled, lopped or modified, or when flying-foxes are within a distance where they are likely to be harmed by the vegetation/tree that is being felled, lopped or modified (which may include a distance >30 m).

- Vegetation management in the core camp habitat will be carried out by suitably qualified and experienced bush regenerators, with at least one supervisor knowledgeable about flying-fox habitat requirements and experienced in working under a camp.
- Vegetation modification, including weed removal, will not alter the conditions of the site such that it becomes unsuitable flying-fox habitat for Level 1.
- Weed removal should follow a mosaic pattern, maintaining refuges in the mid- and lower storeys at all times.
- Weed control in the core habitat area will be undertaken using methods to minimise time in the core habitat for most effective outcomes. This may include the use of machinery in accordance with conditions of the Threatened Species licence. .
- Species selected for revegetation within the VMP area will be consistent with the Illawarra Lowlands Grassy Woodland habitat on site.
- Landscape maintenance outside the core habitat must be conducted in accordance with the Threatened Species Licences.

7. Camp management actions – operational phase

7.1. Education and awareness programs

A comprehensive and targeted flying-fox education and awareness program would be developed to provide accurate information to the local community about flying-foxes. The program will include:

- Grey-headed Flying-fox ecology and behaviour.
- Camp dynamics and numbers.
- Ways to manage risk to human health.
- Alleviate concerns regarding health and safety issues.
- Program of works proposed for the camp .
- Procedure for community feedback.

The aim of establishing an education program is to improve community understanding of flying-fox issues and alleviate community concerns about the presence of the camp. The education and awareness program would be developed and appended to this plan for implementation once the subject land is in its operational phase.

7.2. Access and signage

Access to the camp from the residential development should be restricted to prevent residents entering the camp area and encountering flying foxes. Signage should be installed at various points around the Grey-headed Flying-fox camp to promote public awareness about the camp.

7.3. Vegetation management

7.3.1. Mowing and other machinery use

Mowing and using brush-cutters within core habitat will be managed under strict protocols to promote vegetation regrowth and prevent disturbance to the camp. Regrowth should be monitored and managed by bush regeneration practices (see below) to promote native species, rather than weeds, as part of the Vegetation Management Plan. Chainsaws may only be used when the cause is to reduce a health and safety risk situation (e.g., unstable tree). Chippers must not be used within 75 m of the camp. Mowing, brush cutting or use of other powered machinery (chainsaws, chippers) will be permitted in adjacent areas (within the 100 m buffer off the development and retained lands) to maintain grass with scattered trees under strict protocols. All other adjacent landscape works must operate mindful of impacts to the camp and refer to stop work triggers for operation.

7.4. Incident management protocols

This management option involves implementing protocols for managing incidents or situations specific to particular camps. Such protocols may include 'flying-fox watch' patrols at sites that host vulnerable people, management of pets at sites popular for walking dogs, or preparation for heat stress incidents (when the camp is subjected to extremely high temperatures leading to flying-foxes changing their behaviour and/or dying).

7.5. Participation in research

Legacy Property have engaged Eco Logical Australia to monitor the camp on a monthly basis. Monthly monitoring commenced in 2019 and is anticipated to continue. Camp monitoring includes population estimates by conducting fly-out counts at dusk when the flying-foxes are exiting the camp for their nightly foraging activities and mapping of camp extent to document any changes to the area of occupation.

7.6. Buffers

During the rezoning process, a 100 m buffer from the core extent of the Grey-headed Flying-fox was established. The intention of the buffer is to provide an area that does not contain foraging resources for the Grey-headed Flying-fox, or human infrastructure, that together will minimise potential interactions between the flying-foxes and humans. The DCP includes provisions for the inner 50% of the buffer (closest to the camp) to be void of any structures that would encourage human use. The buffer may involve planting low-growing or spiky plants between the residential subdivision and the camp. The plantings could create a visual buffer between the camp and residences and make access to the camp difficult.

The DCP includes provisions for the outer 50 m of the buffer to include recreational structures such as play equipment.

To facilitate the establishment of the buffer, it is recommended that the current vegetation and dam are removed using a staged approach and when the camp is not occupied (i.e. winter and early spring).

A clearing program must be established and appended to this plan to ensure that any clearing is conducted to minimise direct and indirect harm to any resident Grey-headed Flying-fox.

7.7. Performance criteria

This Plan will be successful if the following measures are satisfied, as determined by annual reporting to DPIE as per licensing requirements:

- no harm to the flying-foxes other than through natural processes
- low levels of conflict with current or future users, as measured by complaints
- camp sustained in situ (as determined by monitoring – see Section 7.2)
- no roosting in unsuitable habitat
- improved amenity (less rubbish and weeds than currently present).

One complaint a month or less when the camp is occupied is considered to reflect low levels of conflict. If complaints escalate, the plan may require review.

7.8. Monitoring and reporting

Monthly camp counts are currently being conducted by ELA. It is recommended that monthly camp counts continue during the construction phase and for one year following the completion of construction activities. Monitoring could be completed quarterly following the one year anniversary of completion of works. All information will be provided to NSW DCCEEW to assist in their management of GHFF issues in the region.

7.9. Plan review triggers

If monitoring indicates that these performance criteria are not being satisfied, this will trigger a review of the Plan. Other factors that would trigger a review include changes to relevant policy/legislation

- new management techniques becoming available
- outcomes of research that may influence the Plan
- incidents associated with the camp.

Results of each review will be included in reports for submission to Council. If the Plan is to remain current, a full review will be completed after five years following the completion of construction. The revision is necessary to determine ongoing long-term management requirements that will be effective for the camp as conditions and information change.

If the number of individuals occupying the camp increases by 200 % from the core numbers (estimated at 350 individuals) this plan must be reviewed immediately and updated to determine the best response. The purpose of reviewing the plan when an influx occurs is to ensure that the response is appropriate to the size, extent and use of the camp.

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7.10. Completion of new MP for operational phase

A new GHFF MP will be prepared for the operational phase of the development. This revised MP will include all of the above listed measures and be adapted to include any additional lessons learnt through the construction phase or changes that may have occurred with GHFF populations more broadly over time.

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APPENDIX A – THREATENED SPECIES LICENSE DOC24/644921-3 FOR STAGE 1 BULK EARTHWORKS DA (DA-2023/166)

Department of Climate Change, Energy, the Environment and Water

Adrian Kilburn
Project Director
LEGACY PROPERTY
LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
45/25 Martin Place
Sydney NSW 2000

Date: 9 August 2024
Our ref: DOC24/644921-3
Licence number: DOC24/644921-3
Contact: Lorraine Oliver 02 6229 7120

Dear Mr Kilburn,

Subject: **Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development – Stage 1 Bulk Earthworks DA2023/166.**

I refer to your application to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) dated 16 July 2024 (emailed 17 July 2024) for a Threatened Species Licence (TS Licence), a class of Biodiversity Conservation Licence under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act), for potential impacts to the on-site grey-headed flying-fox camp relating to the proposed Corrimal Cokeworks residential and commercial development (GDA94 Latitude: -34.378589, Longitude: 150.90239). Specifically, the TS Licence application was for a licence to manage impacts from the following stages of development:

- Stage 1 Bulk Earthworks – DA-2023/166.

DCCEEW understands the aim of the actions referred to in the TS Licence application is to prepare the Corrimal Cokeworks site for the establishment of a future residential and commercial development. DCCEEW understands this TS Licence application is only for site preparation actions and not for construction of the proposed residential and commercial development.

This TS Licence is separate to any development approvals, and any conditions associated with such approvals, relating to the Corrimal Cokeworks residential and commercial development.

This TS Licence and conditions are for the Stage 1 Bulk Earthworks – DA-2023/166. As discussed, where applicable the TS Licence conditions will remain consistent across the breadth of TS Licences issued for this development and will only change when an aspect of the staged development impacts differently on the on-site grey-headed flying-fox camp.

The TS Licence conditions account for the following possible scenarios regarding the grey-headed flying-fox:

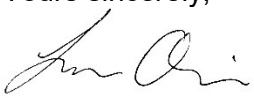
1. Camp occupation
2. Signs of breeding in an occupied camp
3. Proximity of works to the camp
    a. Any on-site works
    b. Any works 75-200 metres from the edge of the occupied camp
    c. Any works within 75 metres of the edge of the occupied camp, and including the occupied camp footprint and the previously-mapped core camp extent (as per Figure 1 in the TS Licence application)

Based on the information provided to DCCEEW by Legacy Property, I have assessed your TS Licence application for the proposed Stage 1 Bulk Earthworks – DA-2023/166in accordance with the provisions of the BC Act and the *Biodiversity Conservation Regulation 2017* and determined that the proposed action is not likely to significantly affect threatened species or their habitats if conducted in accordance with the conditions attached to this TS Licence.

A copy of your new biodiversity conservation TS Licence is enclosed. Please note that your TS Licence is subject to conditions. These conditions are outlined in the TS Licence. It is an offence under s2.14(4) of the BC Act to breach a condition of a TS Licence.

A public register of all biodiversity conservation licences and all decisions made to vary, suspend or cancel those licences can be viewed at https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/threatened-species-licences

If you have any further questions regarding this matter, please contact me on 02 6229 7120 or at Lorraine.oliver@environment.nsw.gov.au.
Yours sincerely,



LORRAINE OLIVER
Senior Team Leader, Ecosystems and Threatened Species
South East Branch, DCCEEW Biodiversity and Conservation

Threatened Species Licence

Biodiversity Conservation Act 2016

Threatened species licence, a class of biodiversity conservation licence under Part 2 of the *Biodiversity Conservation Act 2016*, to:

- harm or pick a threatened species, threatened ecological community or protected plant or animal
- and/or damage habitat of a threatened species or threatened ecological community

Licence number: **DOC24/644921-3**
Date granted: **9th August 2024**
Date of expiry: **9th August 2029**

Granted To:

LEGPRO 70 Pty. Ltd. ATF LEGPR 70 Unit Trust
ABN: 62 744 723 737
45/25 Martin Place
Sydney NSW 2000

DESCRIPTION OF PROPOSED ACTION
The proposed action:
Legacy Property are proposing a residential and commercial development within the subject land (GDA94 Latitude: -34.378589 Longitude: 150.90239 Wollongong LGA). Stage 1 of the proposed development is 3.63 ha in size and is positioned in the northeast of the subject land. The proposed development includes:

- Bulk earthworks using heavy machinery
- Tree and vegetation removal
- Ancillary works including compounds, access, parking, fencing and sediment management.

DCCEEW understands these works have been approved as per the Land and Environment Court Notice of Orders Made, granting consent subject to the conditions specified in Annexure A as determined 30 July 2024 (Case number 2023/00447943, dated 30 July 2024). Legacy Property have advised Stage 1 Bulk Earthworks – DA-2023/166 “will involve the following activities:

- Site establishment including but not limited to site compounds and on-site parking areas;
- Establishment of sediment and erosion control measures in accordance with the requirements of managing Urban Stormwater handbook (commonly referred to as the ‘Blue Book’ prepared by Landcom (2004);
- Protection and removal of existing trees within the site;
- Bulk earthworks operations to achieve design levels including preliminary box out roads and construction of protective pavement for construction access; and

- Material stockpile within the future Stage 2 area of the site."

DCCEEW notes conditions within the Land and Environment Court's Grant of Consent relevant to the grey-headed flying-foxes and their habitat include, but are not necessarily limited to, Conditions 3, 4, 21, 50 and 68.

This TS Licence applies only to the Stage 1 Bulk Earthworks – DA-2023/166 and not to the construction of the proposed residential and commercial development. This licence only applies to grey-headed flying-foxes and grey-headed flying-fox habitat.

RELEVANT CONDITIONS

The holder of the certificate must ensure that

1. Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated
2. Any incident/s of harmed/dead grey-headed flying-foxes
    a. Must be reported immediately to a local wildlife carer group for welfare response and collection
    b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
    c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes
3. At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).
4. If the camp is **deemed empty** of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert
5. When the grey-headed flying-fox camp is occupied and on-site actions are planned:
    a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for
        - Grey-headed flying-fox numbers
        - The camp footprint
        - The distance from on-site actions to the camp
        - General health of flying-foxes (including signs of malnourishment)
        - Signs of breeding including
            - The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant.
            - Birthing or lactating females
            - Females carrying young
            - Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
            - Courtship and/or mating behaviours

- Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps

b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site actions have commenced

   i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request

6. Signs of stress in the grey-headed flying-foxes are defined as any of the following

   - More than 30% of the camp takes flight and remains in flight for more than 20 minutes
   - Saliva spreading (i.e. licking themselves other than for grooming)
   - Grey-headed flying-foxes located on or within 2 metres of the ground
   - Aborting young
   - Dependant young abandoned for greater than 20 minutes during the day
   - An increase in the number of flying-foxes being taken into local care
   - Harmed/dead flying-fox/es found under or adjacent to the camp
   - New grey-headed flying-fox camps forming within 5 kilometres of the on-site actions

7. If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken**. Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery. This also includes the stockpiling of materials within the future Stage 2 area of the site (refer to Condition 8 for works 75-200 metres from the edge of the camp).

8. If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp**,
   a. In addition to on-site personnel continuous monitoring requirements (Condition 7) a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

   b. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

      i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)

      ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to monitor for signs of stress and advise site-managers on response

c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

    i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

    ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

    iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

    iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

    v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW

9. If the grey-headed flying-fox camp is occupied, for any works **within 75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

    a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

    b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted

    c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

        i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress

        ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

        iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day

        iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works

causing the signs of stress are appropriate to continue or should be deferred to a later date.

v. All signs of stress incidents and responses for works within 75 metres of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au

d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 metres of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.

e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately

10. When temperatures are predicted to be above 35°C

    a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including
        - Panting
        - Saliva spreading (i.e. licking themselves other than for grooming)
        - Grey-headed flying-foxes located on or within 2 metres of the ground
        - Grey-headed flying-foxes clumping around tree trunks
        - Grey-headed flying-foxes on the ground
        - Grey-headed flying-foxes dying

    b. Should any signs of heat-stress be noted,

        i. On-site actions that cause any disturbance to the camp must cease immediately

        ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

11. When temperatures are predicted to be above 38°C

    a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease

    b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress

    c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

12. A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage

    a. Minimise disturbance within 200 metres of the grey-headed flying-fox camp

    b. Monitor for signs of stress

c. Cease actions should the grey-headed flying-foxes show signs of stress

13. New grey-headed flying-fox camps that establish within 5 kilometres of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.
14. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including
    - Information about camp occupation dates
    - Grey-headed flying-fox numbers
    - The camp footprint (providing maps to show any temporal and spatial changes)
    - The distance from on-site actions to the camp
    - Signs of breeding (providing details on what signs were observed)
    - General health of flying-foxes (including signs of malnourishment)
    - Any stress incidents and responses
    - Feedback on flying-fox responses to any works undertaken within 75 metres of the edge of the camp (including details on what the works were, and what the immediate and short-term responses were)
    - Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management

Note it is an offence under s2.14(4) of the *Biodiversity Conservation Act 2016* to breach a condition of a licence.

LORRAINE OLIVER

Senior Team Leader, Ecosystems and Threatened Species

South East Branch, DCCEEW Biodiversity and Conservation Illawarra

(by Delegation)
9 August 2024

APPENDIX B – THREATENED SPECIES LICENSE DOC24/536883-5 FOR DEMOLITION DA (DA22/1249)

Department of Climate Change, Energy, the Environment and Water

Adrian Kilburn
Project Director
LEGACY PROPERTY
LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
45/25 Martin Place

Sydney NSW 2000

Date: 9 July 2024
Our ref: DOC24/536883-5
Licence number: DOC24/536883-5
Contact: Lorraine Oliver 02 6229 7120

Dear Mr Kilburn,

Subject: **Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development – Demolition Development Application (DA) – DA-2022/1249.**

I refer to your application to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) dated 22 May 2024 (with emailed amendment documentation 22 May 2024) for a Threatened Species Licence (TS Licence), a class of Biodiversity Conservation Licence under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act), for potential impacts to the on-site grey-headed flying-fox camp relating to the proposed Corrimal Cokeworks residential and commercial development (GDA94 Latitude: -34.378589, Longitude: 150.90239). Specifically, the TS Licence application was for a TS Licence to manage impacts from the following stages of development:

- Demolition Development Application (DA) – DA-2022/1249
- Sewer lead-in works

DCCEEW understands the aim of the actions referred to in the TS Licence application is to prepare the Corrimal Cokeworks site for the establishment of a future residential and commercial development. DCCEEW understands this TS Licence application is only for site preparation actions and not for construction of the proposed residential and commercial development.

This TS Licence is separate to any development approvals, and any conditions associated with such approvals, relating to the Corrimal Cokeworks residential and commercial development.

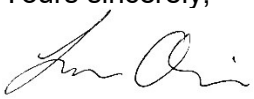
To provide clear guidance and conditions for each stage of the development we have treated the TS Licence applications for Demolition Development Application (DA) – DA-2022/1249 and the Sewer lead-in works separately. This TS Licence and conditions are for Demolition Development Application (DA) – DA-2022/1249. As discussed, where applicable the TS Licence conditions will remain consistent across the breadth of TS Licences issued for this development and will only change when an aspect of the staged development impacts differently on the on-site grey-headed flying-fox camp.

I have assessed your TS Licence application for the proposed Demolition Development Application (DA) – DA-2022/1249 in accordance with the provisions of the BC Act and the *Biodiversity Conservation Regulation 2017* and, based on the information provided to DCCEEW by Legacy property in the application, have determined that the proposed action is not likely to significantly affect threatened species or their habitats if conducted in accordance with the conditions attached to this TS Licence.

A copy of your new biodiversity conservation TS Licence is enclosed. Please note that your TS Licence is subject to conditions. These conditions are outlined in the TS Licence. It is an offence under s2.14(4) of the BC Act to breach a condition of a TS Licence.

A public register of all biodiversity conservation TS Licences and all decisions made to vary, suspend or cancel those TS Licences can be viewed at www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/threatened-species-licences

If you have any further questions regarding this matter, please contact me on 02 6229 7120 or at Lorraine.oliver@environment.nsw.gov.au.
Yours sincerely,



LORRAINE OLIVER
Senior Team Leader, Ecosystems and Threatened Species
South East Branch, DCCEEW Biodiversity and Conservation

Threatened Species Licence

Biodiversity Conservation Act 2016

Threatened species licence, a class of biodiversity conservation licence under Part 2 of the *Biodiversity Conservation Act 2016*, to:

- harm or pick a threatened species, threatened ecological community or protected plant or animal
- and/or damage habitat of a threatened species or threatened ecological community

Licence number: **DOC24/536883-5**
Date granted: **9th July 2024**
Date of expiry: **9th July 2029**

Granted To:

LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
ABN: 62 744 723 737
45/25 Martin Place
Sydney NSW 2000

DESCRIPTION OF PROPOSED ACTION

The proposed action:

Legacy Property are proposing a residential and commercial development within the subject land (GDA94 Latitude: -34.378589 Longitude: 150.90239 Wollongong LGA). Prior to development the site requires demolition works. Large existing remnant structures of the former Corrimal Cokeworks present on the site require demolition, with some structures proposed to be retained. The site consists of batteries, conveyors, storage tanks, stacks, offices, quench towers and warehouses. Generally, these structures will be demolished using 25t - 48t excavators, systematically shearing the infrastructure to the ground in a safe and controlled manner. The structures will be processed into smaller, more manageable sizes before transport to a laydown and processing area on site, all of which will occur > 200 m from the resident grey-headed flying-fox colony.

This licence applies only to the preparatory demolition works as described in Demolition Development Application (DA) – DA-2022/1249 and not to the construction of the proposed residential and commercial development. This licence only applies to grey-headed flying-foxes and grey-headed flying-fox habitat.

RELEVANT CONDITIONS

The holder of the certificate must ensure that

1. Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated
2. Any incident/s of harmed/dead grey-headed flying-foxes
    a. Must be reported immediately to a local wildlife carer group for welfare response and collection
    b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
    c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes
3. At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).
4. If the camp is **deemed empty** of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert
5. When the grey-headed flying-fox camp is occupied and on-site actions are planned:
    a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for
        - Grey-headed flying-fox numbers
        - The camp footprint
        - The distance from on-site actions to the camp
        - General health of flying-foxes (including signs of malnourishment)
        - Signs of breeding including
            - The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant.
            - Birthing or lactating females
            - Females carrying young
            - Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
            - Courtship and/or mating behaviours
            - Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps
    b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site actions have commenced

i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request

6. Signs of stress in the grey-headed flying-foxes are defined as any of the following

   - More than 30% of the camp takes flight and remains in flight for more than 20 minutes
   - Saliva spreading (i.e. licking themselves other than for grooming)
   - Grey-headed flying-foxes located on or within 2 metres of the ground
   - Aborting young
   - Dependant young abandoned for greater than 20 minutes during the day
   - An increase in the number of flying-foxes being taken into local care
   - Harmed/dead flying-fox/es found under or adjacent to the camp
   - New grey-headed flying-fox camps forming within 5 kilometres of the on-site actions

7. If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken**. Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery.

8. If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp**,
   a. In addition to on-site personnel continuous monitoring requirements (Condition 7) a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

   b. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

      i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)

      ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to monitor for signs of stress and advise site-managers on response

   c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

      i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

      ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

      iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW

9. If the grey-headed flying-fox camp is occupied, for any works **within 75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

    a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

    b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted

    c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

        i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress

        ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

        iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day

        iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works causing the signs of stress are appropriate to continue or should be deferred to a later date.

        v. All signs of stress incidents and responses for works within 75 metres of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au

    d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 metres of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.

e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately

10. When temperatures are predicted to be above 35°C
    a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including
        - Panting
        - Saliva spreading (i.e. licking themselves other than for grooming)
        - Grey-headed flying-foxes located on or within 2 metres of the ground
        - Grey-headed flying-foxes clumping around tree trunks
        - Grey-headed flying-foxes on the ground
        - Grey-headed flying-foxes dying
    b. Should any signs of heat-stress be noted,
        i. On-site actions that cause any disturbance to the camp must cease immediately
        ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately
11. When temperatures are predicted to be above 38°C
    a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease
    b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress
    c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately
12. A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage
    a. Minimise disturbance within 200 metres of the grey-headed flying-fox camp
    b. Monitor for signs of stress
    c. Cease actions should the grey-headed flying-foxes show signs of stress
13. New grey-headed flying-fox camps that establish within 5 kilometres of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.
14. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including
    - Information about camp occupation dates
    - Grey-headed flying-fox numbers

- The camp footprint (providing maps to show any temporal and spatial changes)
- The distance from on-site actions to the camp
- Signs of breeding (providing details on what signs were observed)
- General health of flying-foxes (including signs of malnourishment)
- Any stress incidents and responses
- Feedback on flying-fox responses to any works undertaken within 75 metres of the edge of the camp (including details on what the works were, and what the immediate and short-term responses were)
- Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management

Note it is an offence under s2.14(4) of the *Biodiversity Conservation Act 2016* to breach a condition of a licence.



LORRAINE OLIVER

Senior Team Leader, Ecosystems and Threatened Species

South East Branch, DCCEEW Biodiversity and Conservation Illawarra

(by Delegation)
9 July 2024

APPENDIX C – THREATENED SPECIES LICENSE DOC24/537230-3 FOR SEWER LEAD-IN WORKS

Department of Climate Change, Energy, the Environment and Water

Adrian Kilburn
Project Director
LEGACY PROPERTY
LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
45/25 Martin Place

Sydney NSW 2000

Date: 9 July 2024
Our ref: DOC24/537230-3
Licence number: DOC24/537230-3
Contact: Lorraine Oliver 02 6229 7120

Dear Mr Kilburn,

Subject: **Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development – Sewer lead-in Works.**

I refer to your application to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) dated 22 May 2024 (with emailed amendment documentation 22 May 2024) for a Threatened Species Licence (TS Licence), a class of Biodiversity Conservation Licence under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act), for potential impacts to the on-site grey-headed flying-fox camp relating to the proposed Corrimal Cokeworks residential and commercial development (GDA94 Latitude: -34.378589, Longitude: 150.90239). Specifically, the TS Licence application was for a licence to manage impacts from the following stages of development:

- Demolition Development Application (DA) – DA-2022/1249
- Sewer lead-in works

DCCEEW understands the aim of the actions referred to in the TS Licence application is to prepare the Corrimal Cokeworks site for the establishment of a future residential and commercial development. DCCEEW understands this TS Licence application is only for site preparation actions and not for construction of the proposed residential and commercial development.

This TS Licence is separate to any development approvals, and any conditions associated with such approvals, relating to the Corrimal Cokeworks residential and commercial development.

To provide clear guidance and conditions for each stage of the development we have treated the TS Licence applications for Demolition Development Application (DA) – DA-2022/1249 and the Sewer lead-in works separately. This TS Licence and conditions are for the Sewer lead-in works. As discussed, where applicable the TS Licence conditions will remain consistent across the breadth of TS Licences issued for this development and will only change when an aspect of the staged development impacts differently on the on-site grey-headed flying-fox camp.

The TS Licence conditions account for the following possible scenarios regarding the grey-headed flying-fox:

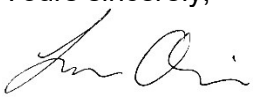
1. Camp occupation
2. Signs of breeding in an occupied camp
3. Proximity of works to the camp
    a. Any on-site works
    b. Any works 75-200 metres from the edge of the occupied camp
    c. Any works within 75 metres of the edge of the occupied camp, and including the occupied camp footprint and the previously-mapped core camp extent (as per Figures 1 and 2 in the TS Licence application)

Based on the information provided to DCCEEW by Legacy Property, I have assessed your TS Licence application for the proposed Sewer lead-in Works in accordance with the provisions of the BC Act and the *Biodiversity Conservation Regulation 2017* and determined that the proposed action is not likely to significantly affect threatened species or their habitats if conducted in accordance with the conditions attached to this TS Licence.

A copy of your new biodiversity conservation TS Licence is enclosed. Please note that your TS Licence is subject to conditions. These conditions are outlined in the TS Licence. It is an offence under s2.14(4) of the BC Act to breach a condition of a TS Licence.

A public register of all biodiversity conservation licences and all decisions made to vary, suspend or cancel those licences can be viewed at www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/threatened-species-licences

If you have any further questions regarding this matter, please contact me on 02 6229 7120 or at Lorraine.oliver@environment.nsw.gov.au.
Yours sincerely,



LORRAINE OLIVER
Senior Team Leader, Ecosystems and Threatened Species
South East Branch, DCCEEW Biodiversity and Conservation

Threatened Species Licence

Biodiversity Conservation Act 2016

Threatened species licence, a class of biodiversity conservation licence under Part 2 of the *Biodiversity Conservation Act 2016*, to:

- harm or pick a threatened species, threatened ecological community or protected plant or animal
- and/or damage habitat of a threatened species or threatened ecological community

Licence number: **DOC24/537230-3**
Date granted: **9th July 2024**
Date of expiry: **9th July 2029**

Granted To:

LEGPRO 70 Pty. Ltd. ATF LEGPR 70 Unit Trust
ABN: 62 744 723 737
45/25 Martin Place
Sydney NSW 2000

DESCRIPTION OF PROPOSED ACTION
The proposed action:
Legacy Property are proposing a residential and commercial development within the subject land (GDA94 Latitude: -34.378589 Longitude: 150.90239 Wollongong LGA). Prior to development the site requires sewer lead-in works, including the removal of the existing disused pipeline and installation of the new sewer pipeline to be trenched. DCCEEW understands these works have been approved by Sydney Water as the proponent and determining authority (Sydney Water Approval Case No. 178698 dated 28/3/23). Legacy Property have advised “these works are relatively small scale, however they include construction and earthworks in close proximity to the flying fox camp”.

The detailed scope of works includes:
- Installation of a new sewer pipeline to be trenched. A 10m construction corridor has been assumed for the portions of the pipeline requiring trenching
- Installation of maintenance holes 5 x 5m
- Open trenching (50m development corridor) to facilitate the removal of the disused pipeline (4.3ha of impact)
- Storage of topsoil, spoil and quarry materials immediately adjacent to the excavated area.
- 50m x 50m launch and retrieval pad, including overflow and evacuation footprint.

The proposed heavy machinery to be used to support underboring and trenching will include:
- Excavators
- Bobcat
- Bogie
- Flatbed truck

Additional machinery may be used that will ensure that only similar low impacts occur to the soil. Other ancillary tools and machinery may be required to undertake the works including pumps, generators, utility vehicles, jack hammers/rock hammering equipment, hand tools etc.

This TS Licence applies only to the sewer lead-in works and not to the construction of the proposed residential and commercial development. This licence only applies to grey-headed flying-foxes and grey-headed flying-fox habitat.

RELEVANT CONDITIONS

The holder of the certificate must ensure that

1. Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated
2. Any incident/s of harmed/dead grey-headed flying-foxes
    a. Must be reported immediately to a local wildlife carer group for welfare response and collection
    b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
    c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes
3. At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).
4. If the camp is **deemed empty** of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert
5. When the grey-headed flying-fox camp is occupied and on-site actions are planned:
    a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for
        - Grey-headed flying-fox numbers
        - The camp footprint
        - The distance from on-site actions to the camp
        - General health of flying-foxes (including signs of malnourishment)
        - Signs of breeding including
            - The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant.
            - Birthing or lactating females
            - Females carrying young
            - Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
            - Courtship and/or mating behaviours

- Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps

b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site works have commenced

   i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request

6. Signs of stress in the grey-headed flying-foxes are defined as any of the following

   - More than 30% of the camp takes flight and remains in flight for more than 20 minutes
   - Saliva spreading (i.e. licking themselves other than for grooming)
   - Grey-headed flying-foxes located on or within 2 metres of the ground
   - Aborting young
   - Dependant young abandoned for greater than 20 minutes during the day
   - An increase in the number of flying-foxes being taken into local care
   - Harmed/dead flying-fox/es found under or adjacent to the camp
   - New grey-headed flying-fox camps forming within 5 kilometres of the on-site actions

7. If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken**. Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery.

8. If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp**,
   a. In addition to on-site personnel continuous monitoring requirements (Condition 7) a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

   b. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

      i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)

      ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to monitor for signs of stress and advise site-managers on response

c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

    i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

    ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

    iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

    iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

    v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW

9. If the grey-headed flying-fox camp is occupied, for any works **within 75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

    a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

    b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted

    c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

        i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress

        ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

        iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day

        iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works

causing the signs of stress are appropriate to continue or should be deferred to a later date.

v. All signs of stress incidents and responses for works within 75 metres of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au

d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 metres of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.

e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately

10. In the area denoted as the potential extent of the flying-fox camp as shown in Figure 1 (as provided in the TS Licence application)

    a. Vegetation/trees providing habitat for the flying-fox camp must not be felled, lopped or have large branches removed if it has not been identified in the **Sewer lead-in Works** for alteration (as per Figure 2 provided in the TS Licence application).

    b. Vegetation/trees that are within the area identified in the **Sewer lead-in Works** (within the Trenching and Disused Pipeline Construction Buffer area identified in Figure 2) must not be felled, lopped or have large branches removed when flying-foxes are in them or within 30 metres of the vegetation/tree being felled, lopped or modified, or when flying-foxes are within a distance where they are likely to be harmed by the vegetation/tree that is being felled, lopped or modified (which may include a distance >30 metres).

11. When temperatures are predicted to be above 35°C

    a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including
        - Panting
        - Saliva spreading (i.e. licking themselves other than for grooming)
        - Grey-headed flying-foxes located on or within 2 metres of the ground
        - Grey-headed flying-foxes clumping around tree trunks
        - Grey-headed flying-foxes on the ground
        - Grey-headed flying-foxes dying

    b. Should any signs of heat-stress be noted,

        i. On-site actions that cause any disturbance to the camp must cease immediately

        ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

12. When temperatures are predicted to be above 38°C
    a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease
    b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress
    c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately
13. A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage
    a. Minimise disturbance within 200 metres of the grey-headed flying-fox camp
    b. Monitor for signs of stress
    c. Cease actions should the grey-headed flying-foxes show signs of stress
14. New grey-headed flying-fox camps that establish within 5 kilometres of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.
15. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including
    - Information about camp occupation dates
    - Grey-headed flying-fox numbers
    - The camp footprint (providing maps to show any temporal and spatial changes)
    - The distance from on-site actions to the camp
    - Signs of breeding (providing details on what signs were observed)
    - General health of flying-foxes (including signs of malnourishment)
    - Any stress incidents and responses
    - Feedback on flying-fox responses to any works undertaken within 75 metres of the edge of the camp (including details on what the works were, and what the immediate and short-term responses were)
    - Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management

Note it is an offence under s2.14(4) of the *Biodiversity Conservation Act 2016* to breach a condition of a licence.



LORRAINE OLIVER

Senior Team Leader, Ecosystems and Threatened Species

South East Branch, DCCEEW Biodiversity and Conservation Illawarra

(by Delegation)
9 July 2024

APPENDIX D – GREY-HEADED FLYING-FOX MONITORING DATA

Date	Survey effort	Observations
18 July 2019	Not documented	No individuals or signs of Grey-headed Flying-fox
26 July 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
8 August 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
23 August 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
6 September 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
20 September 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
4 October 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
25 October 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
15 November 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
22 November 2019	3 person hours, count	100 – 200 individuals observed
5 December 2019	1 person hour, count	200 – 350 individuals observed
12 December 2019	1 person hour, count	250 – 450 individuals observed
10 January 2020	2 person hours, count	Influx recorded, numbers estimated to have significantly increased
22 January 2020	6 person hours, static count and fly out watch	4,000 – 5,000 flying-foxes recorded (flyout) and estimated 5,208 flying-foxes during static count
29 January 2020	4 person hours, fly out watch, camp extent mapping	3,321 -5,831 flying-foxes recorded, camp extent mapped
19 February 2020	4 person hours, fly out watch	940 – 5,241 flying-foxes recorded (flyout).
24 March 2020	Fly out	Approx. 500
23 April 2020	Fly out	Approx 600
13 May 2020	Fly out	2
23 July 2020	Fly out	None observed
2 September 2020	Fly out	None observed
October 2020	Passive observation	Flying-foxes present in low numbers (>5)
3 November 2020	Passive observation	Approx. 50, camp size reduced
11 November 2020	Passive observation	Approx. 50, camp size reduced
6 December 2020	Fly out	Approx. 300
21 January 2021	Fly out	Approx. 200
2 February 2021	Fly out	Approx. 450 – 650
30 March 2021	Fly out	Approx. 450 – 500
13 April 2021	Fly out	Approx. 130
10 May 2021	Fly out	Approx 200

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Date	Survey effort	Observations
2 June 2021	Fly out	Approx 30 – 50
29 June 2021	Fly-out	One (1)
10 August 2021	Fly-out	Approx 11
28 September 2021	Fly-out	Three (3) noting that the team observed these could have been from another adjacent camp
26 October 2021	Fly-out	Approx 9
3 November 2021	Fly-out	Approx 150
12 December 2021	Fly-out	Approx 150 (noting weather could have compromised count)
January 2022	No count due to poor weather	No count
25 February 2022	Fly-out	Approx 50
30 March 2022	Fly-out	Approx 12
26 April 2022	Fly out	Approx 3
31 May 2022	Fly -out	No individuals identified, noting the weather was suboptimal for surveys
14 June 2022	Fly-out	Approx 48
14 July 2022	Fly out	None observed
15 August 2022	Fly out	None observed
27 September 2022	Fly out	Approx. 30
27 October 2022	Fly out	Approx. 155-165
29 November 2022	Fly out	Approx. 190
20 December 2022	Fly out	Approx. 35
23 January 2023	Fly out	Approx. 80
15 February 2023	Fly out	Approx.280
22 February 2023	Fly out	Approx. 260
1 March 2023	Fly out	Approx. 560
8 March 2023	Fly out	Approx. 290
15 March 2023	Fly out	Approx. 525
11 April 2023	Fly-out	Approx. 1200
21 April 2023	Day time count in tree canopies	Approx. 550
27 April 2023	Fly out	Approx. 2000
02 May 2023	Fly-out	Approx. 3500
09 May 2023	Fly-out	Approx. 4500
16 May 2023	Fly-out	Approx. 2600
26 May 2023	Fly-out	None observed

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Date	Survey effort	Observations
31 May 2023	Fly-out	None observed
06 June 2023	Fly-out	None observed
14 June 2023	Fly-out	None observed
20 June 2023	Fly-out	None observed
27 June 2023	Fly-out	None observed
6 July 2023	Fly-out	None observed
20 July 2023	Fly-out	None observed
26 July 2023	Fly-out	None observed
03 August 2023	Fly-out	None-observed
09 August 2023	Fly-out	None observed
17 August 2023	Fly-out	None observed
24 August 2023	Fly-out	None-observed
31 August 2023	Fly-out	None-observed
06 September 2023	Fly-out	None-observed
14 September 2023	Fly-out	Approx. 14
21 September 2023	Fly-out	Approx. 25
28 September 2023	Fly-out	Approx. 21
6 October 2023	Fly out	Approx. 20
13 October 2023	Fly out	None observed, noting survey was ceased early due to strong wind and heavy rain
19 October 2023	Fly out	Approx. 228. Camp present behind the dam
25 October 2023	Fly-out	Approximately 620
7 November	Fly-out	439
18 April 2024	Daytime roost survey	250-300.
25 April 2024	Daytime roost survey	250-300.
3 May 2024	Daytime roost survey	Approx. 500
10 May 2024	Daytime roost survey	450-500
17 May 2024	Daytime roost survey	450-500
22 May 2024	Daytime roost survey	450-500
30 May 2024	Daytime roost survey	450-550
05 June 2024	Daytime roost survey	150
14 June 2024	Daytime roost survey	100-120
21 June 2024	Daytime roost survey	0
28 June 2024	Daytime roost survey	0
5 July 2024	Daytime roost survey	0

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Date	Survey effort	Observations
12 July 2024	Daytime roost survey	0
16 July 2024	Daytime roost survey	None-observed
24 July 2024	Daytime roost survey	None-observed
1 August 2024	Daytime roost survey	None-observed
9 August 2024	Daytime roost survey	None-observed
5 September 2024	Daytime roost survey	None-observed
12 September 2024	Daytime roost survey	None-observed
16 September 2024	Daytime roost survey	None-observed
24 September 2024	Daytime roost survey	None-observed

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APPENDIX E – GREY-HEADED FLYING-FOX COMBINED MONTHLY MONITORING REPORT

Corrimal Cokeworks Grey-headed Flying Fox Monitoring Report			
TO	NSW Department of Climate Change, Energy, the Environment and Water		
FROM	Eco Logical Australia Pty Ltd.		
DATE	11 July 2024	PURPOSE	Monthly monitoring report
SUBJECT	Corrimal Cokeworks Grey-headed Flying Fox Monthly Monitoring Report		

This monitoring report is prepared to satisfy the *NSW Biodiversity Conservation Act 2016* (BC Act) Threatened Species Licence DOC24/536883-5 (issued on 9 July 2024) that Legacy Property Development Pty Ltd hold for the implementation of the demolition works at the Corrimal Cokeworks development Site. Previously, demolition works were undertaken under licence DOC23/597669-1, however this licence was cancelled on 20 May 2024. The demolition works have been approved under DA-2022/1249 and the conditions of the DA require that the works are to be undertaken in accordance with the Threatened Species Licence.

One of the requirements of the licence is that weekly monitoring of the camp is to occur when the GHFF camp is present and works are being undertaken on the site. Clause 5 of the licence states licence:

When the Grey-headed Flying-fox camp is occupied. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for:

- Grey-headed flying-fox numbers
- The camp footprint
- The distance from on-site actions to the camp
- General health of flying-foxes (signs of malnourishment)
- Signs of breeding including:
    - The presence of female flying-foxes in late-stage pregnancy
    - Birthing or lactating females
    - Females carrying young
    - Dependant young
    - Courtship or mating behaviour
    - Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps.

A monthly report to DPE is also required under the licence as per condition 13 (DOC23/597669-1) and condition 14 (DOC24/536883-5):

A suitably qualified ecologist/flying-fox expert will provide monthly reports to DPE on commencement of the action including Information about camp occupation dates;

- Grey-headed flying-fox numbers
- The camp footprint

- The distance from on-site actions to the camp
- Signs of breeding
- General health of flying-foxes (signs of malnourishment)
- Any stress incidents and responses
- Report successes and failures in managing signs-of-stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management.

Demolition works commenced in November 2023. Legacy have advised that demolition works are currently complete as of 11 July 2024. Demolition supervision to monitor the flying foxes for signs of stress by ELA ecologists was undertaken on 20 and 26 February 2024 during demolition of structures within 76-200m of the flying fox camp and the Chimney stack. This supervision report is provided in Attachment A. Weekly monitoring of the camp commenced 18 April 2024. The results of the weekly monitoring are provided in Table 1. The approximate recorded extent of the flying fox camp is show in Figure 1.

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Figure 1: Flying fox camp extent as at 5 June 2024

Table 1: Monitoring results

Date	Number of flying foxes (approximate)	Distance from on-site actions to the camp	Dependent young	Signs of breeding	Signs of malnourishment	Any stress incidents, responses.
18 April 2024	250	>200m.	Absent	No	No	Flying foxes became slightly disturbed by presence of ecologists. They were vocal and were observed briefly flying to different trees an a few occasions – approximately 10 flying foxes at a time. However, were able to settle quickly. No prolonged circling in flight occurred.
24 April 2024	350	>200m	Absent	Yes, one pair appeared to be mating during inspection	No	None
03 May 2024	500+	>200m	Absent	Yes, one pair appeared to be mating during inspection	No	Minor disturbance as ecologists walked underneath roosting trees.
10 May 2024	450-500	>200m	Absent	Yes, four pairs appeared to be mating during inspection	No	No
17 May 2024	450-500	>200m	Absent	Yes, at least ten pairs appeared to be mating during inspection	No	No
22 May 2024	450-500	>200m	Absent	Yes, three pairs appeared to be mating during inspection	No	No
30 May 2024	450-550	>200m	Absent	Yes, at least two pairs appeared to be mating during inspection	No	No
5 June 2024	150	>200m	Absent	None	No	No
14 June 2024	100-120	>200m	Absent	None	No	Flying foxes were largely condensed to three trees on the site. The few that were in neighbouring trees were active, crawling and swinging, however did not take flight. Movement likely attributed to morning, post foraging restlessness prior to sleep.

Date	Number of flying foxes (approximate)	Distance from on-site actions to the camp	Dependent young	Signs of breeding	Signs of malnourishment	Any stress incidents, responses.
21 June 2024	0	>200m	-	-	-	-
28 June 2024	0	>200m	-	-	-	-
5 July 2024	0	>200m	-	-	-	-

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ATTACHMENT A – ECO LOGICAL AUSTRALIA – CORRIMAL COKEWORKS CLEARANCE REPORT

8/14 Stennett Road
Ingleburn
NSW 2565
t: (02) 8579 5185

29 April 2024

Our ref: 23GWS 6652

Legacy Property
Level 45, 25 Martin Place
Sydney, NSW 2000

Attention: Thomas Kent

Dear Thomas,

Clearance supervision report – Threatened species supervision

Eco Logical Australia (ELA) was engaged by Legacy Property to conduct threatened species supervision during building demolition for the proposed development of the Corrimal Cokeworks site. This task was completed to satisfy the conditions of consent (DA-2022/1249) granted by Wollongong City Council as well as actions outlined in the Corrimal Cokeworks Microbat Management Plan (MMP) and Grey-headed Flying-fox Management Plan (GHFFMP), both prepared for Legacy Property by ELA in 2022.

Summary of results

Prior to clearance of buildings previously identified on site to contain Large Bent-winged Bat (*Miniopterus orianae oceanensis*) daily pre-clearance inspections for signs of microbat species were conducted to ensure no microbats were present prior to building demolition.

Buildings that were removed within the 76-200 metre buffer zone indicated in the GHFFMP (ELA 2022b) were completed under the supervision of ELA Ecologists to ensure minimal disturbance occurred to the Grey-headed Flying-fox colony. A brief pre-clearance survey was undertaken prior to building removal and then on-going monitoring of the Flying foxes for the remainder of the building demolition.

Results are provided in Appendix A and Appendix B provides maps and photos. If you have any questions about this report, please do not hesitate to contact me on jake.webb@ecoaus.com.au or 0482 860 875.

Regards,

Jake Webb
Project Manager

REFERENCES:

Eco Logical Australia 2022a. *Corrimal Cokeworks Microbat Management Plan.* Prepared for Legacy Property, dated 19 April 2023.

Eco Logical Australia 2022b. *Corrimal Residential Development Grey-headed Flying-fox Management Plan.* Prepared for Legacy Property, Dated 29 June 2023.

Department of Planning and Environment 2023*. Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development,* dated 29 June 2023.

Eco Logical Australia 2024. *Corrimal Cokeworks Pre-clearance Microbat Activity.* Addressed to Thomas Kent, dated 5 February 2024*.*

Appendix A: Requirements Addressed and Results

REQUIREMENTS ADDRESSED

Requirements to be addressed are derived from the conditions of consent within DA-2022/1249

Condition	Task
2. Project Ecologist	*A project ecologist shall be engaged for the duration of the works and oversee all demolition and associated works that may disturb or harm threatened species across the broader site, including Grey-headed Flying-foxes and Large Bent-winged Bats.*
3. Microbat Management Plan	*The Microbat Management Plan, prepared by Ecological Australia and dated 19 April 2023 is to be implemented in its entirety under the supervision of the appointed project ecologist.*

METHODOLOGY AND RESULTS

Microbat Supervision

Prior to the scheduling of works a pre-clearance microbat survey was completed by use of ultrasonic detectors, as outlined in the MMP (ELA 2022a). The summary letter of these works (ELA 2024) identified that there was no evidence of roosting colonies within the Cokeworks area at the time.

However, prior to the demolition of buildings that had been identified in the MMP (ELA 2022a) as containing Large Bent-wing bat, a brief pre-clearance inspection was completed on 14 February 2024 by ELA ecologist John Foster. This inspection was completed to identify any signs of roosting microbat species and to confirm that no roosting microbat species were present. During this survey, no signs indicating microbat presence were identified.

The demolition of the structure was completed in a staged approach under the guidance of the ecologist. The building was sectionally dismantled with periodic inspections of the building and surrounds to ensure no fauna was present. An excavator with a shear was used to remove portions of the roofing and beams before removing the remaining portion of the building. During these works, an underground tunnel was identified that continued to an adjacent building. A portion of the adjacent building was also removed, however the underground sections remained.

On 14 March 2024, ELA ecologist Jake Webb supervised the removal of the remaining underground structure of the adjacent building. A brief pre-clearance survey was completed, during to confirm that there were no microbats present. Removal of the remaining structure was completed by an excavator with grab attachments under the supervision of the ecologist and no microbats or signs of microbats were identified.

Grey-headed Flying-fox Supervision

No works were scheduled to occur within 75m from the GHFF camp and therefor the 76 – 200m buffer was applied as per the GHFFMP (ELA 2022b). This was done to ensure that demolition of the buildings result in minimal disturbance to the GHFF population. As per the GHFFMP (ELA 2022b), works conducted within 76 – 200m of the camp requires supervision by ecologists to ensure the welfare of the population. The demolition of two structures (one pump house and one concrete water tank), identified as D14 in

Figure 1, was completed within the 76 – 200m buffer zone on 20 February 2024 under the supervision of ELA ecologists Tim Finter and John Foster.

An initial survey of the GHFF camp was completed by ELA ecologist Tim Finter immediately prior to works. This was undertaken to determine the location of the population and assess their behaviour for signs of stress as derived from the Department of Planning and Environment Threatened species licence, dated 25 August 2023. This information collected prior to demolition starting was used as a base level to determine whether the flying foxes become stressed during the structure removal.

A brief pre-clearance survey of the two structures approved for removal as well as the surrounding areas was also completed by ELA ecologist John Foster immediately prior to works. No fauna as identified within the structures and demolition was cleared to commence.

Throughout the demolition process ELA ecologist remained in close proximity to the GHFF camp to monitor the behaviour of the flying-foxes. Another ELA ecologist, remained at the demolition site to supervise the removal of the structures. The ecologists remained in contact via 2-way UHF communication to inform of any changes to the camps behaviour.

The two structures were removed sectionally by an excavator with either a grab attachment or bucket. This allowed the slower and more controlled removal of the structures ensuring disturbance to the GHFF camp was minimised.

Throughout the removal of both structures the GHFF camp showed no signs of stress due to the removal of the two structures.

Once demolition was completed a final survey of the GHFF population, and immediate surrounds, was completed to ensure the welfare of the camp. No GHFF were identified to show any signs of stress during the demolition or after works were completed.

On 26 February 2024 ELA ecologist Kody Kemp, was on site to supervise the removal of a chimney stack, Identified in Figure 1 as D9. The removal of this stack was outside of the 200-metre buffer zone but was being felled towards the edge of the buffer zone boundary and had potential to cause a louder than normal noise for the area briefly. Due to these factors an ecologist was requested to be on site to monitor the GHFF population during this time. The GHFF camp was surveyed to assess for any signs of stress and create a base level for monitoring during the removal. The ecologist was in frequent communication via 2-way Radio with the contractors responsible for demolishing the structure. The stack was felled and the GHFF camp showed no signs of stress during works, leading up to and after the felling. Once the stack was felled another survey of the area was completed by the ecologist to ensure no GHFF were observed to show signs of stress or had become separated from the camp. No signs of stress or separation were identified.

PERMITS AND LICENSES

ELA is accredited as an 'Animal Research Establishment' under the NSW *Animal Research Act 1985*. In addition, ELA holds a Biodiversity Conservation Licence under Part 2, Division 3 of the *Biodiversity Conservation Act 2016*. Copies of the relevant permits and licenses can be provided if required.

Appendix B: Site map and Photos



Figure 1: Site map



Figure 2: Removal of structure previously identified as containing microbats



Figure 3: Removal of structure previously identified as containing microbats



Figure 4: Inspection of building previously identified as containing microbats



Figure 5: Demolition of building adjacent to microbat habitat building



Figure 6: Removal of structure within GHFF buffer zone



Figure 7: Removal of structure within GHFF buffer zone



Figure 8: Stack building preparing to be felled



Figure 9: Stack after being felled



Figure 10: Grey-headed Flying-fox camp in-situ



Figure 11: Grey-headed Flying-fox camp in-situ

APPENDIX F – GREY-HEADED FLYING-FOX INDUCTION MATERIAL

Grey-headed Flying Fox inspections

Frank Lemckert

17/7/2024



Inspection requirements

a) Map the location of the bats.

b) Number of bats present.

c) Tree occupancy.

d) Presence of juvenile bats.

e) Evidence of mating.

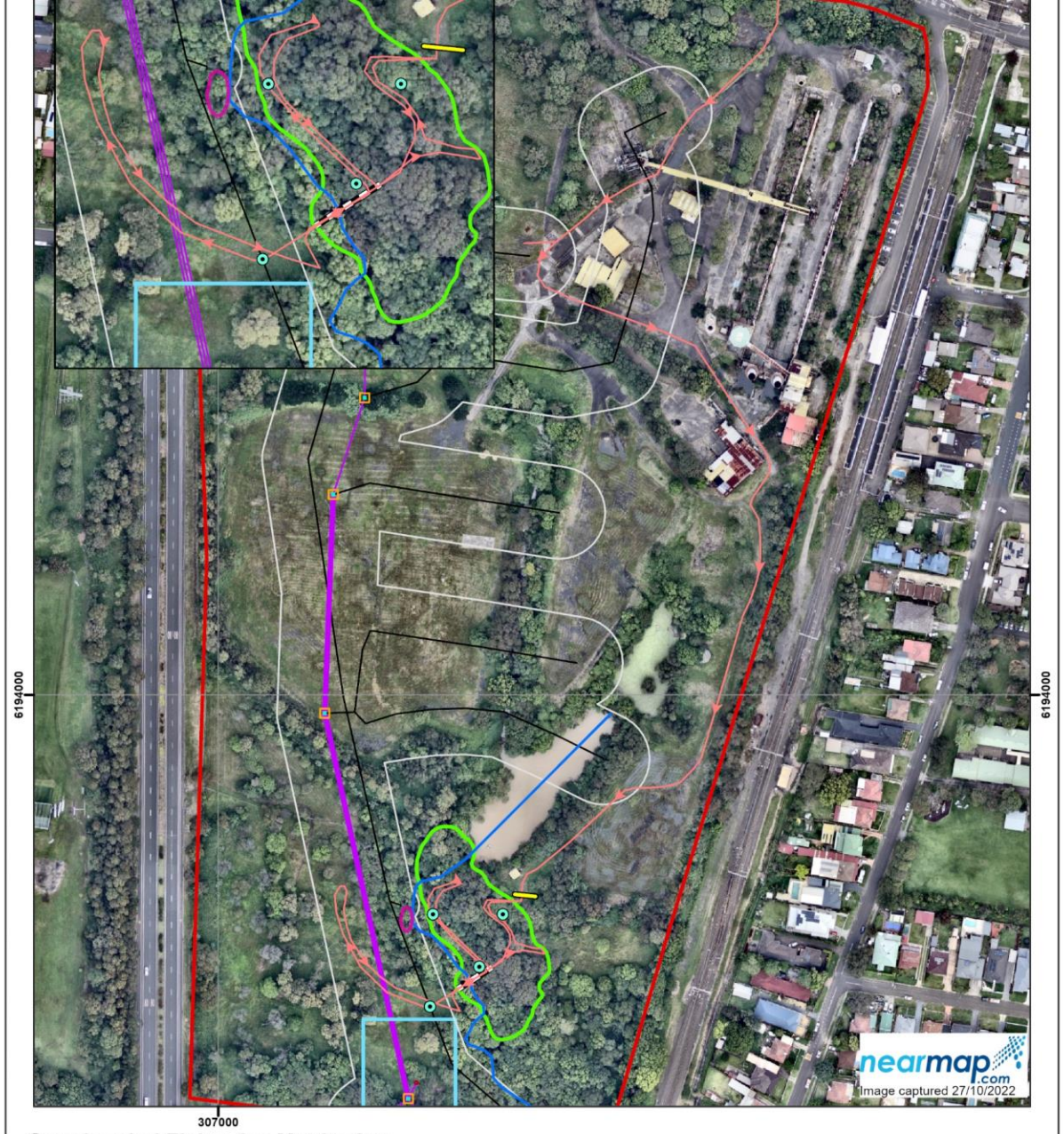
f) Signs of sick or dead bats.

g) Signs of bat disturbance.

A spreadsheet with the required fields for filling in will be made available.

This must be read in conjunction with the GHFF licence and Plan of Management for all details.





Presence and location of bats in the camp

Suitably qualified personnel inspect the camp site daily prior to work commencing and report signs of occupation (check license for details – required qualifications vary depending on works).

Walk the transect in the adjacent figure to determine and record the presence/ absence of bats and take photos at designated points to ensure consistent monitoring.

If bats are absent, note on the available spreadsheet, filling in all relevant fields (e.g. time, date, staff names).

If bat are present, undertake the camp assessment process as per the following slides and using the available spreadsheet.

Provide that information to the project ecologist.

The information is required to inform management decisions based on the License and Grey-headed Flying-fox Management Plan prepared for the site.

Record any other threatened fauna/flora that are seen incidentally during the inspection.

Number of bats present

Record number of bats present as accurately as you can – count individual bats if possible, but approximate numbers may be needed.

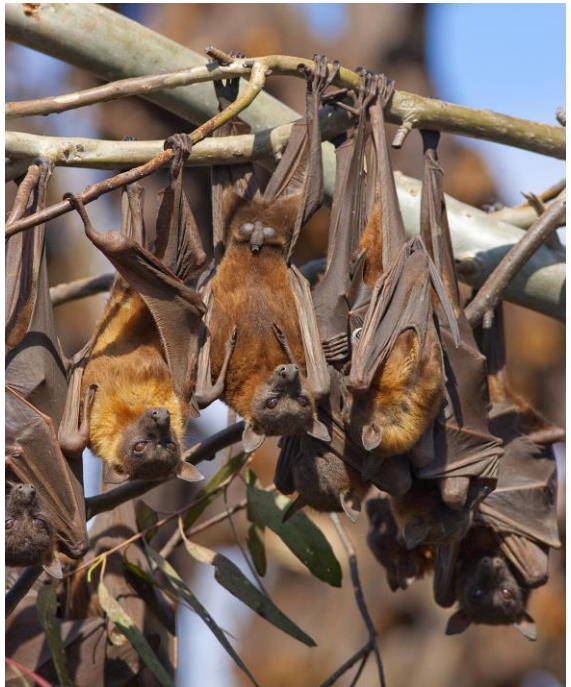
Record the location and extent of bats present and take a photograph.

If bats are in distinct groups, record the number of bats in each group, take a photograph and map the extent of each group.

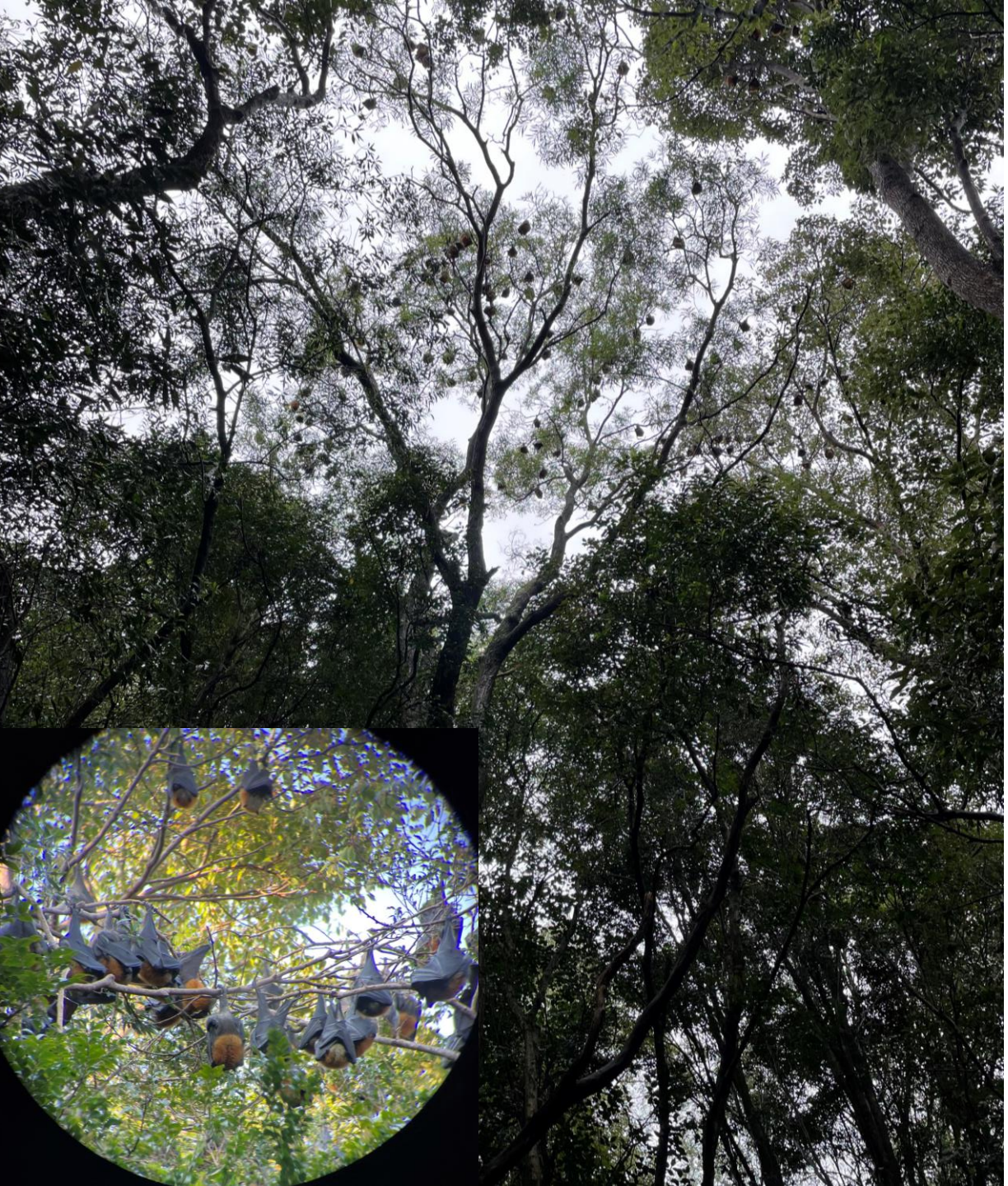
Confirm all bats are Grey-headed Flying-foxes (large with grey heads, reddish necks and black bodies) – Little Red Flying-foxes (smaller and uniform reddish colour; lower left) and Black Flying-foxes (same size as Grey-headed Flying-foxes, but all black; lower right) may use the camp. Record separately. Photos can help with confirming identification.

Field surveys will be assisted by having at least binoculars available and preferably a camera with a telephoto lens.









Tree occupancy

Record the species of trees being used by the bats at the time of the inspection.

Record the roosting height of the bats, which may change in different environmental conditions, particularly heat waves.

This information is important to understand if bats are using specific trees preferentially and if the use different types of trees at different time. This can help with decisions on bush regeneration approaches and core areas for the colony.

Presence of mating bats and juvenile bats

All parts of the colony should be observed for 5 minutes to record any mating, juvenile or likely pregnant female bats.

Mating behaviour is relatively obvious, with males testing the reproductive status of the females (top left) and then, if receptive, copulating (bottom left).

Heavily pregnant females should have distended bellies and perhaps identifiably enlarged nipples.

Juvenile bats may be present as individuals clinging to the mother's chest (images on right) or as smaller bats left in a creche.

Record the timing and location of any observed mating, juvenile bats or likely pregnant female bats – use the provided spreadsheet.

Take a photograph, if possible.





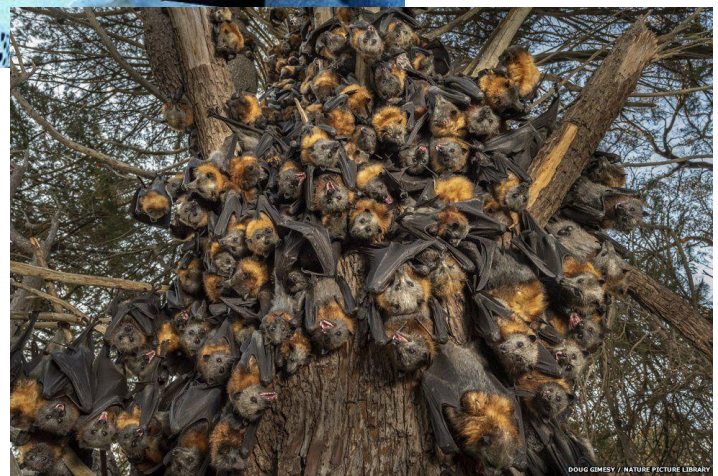












Check for malnourished, sick and dead bats

Check ground and trees for dead, injured, sick or malnourished bats (dead bats do not automatically fall to the ground).

Take a photo and record the location of dead bats and contact the approved bat expert for next steps – DO NO TOUCH THE BAT.

Sick/injured bats have poorly coordinated movements, blood on fur or injuries such as limp or badly torn wings.

Malnourished bats will be obviously skinny.

Heat stressed bats will cluster in lower, shaded places (bottom right). They may also pant and lick their wings to cool down.

For sick or injured bats, take photo and record location and observed illness/injury as per spreadsheet. Call WIRES or vet to attend the bat. Consult with approved bat expert. DO NOT TOUCH THE BAT.

The presence of sick or injured bats must be recorded and the approved bat expert notified immediately, who will notify DCCEEW.

Signs of stress and disturbance



- More than 30% of the camp takes flight and remains in flight for more than 20 minutes
- Saliva spreading (i.e. licking themselves other than for grooming) or fanning their wings continuously
- Grey-headed flying-foxes located on or within 2 m of ground
- Aborted young
- Dependant young abandoned for greater than 20 minutes during the day
- An increase in the number of flying-foxes being taken into local care (from local carers)
- Harmed/dead flying-fox/es found under or adjacent to the camp
- New grey-headed flying-fox camps forming within 5 km of the Cokeworks (from local information sources)

Signs of stress and disturbance



Record bat activity and any signs of stress. If no stress then proceed with works.

If stress is observed:

- Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

  ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

  iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

  iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

  v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW.



Signs of stress and disturbance

The colony should typically be noisy, but bats should be mostly (>90%) hanging in the trees relaxing.

Individual bats will constantly take flights around the camp, but that is normal if they are short flights.

Stress can occur because of noise, visual disturbance or heat. This is evident as bats flying more than usual (as above) or by excessive panting and flapping of wings to cool themselves (top right).

Record temperatures – if 35°C is expected or exceeded, work must follow the license protocol (following slide).

Again, if young are observed, works must not commence and a flying fox expert informed immediately. Works stop until a decision can be made by the expert on how to proceed.







Hot days procedure

When temperatures are predicted to be above 35°C

a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including:

– Panting

– Saliva spreading (i.e. licking themselves other than for grooming)

– Grey-headed flying-foxes located on or within 2 metres of the ground

– Grey-headed flying-foxes clumping around tree trunks

– Grey-headed flying-foxes on the ground

– Grey-headed flying-foxes dying

b. Should any signs of heat-stress be noted,

i. On-site actions that cause any disturbance to the camp must cease immediately

ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately.

When temperatures are predicted to be above 38°C

a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease

b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress

c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately





Which are Grey-headed Flying Foxes?

















ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au

Appendix H Grey-headed Flying-fox monitoring counts

Date	Survey effort	Observations
18 July 2019	Not documented	No individuals or signs of Grey-headed Flying-fox
26 July 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
8 August 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
23 August 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
6 September 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
20 September 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
4 October 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
25 October 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
15 November 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
22 November 2019	3 person hours, count	100 – 200 individuals observed
5 December 2019	1 person hour, count	200 – 350 individuals observed
12 December 2019	1 person hour, count	250 – 450 individuals observed
10 January 2020	2 person hours, count	Influx recorded, numbers estimated to have significantly increased
22 January 2020	6 person hours, static count and fly out watch	4,000 – 5,000 bats recorded (flyout) and estimated 5,208 bats during static count
29 January 2020	4 person hours, fly out watch, camp extent mapping	3,321 -5,831 bats recorded, camp extent mapped
19 February 2020	4 person hours, fly out watch	940 – 5,241 bats recorded (flyout).
24 March 2020	Fly out	Approx 500
23 April 2020	Fly out	Approx 600
13 May 2020	Fly out	2
23 July 2020	Fly out	None observed
2 September 2020	Fly out	None observed
October 2020	Passive observation	Bats present in low numbers (>5)
3 November 2020	Passive observation	Approx. 50, camp size reduced
11 November 2020	Passive observation	Approx. 50, camp size reduced
6 December 2020	Fly out	Approx 300
21 January 2021	Fly out	Approx 200
2 February 2021	Fly out	Approx 450 - 650
30 March 2021	Fly out	Approx 450 – 500
13 April 2021	Fly out	Approx 130
10 May 2021	Fly out	Approx 200
2 June 2021	Fly out	Approx 30 - 50
29 June 2021	Fly-out	One (1)

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Date	Survey effort	Observations
10 August 2021	Fly-out	Approx 11
28 September 2021	Fly-out	Three (3) noting that the team observed these could have been from another adjacent camp
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16 May 2023	Fly-out	Approx 2600
26 May 2023	Fly-out	None observed
31 May 2023	Fly-out	None observed
06 June 2023	Fly-out	None observed
14 June 2023	Fly-out	None observed
20 June 2023	Fly-out	None observed

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Date	Survey effort	Observations
27 June 2023	Fly-out	None observed
6 July 2023	Fly-out	None observed
20 July 2023	Fly-out	None observed
26 July 2023	Fly-out	None observed
03 August 2023	Fly-out	None-observed
09 August 2023	Fly-out	None observed
17 August 2023	Fly-out	None observed
24 August 2023	Fly-out	None-observed
31 August 2023	Fly-out	None-observed
06 September 2023	Fly-out	None-observed
14 September 2023	Fly-out	Approx 14
21 September 2023	Fly-out	Approx 25
28 September 2023	Fly-out	Approx 21
6 October 2023	Fly out	Approx 20
13 October 2023	Fly out	None observed, noting survey was ceased early due to strong wind and heavy rain
19 October 2023	Fly out	Approx. 228. Camp present behind the dam
25 October 2023	Fly-out	Approximately 620
7 November	Fly-out	439
18 April 2024	Daytime roost survey	250-300
25 April 2024	Daytime roost survey	250-300
3 May 2024	Daytime roost survey	Approx 500
10 May 2024	Daytime roost survey	450-500
17 May 2024	Daytime roost survey	450-500
22 May 2024	Daytime roost survey	450-500
30 May 2024	Daytime roost survey	450-550
05 June 2024	Daytime roost survey	150
14 June 2024	Daytime roost survey	100-120
21 June 2024	Daytime roost survey	0
28 June 2024	Daytime roost survey	0
5 July 2024	Daytime roost survey	0
12 July 2024	Daytime roost survey	0

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Appendix I Railway Street intersection communication

Provided as a separate document.

Gold Coast Office
S: Suite 26, 58 Riverwalk Avenue
Robina QLD 4226
M: PO Box 5102 Q Super Centre
Mermaid Waters QLD 4218
P: (07) 5562 5377
F: (07) 5562 5733
W: www.bitziosconsulting.com.au

Brisbane Office
S: Level 2, 428 Upper Edward Street
Spring Hill QLD 4000
M: Level 2, 428 Upper Edward Street
Spring Hill QLD 4000
P: (07) 3831 4442
F: (07) 3831 4455
E: admin@bitziosconsulting.com.au

Sydney Office
S: Studio 203, 3 Gladstone Street
Newtown NSW 2042
M: Studio 203, 3 Gladstone Street
Newtown NSW 2042
P: (02) 9557 6202
F: (02) 9557 6219

Our reference: P3495.002L
20 May 2019

Legacy Property
Level 27, MLC Centre
19-29 Martin Place, Sydney NSW 2000
Attention: Mike Williams
Sent via email: mwilliams@legacyproperty.com.au

Dear Mike,

RE : CORRIMAL STATION RESIDENTIAL DEVELOPMENT
ROUNDABOUT ACCESS INTERSECTION PROPOSAL

We refer to Wollongong City Council's email to you dated 9th May 2019 which requested that the access to the development be assessed as a four-leg roundabout with Harbinger Street and Railway Street.

We have modelled this intersection as a single lane roundabout with the year 2026 traffic volumes which include background traffic growth, the leagues club redevelopment and development traffic.

The SIDRA results are provided in Attachment 1 and the analysis has revealed that the four leg roundabout:

- operates with LoS of A and an average delay 7 seconds for both peak periods;
- generates a maximum 95th percentile queue on the eastern approach of 16m which means there is no chance of queueing back to anywhere near the railway level crossing; and
- generates a maximum 95th percentile queue on the western approach of 30m which means that there is no chance of queuing back to anywhere near the Memorial Drive intersection with Railway Street which is over 150m away.

Sensitivity analysis with increased traffic volumes also demonstrated acceptable performance levels, indicating that the roundabout would not impose a constraint to future growth beyond the modelled 2026 background growth plus development traffic.

We have prepared a preliminary concept plan of the roundabout in Attachment 2. This concept:

- shows no property impacts on the northern side of the road;
- shows limited intrusion into the site on its southern side;
- has a 10m diameter of which the outer 2.5m lip is mountable;
- includes pedestrian refuges;
- caters for rigid truck, garbage truck and bus movements for through movements, right turns and left turns at the roundabout; and
- does require some of the (currently unmarked) on street parking to be removed however some of this kerbside parking would be reinstated in the location of the existing site crossover.

This plan would need to be detailed further to finalise its footprint and approach and departure line marking details however the concept attached provides sufficient confidence that a single lane roundabout could be conditioned to be provided as the access for the development.

Please do not hesitate to contact me with any question regarding this letter.

Yours faithfully



Damien Bitzios
Director
BITZIOS CONSULTING

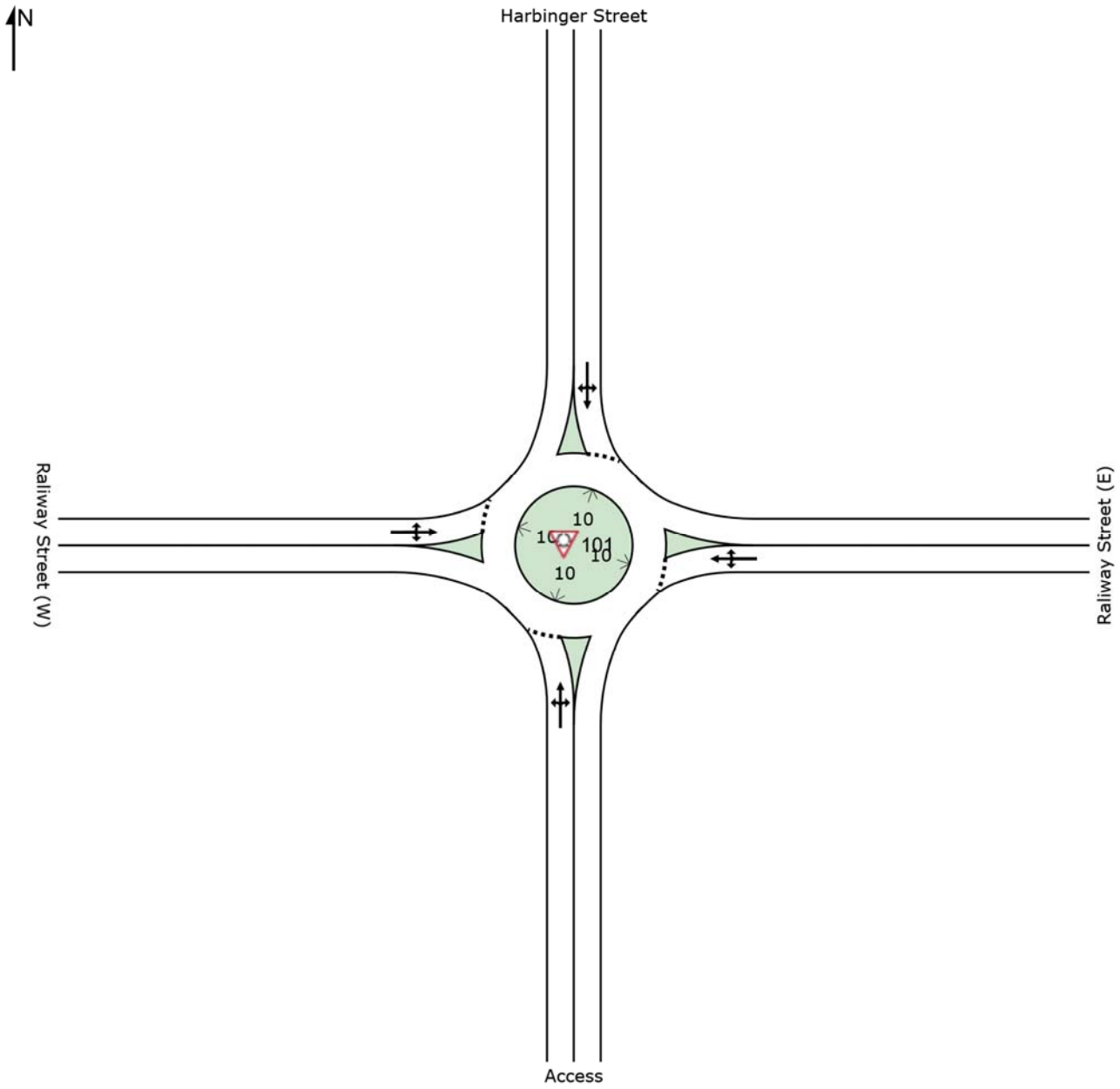
ATTACHMENT 1

SIDRA OUTPUT SUMMARIES

SITE LAYOUT

Site: 101 [Access to Development_AM-R/A]

Access to Coke Works Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Access to Development_AM-R/A]

Access to Coke Works Site
Roundabout

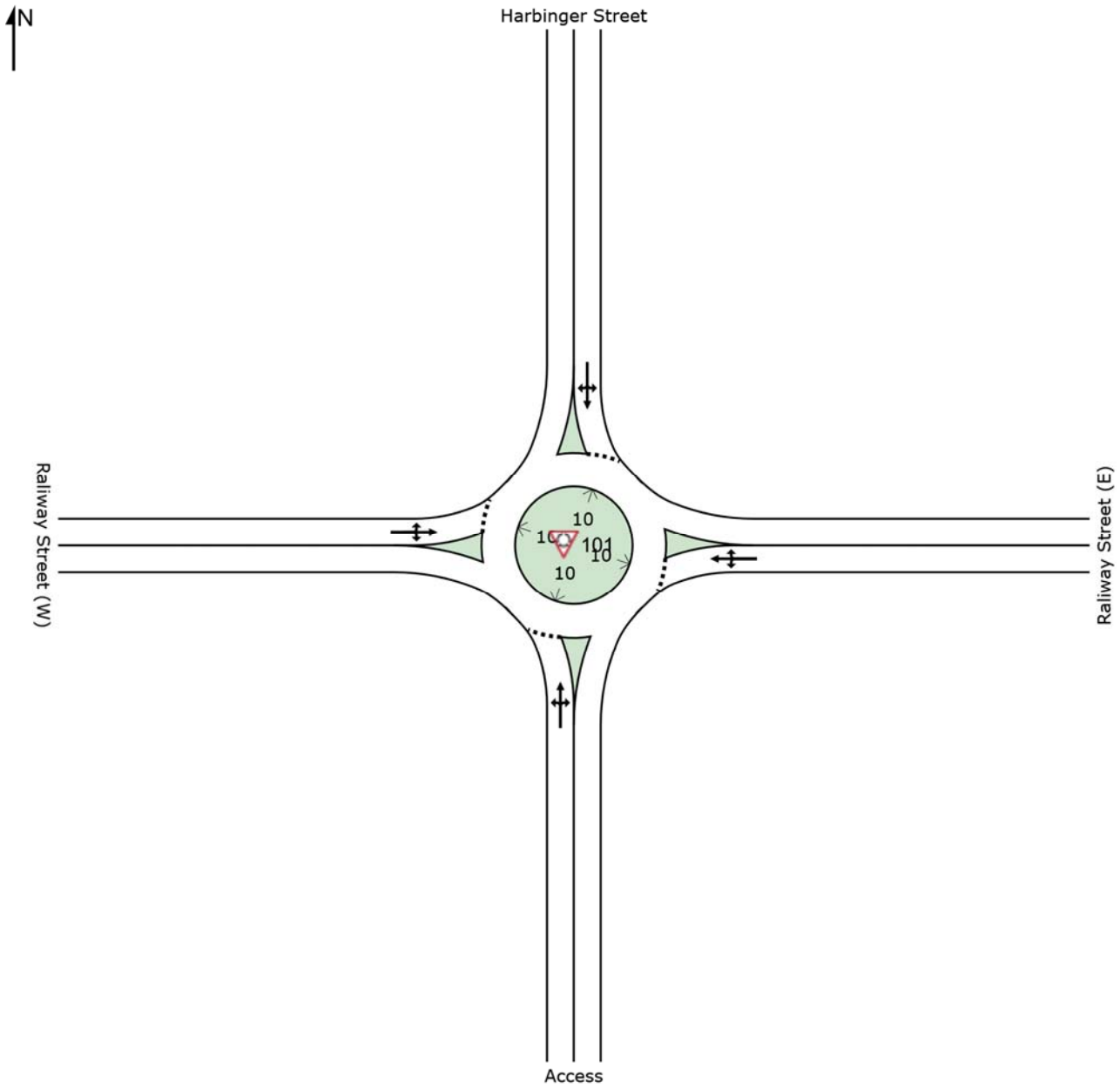
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access											
1	L2	225	2.0	0.355	7.7	LOS A	2.2	15.9	0.66	0.76	47.5
2	T1	1	2.0	0.355	7.9	LOS A	2.2	15.9	0.66	0.76	48.8
3	R2	85	2.0	0.355	11.2	LOS A	2.2	15.9	0.66	0.76	48.3
Approach		312	2.0	0.355	8.6	LOS A	2.2	15.9	0.66	0.76	47.7
East: Raliway Street (E)											
4	L2	21	5.0	0.327	5.5	LOS A	2.1	15.2	0.39	0.53	49.3
5	T1	360	5.0	0.327	5.7	LOS A	2.1	15.2	0.39	0.53	43.3
6	R2	7	5.0	0.327	9.0	LOS A	2.1	15.2	0.39	0.53	42.3
Approach		388	5.0	0.327	5.8	LOS A	2.1	15.2	0.39	0.53	43.8
North: Harbinger Street											
7	L2	7	5.0	0.090	6.9	LOS A	0.5	3.4	0.53	0.70	37.1
8	T1	1	5.0	0.090	7.1	LOS A	0.5	3.4	0.53	0.70	47.6
9	R2	72	5.0	0.090	10.4	LOS A	0.5	3.4	0.53	0.70	38.2
Approach		80	5.0	0.090	10.1	LOS A	0.5	3.4	0.53	0.70	38.3
West: Raliway Street (W)											
10	L2	34	5.0	0.284	5.1	LOS A	1.9	13.9	0.33	0.52	41.1
11	T1	256	5.0	0.284	5.4	LOS A	1.9	13.9	0.33	0.52	43.2
12	R2	65	5.0	0.284	8.7	LOS A	1.9	13.9	0.33	0.52	50.1
Approach		355	5.0	0.284	6.0	LOS A	1.9	13.9	0.33	0.52	45.0
All Vehicles		1135	4.2	0.355	6.9	LOS A	2.2	15.9	0.45	0.60	45.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Access to Development_PM-R/A]

Access to Coke Works Site
Roundabout



MOVEMENT SUMMARY

Site: 101 [Access to Development_PM-R/A]

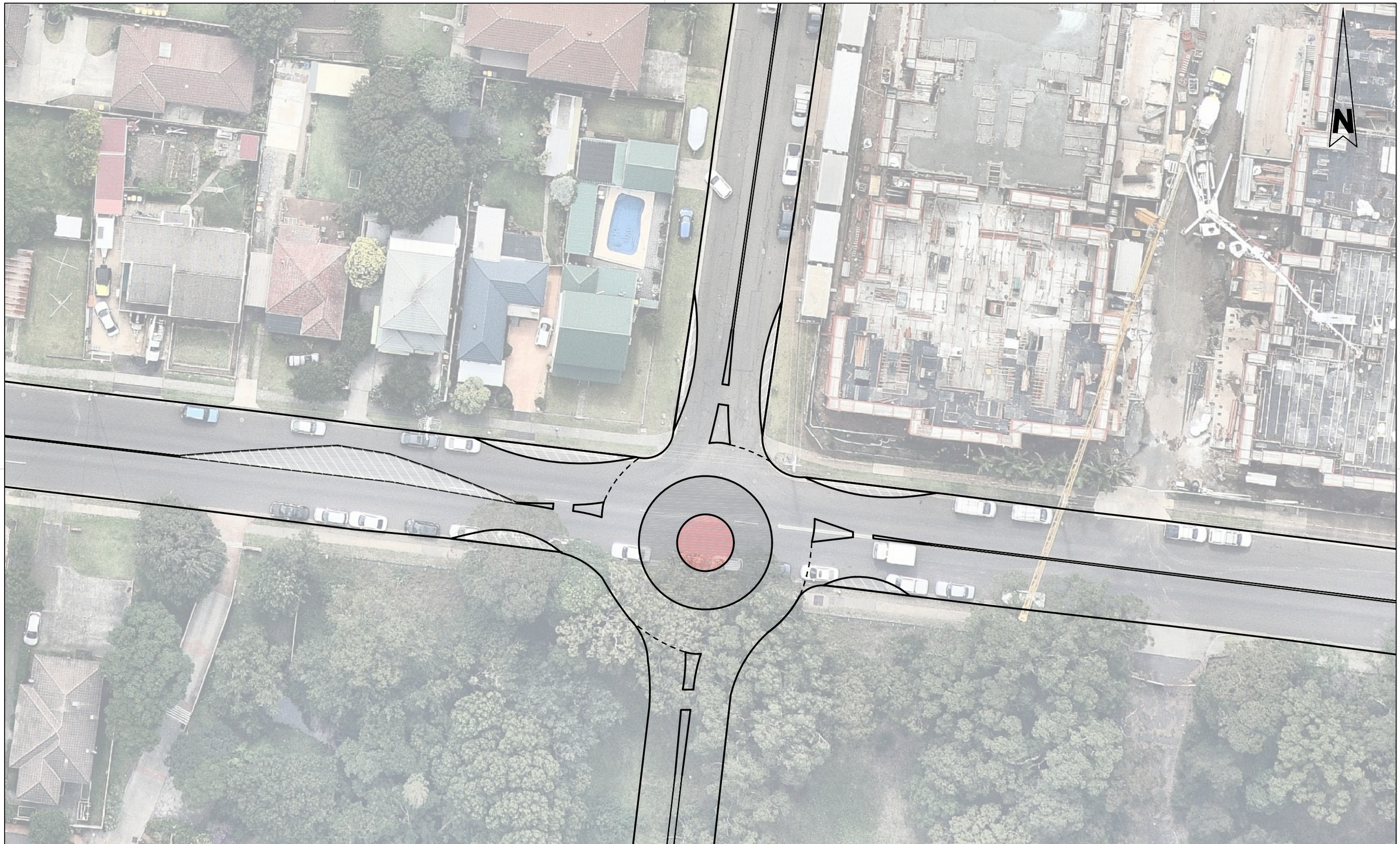
Access to Coke Works Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access											
1	L2	114	2.0	0.167	6.3	LOS A	0.9	6.7	0.51	0.65	48.7
2	T1	2	2.0	0.167	6.5	LOS A	0.9	6.7	0.51	0.65	50.0
3	R2	47	2.0	0.167	9.9	LOS A	0.9	6.7	0.51	0.65	49.5
Approach		163	2.0	0.167	7.3	LOS A	0.9	6.7	0.51	0.65	49.0
East: Raliway Street (E)											
4	L2	95	5.0	0.355	6.6	LOS A	2.2	16.2	0.56	0.65	48.6
5	T1	240	5.0	0.355	6.9	LOS A	2.2	16.2	0.56	0.65	42.1
6	R2	16	5.0	0.355	10.2	LOS A	2.2	16.2	0.56	0.65	41.1
Approach		351	5.0	0.355	7.0	LOS A	2.2	16.2	0.56	0.65	44.6
North: Harbinger Street											
7	L2	2	5.0	0.069	8.4	LOS A	0.4	2.7	0.65	0.74	35.3
8	T1	1	5.0	0.069	8.6	LOS A	0.4	2.7	0.65	0.74	46.1
9	R2	47	5.0	0.069	12.0	LOS A	0.4	2.7	0.65	0.74	36.3
Approach		51	5.0	0.069	11.7	LOS A	0.4	2.7	0.65	0.74	36.5
West: Raliway Street (W)											
10	L2	88	5.0	0.483	5.0	LOS A	4.0	29.4	0.32	0.54	40.5
11	T1	337	5.0	0.483	5.3	LOS A	4.0	29.4	0.32	0.54	42.6
12	R2	239	5.0	0.483	8.6	LOS A	4.0	29.4	0.32	0.54	49.7
Approach		664	5.0	0.483	6.4	LOS A	4.0	29.4	0.32	0.54	45.9
All Vehicles		1228	4.6	0.483	6.9	LOS A	4.0	29.4	0.43	0.59	45.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

ATTACHMENT 2

ROUNDABOUT CONCEPT PLAN



BITZIOS consulting
traffic engineering ■ transport planning

Gold Coast
Suite 26, 58 Riverwalk Avenue, Robina QLD 4226.
P: (07) 5562-5377
W: www.bitziosconsulting.com.au
Brisbane
Level 2, 428 Upper Edward Street, Spring Hill 4000.
P: (07) 3831-4442
E: admin@bitziosconsulting.com.au
Sydney
Studio 203, 3 Gladstone Street, Newtown NSW 2042.
P: (02) 9557 6202

REVISIONS

Issue	Revisions/Descriptions	Drawn	Date
001	CONCEPT DESIGN	F.K	13.05.2019

Scale @ A3 — 0 5 10 15 20 25 — 1:500

NOT TO SCALE

Project: P3495 - Corrimal Station Residential TIA (Site Access)

Title: Access to Site (Single Lane Roundabout)

Design	Drawn	Checked
F.K	F.K	T.W

CONCEPT ONLY

Date: 13.05.2019

Project Number	Sheet Number	Issue
P3495	1	001

Appendix J Microbat analysis report

Corrimal Coke Works, Microbat Ultrasonic Call Identification Report

Project Reference Number 22SYD-2750

A report prepared for Alex Gorey, Senior Ecologist, Eco Logical Australia Pty Ltd

Prepared by RA Environmental Consultants

ABN – 63 6685 875 27



Corrimal Coke Works, Microbat Ultrasonic Call Identification Report

Project Reference Number 22SYD-2750

A report prepared for Alex Gorey, Senior Ecologist, Eco Logical Australia Pty Ltd

Project aim

The assessment was undertaken to determine:

- If there are any microbats using the Corrimal Coke Works study area, and if so, which species?
- If *Myotis macropus* (Southern Myotis) are activity over the settlement dam?

The results of this assessment will inform a Biodiversity Development Assessment Report (BDAR) and determine if a microbat management plan (MMP) is necessary.

Methods

Survey effort

The Corrimal Coke Works study area (hereafter known as the study area) is located approximately ~5 km north of Wollongong's central business centre. The data received for analysis was collected on three Anabat Swift detectors that were passively deployed at five survey sites (Table 1). Each detector set to record across the entire night (e.g., from dusk to dawn). A total of 28 survey nights were achieved during this survey (Table 1).

Preparation of a candidate species list

A candidate list of microbats was prepared by completing a search of the Australian Bat Society Bat Maps (BatMap - Ausbats) and Atlas of Living Australia (Atlas of Living Australia – Open access to Australia's biodiversity data (ala.org.au)), and a review of Churchill (2008), Pennay *et al.* (2011) and Van Dyck and Strahan (2008). This search and review identified 20 microbat species

that had previously been recorded or are considered likely to occur within a 10 km radius of the study area (Appendix 1 and Appendix 2).

The study area is located within the Sydney Basin biogeographical region as described in Pennay (*et al.* 2004). To acknowledge the geographic variability among the characteristic frequency (Fc) among some microbat species, the regional characteristic frequency (Fc) of each candidate species is shown in Appendix 1.

Data analysis

A total of 11,908 WAV sound files were submitted for analysis (Table 1). To exclude any non-microbat noise files from the analysis, the WAV files were subject to a generic noise removal filter using the software program Anabat Insight (Version 2.0.6-3-g73846db (Titley Scientific)). The microbat call profiles passed by the noise filter were then subject to a Decision Tree (DT) analysis to:

- Separate the microbat call profiles into 5 to 10 kHz increments based on the average characteristic frequency (Fc), and then,
- Attach a label to each microbat call profile that best represents a species or a species complex that could be responsible for the call.

Following this process, the microbat call profiles that were passed and labeled during the DT analysis were manually reviewed. The species and species complex identifications were reviewed by Rod Armistead by comparing the features of the recorded call profiles to the published call parameters presented in the:

- *Region based guide to the echolocation calls of microbats in New South Wales* (Pennay *et al.* 2004) (Bat Calls of New South Wales (PDF - 1.4MB) (nsw.gov.au) and an

accompanying reference library of over 200 calls collected from the Sydney Basin bioregion of NSW (http://www.forest.nsw.gov.au/research/bats/default.asp).

- *Key to the bat calls of south-east Queensland and north-east New South Wales* (Reinhold *et al.* 2001) (1) (PDF) Key to the bat calls of south-east Queensland and north-east New South Wales (researchgate.net).

While reviewing the recorded microbat calls, the following protocols (adapted from Lloyd *et al.* 2006) were applied:

- Recorded calls containing less than three pulses were generally excluded from the analysis as they can often be too short to confidently determine the identity of the species making the call (Law *et al.* 1999). These short sequences were removed from the data either during the DT analysis or the manual review.
- For those calls that can be used to identify the species or species complex responsible for the call, two categories of confidence are used (Mills *et al.* 1996):
  - Present – the Fc, quality, and structure of the call profile features (as per Pennay *et al.* 2004 and Rheinold *et al.* 2001) are such that the identity of the microbat species making the call can be determined with a relatively high degree of confidence.
  - Potentially present – the quality and structure of the call profile are such that there is some uncertainty about the identity of the species making the call, or there is some likelihood of confusion with another species that produces a similar call profile.
- Unusual calls (e.g. possible social calls, intra and inter-species interactions calls, forage or feeding buzzes) that cannot be used to identify a microbat species were labeled as being of 'low' quality or dismissed from the analysis.

- Sequences that cannot be attributed to microbat echolocation calls (e.g. insect buzzes, wind, train, and vehicle movements), were dismissed from the analysis.

Reporting and nomenclature

This microbat bat call identification report follows the recommended reporting requirements provided by the Australian Bat Society (Reardon 2003). Microbat species and common names follow Jackson and Groves (2015) and Armstrong *et al.* (2020), except for *Miniopterus orianae oceanensis*, which follows the nomenclature dictated by the New South Wales Office of Environment and Heritage (2019) Large bent-winged Bat – profile web page (Large Bent-winged Bat - profile | NSW Environment, Energy and Science).

Table 1. Survey sites, Anabat detectors used, dates surveyed and survey effort

Survey site	Brief site Description	Anabat detector (reference number)	Nights surveyed	Survey effort	GPS location	Files submitted for analysis
1	Eastern edge of coke ovens / kilns	COF01 (536741)	11/01/23-12/01/23	2	-34.37566 / 150.90458	28
2	Northern end of the settlement Dam	COF02 (536907)	12/01/23-19/01/23	3	-34.377728 / 150.903372	2912
		SYD01 (514008)	26/1/23-01/02/23	7	-34.377662 / 150.903383	6129
3	Near large steel building	COF02 (536907)	20/1/23-26/1/23	2	-34.376453 / 150.903853	1023
4	Beneath metal infrastructure	SYD01 (514008)	12/1/23-19/1/23	7	-34.374855 / 150.903432	1216
5	Southern end of coke ovens / kilns	SYD01 (514008)	20/01/23-26/1/23	7	-34.37426 / 150.902107	600
Total survey nights and WAV files submitted for analysis				28		11,908

Results and Discussion

Overview

Based on the recorded microbat data, six microbat species were identified as being present in the study area (Table 2 and Table 3, Figure 1 - Figure 11). A further seven species were determined to be potentially present in the study area (Table 2 and Table 3, Figure 1 - Figure 11). The call profiles of the seven species identified as being 'potentially present' had a similar characteristic frequency (Fc) range (see Appendix 1) and pulse shape to that of at least one other microbat species (see the Survey limitations section below).

Threatened species

One threatened microbat, *Miniopterus orianae oceanensis* (Large Bent-winged Bat), which is listed as Vulnerable under the New South Wales *Biodiversity Conservation Act 2016* (BC Act) was determined to be present in the study area (Table 2 and Table 3). Definite and potential Large Bent-winged Bat calls were recorded at all of the survey sites (Table 3).

Three other microbat species that are also listed as Vulnerable under the BC Act were determined to be potentially present in the study area (Table 2 and Table 3).

The threatened species deemed to be potentially present comprised of the following species:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Myotis macropus* (Southern Myotis)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

During this assessment two potential Southern Myotis calls were recorded at Site 4 (Table 3, Table 6 and Figure 7). No Southern Myotis activity was recorded at the settlement dam (Site 2).

Table 2. Microbat species recorded as being present or potentially present within the study area.

Species name[1]	Common name[1]	Conservation status		Present / potentially present
		EPBC Act 1999	BC Act 2016	
Austronomus australis	White-striped Free-tailed Bat	-	-	Present
Chalinolobus gouldii	Gould's Wattled Bat	-	-	Present
Chalinolobus morio	Chocolate Wattled Bat	-	-	Present
Falsistrellus tasmaniensis	Eastern False Pipistrelle	-	Vulnerable	Potentially present
*Miniopterus orianae oceanensis**	Large Bent-winged Bat	-	Vulnerable	Present
Myotis macropus	Southern Myotis	-	Vulnerable	Potentially present
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	-	Potentially present
Nyctophilus gouldi	Gould's Long-eared Bat	-	-	Potentially present
Ozimops ridei	Ride's Free-tailed Bat	-	-	Present
Scoteanax rueppellii	Greater Broad-nosed Bat	-	Vulnerable	Potentially present
Scotorepens orion	Eastern Broad-nosed Bat	-	-	Potentially present
Vespadelus darlingtoni	Large Forest Bat	-	-	Present
Vespadelus regulus	Southern Forest Bat	-	-	Potentially present

[1]Microbat species and common names follow Jackson and Groves (2015) and Armstrong *et al.* 2020, except * which follows New South Wales Office of Environment and Heritage (2019)

Microbat use of the study area

A total of 902 useful calls (calls that could be used to identify of a microbat species or species complex) were recorded during this assessment (Table 4 - Table 7). Of the 902 recorded calls, 428 were recorded at Site 4 across seven survey nights (average of 61.14 calls per survey night) (Table *6*). While in contrast, a low of 22 calls was recorded over two survey nights at Site 1.

To understand how the microbats are using the study area an assessment of the microbat activity within three time periods was undertaken. The time periods comprised of the following:

- **Emergence from roost**, between 8.30 p.m., and 9.30 p.m., which is when a microbat is most likely to be active at the entrance before leaving their daytime roost to undertake their nightly forage activities.
- **Time to forage**, between 9.30 p.m., and 4.30 a.m. when a microbat is likely to be actively searching for, and consuming prey.
- **Return to the roost**, between 4.30 a.m., and 6.00 a.m., when a microbat is returning to their daytime roost.

As was expected, the activity across the five sites, and during each time-period varied (Table 4 - Table 7). The activity during each time-period consisted of the following:

- 125 (13.86%) of the 902 calls were recorded during the *emergence from roost* time period.
- 736 (81.59%) of the 902 calls were recorded during the *time to forage* period.
- 41 (4.55%) of the 902 calls were recorded during the *return to roost* time period.

The result of this assessment shows that microbats do use the study area to forage. The bulk of foraging activity was recorded at Site 2 (the dam) and Site 4 (steel infrastructure) (Table 4 and Table 6).

To prove if a microbat is using (or not using) the man-made structures, or a tree hollow to roost during the day, based upon recorded ultrasonic call data alone, can be difficult. Despite this, the microbat activity recorded at the *emergence from* and *returning to roost* time periods at Sites 1, 2, 3 and 5, was relatively low (Table 4 - Table 7). This suggests that these structures (e.g., the coke kilns/ovens and steel building) were at the time of the survey, not occupied.

However, the microbat activity at the *emergence from roost* time period at Site 4 was relatively high, with a total of 87 calls being recorded across seven survey nights (Table 6). The microbat activity at Site 4 over the seven survey nights commenced between 8.40 and 8.50 p.m. Microbats have previously been observed emerging from their daytime roost at this time (Eco Logical Australia (ELA) 2020a; 2020b). This result suggests that there are microbats possibly roosting somewhere nearby.

The bulk of the activity recorded at Site 4 was attributed to six species, including the threatened Eastern False Pipistrelle, Greater Broad-nosed Bat, Large Bent-winged Bat, the non-threatened Eastern Broad-nosed Bat, Large Forest Bat and Southern Forest Bat. While the literature states that the bulk of these species preferentially roost in tree hollow, all six species have been observed roosting in man-made structures (Department of Environment and Climate Change (2007) and Churchill (2008)).

Cautionary approach

A cautionary approach is encouraged regarding the results provided and discussed above. As stated, it is difficult to provide certainty that a microbat is (or is not) roosting at a particular location based upon recorded ultrasonic data alone. Consequently, further information should be sourced from the results of the previously conducted surveys, or an additional emergence survey (using hand-held detectors and thermal cameras) may be required at Site 4.

However, prior to the undertaking of additional surveys, the time zone and therefore the time stamps settings on the detector labelled SYD01 (reference # 514008) need to be checked.

Table 3. Microbat species recorded at each survey site

Species name	Common name	Present / Potentially present				
		Survey site, detector used and brief description of the nearby habitat				
		1	2	3	4	5
		COF01	COF02 / SYD01	COF02	SYD01	SYD01
		Near coke kilns (eastern)	Edge of a large dam	Near steel building	Under metal infrastructure	Near coke kilns (southern)
Austronomus australis	White-striped Free-tailed Bat	-	Present	-	-	Present
Chalinolobus gouldii	Gould's Wattled Bat	-	Present	-	Present	Present
Chalinolobus morio	Chocolate Wattled Bat	-	Present	-	Present	-
*Falsistrellus tasmaniensis**	Eastern False Pipistrelle	-	Potentially present	Potentially present	Potentially present	-
*Miniopterus orianae oceanensis**	Large Bent-winged Bat	Potentially present	Potentially present	Potentially present	Present	Present
*Myotis macropus**	Southern Myotis	-	-	-	Potentially present	-
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	-	-	Potentially present	-
Nyctophilus gouldi	Gould's Long-eared Bat	-	-	-	Potentially present	-

Species name	Common name	Present / Potentially present Survey site, detector used and brief description of the nearby habitat				
		1	2	3	4	5
		COF01	COF02 / SYD01	COF02	SYD01	SYD01
		Near coke kilns (eastern)	Edge of a large dam	Near steel building	Under metal infrastructure	Near coke kilns (southern)
Ozimops ridei	Ride's Free-tailed Bat	Present	Present	-	Potentially present	Present
*Scoteanax rueppellii**	Greater Broad-nosed Bat	-	Potentially present	Potentially present	Potentially present	Potentially present
Scotorepens orion	Eastern Broad-nosed Bat	-	Potentially present	Potentially present	Potentially present	Potentially present
Vespadelus darlingtoni	Large Forest Bat	-	Present	Present	Potentially present	Present
Vespadelus regulus	Southern Forest Bat	Potentially present	Potentially present	Potentially present	Potentially present	Potentially present

*Represents those species that are listed as Vulnerable under the BC Act

Table 4. Species activity during three broad time periods that was recorded at Site 2

Species names	Common names	Activity and time		
		Emergence	Forage	Return to roost
		8.00 p.m. to 9.30 p.m.	9.30 p.m. to 4.30 a.m.	4.30 a.m. to 5.30 a.m.
Austronomus australis	White-striped Free-tailed Bat	0	1	0
Chalinolobus gouldii	Gould's Wattled Bat	0	189	2
Chalinolobus gouldii / *Ozimops ridei*	Gould's Wattled Bat / Ride's Free-tailed Bat	3	39	0
Chalinolobus morio	Chocolate Wattled Bat	0	2	0
*Falsistrellus tasmaniensis** / *Scoteanax rueppellii** / *Scotorepens orion*	Eastern False Pipistrelle / Greater Broad-nosed Bat / Eastern Broad-nosed Bat	0	1	0
*Miniopterus orianae oceanensis**/ *Vespadelus darlingtoni* / *Vespadelus regulus*	Large Bent-winged Bat / Large Forest Bat / Southern Forest Bat	0	17	0
Ozimops ridei	Ride's Freetail Bat	0	4	0
*Scoteanax rueppellii** / *Scotorepens orion*	Greater Broad-nosed Bat / Eastern Broad-nosed Bat	14	13	12
Vespadelus darlingtoni / *Vespadelus regulus*	Large Forest Bat / Southern Forest Bat	0	5	0
Vespadelus darlingtoni	Large Forest Bat	0	6	0
Grand Total		**17**	**277**	**14**

*Represents those species that are listed as Vulnerable under the BC Act

Table 5. Species activity during three broad time periods that was recorded at Site 3

Species names	Common names	Activity and time		
		Emergence	Forage	Return to roost
		8.00 p.m. to 9.30 p.m.	9.30 p.m. to 4.30 a.m.	4.30 a.m. to 5.30 a.m.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	1	1	0
*Falsistrellus tasmaniensis** / *Scoteanax rueppellii** / *Scotorepens orion*	Eastern False Pipistrelle / Greater Broad-nosed Bat / Eastern Broad-nosed Bat	1	2	0
*Miniopterus orianae oceanensis**/ *Vespadelus darlingtoni* / *Vespadelus regulus* / *Vespadelus vulturnus*	Large Bent-winged Bat / Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	3	0
Scoteanax rueppellii / *Scotorepens orion*	Greater Broad-nosed Bat / Eastern Broad-nosed Bat	0	1	0
Vespadelus darlingtoni	Large Forest Bat	1	2	0
Total calls		**3**	**9**	**0**

*Represents those species that are listed as Vulnerable under the BC Act

Table 6. Species activity during three broad time periods that were recorded at Site 4

Species names	Common names	Activity and time		
		Emergence from roost	Forage and feeding	Return to roost
		8.00 p.m. to 9.30 p.m.	9.30 p.m. to 4.30 a.m.	4.30 a.m. to 5.30 a.m.
Chalinolobus gouldii	Gould's Wattled Bat	0	11	0
Chalinolobus gouldii / *Scoteanax rueppellii**	Gould's Wattled Bat / Greater Broad-nosed Bat	0	1	0
Chalinolobus gouldii / *Ozimops ridei*	Gould's Wattled Bat / Ride's Free-tailed Bat	1	1	1
Chalinolobus morio	Chocolate Wattled Bat	0	1	0
*Falsistrellus tasmaniensis** / *Scoteanax rueppellii** / *Scotorepens orion*	Eastern False Pipistrelle / Greater Broad-nosed Bat / Eastern Broad-nosed Bat	1	1	0
*Miniopterus orianae oceanensis**	Large Bent-winged Bat	0	5	7
*Miniopterus orianae oceanensis**/ *Vespadelus darlingtoni* / *Vespadelus regulus*	Large Bent-winged Bat / Large Forest Bat / Southern Forest Bat	14	132	10
*Myotis macropus**, *Nyctophilus geoffroyi* or *Nyctophilus gouldi*	Southern Myotis, Gould's or Lesser Long-eared Bats	0	2	0
Ozimops ridei	Ride's Freetail Bat	3	1	2
*Scoteanax rueppellii** / *Scotorepens orion*	Greater Broad-nosed Bat / Eastern Broad-nosed Bat	19	45	0
Vespadelus darlingtoni	Large Forest Bat	47	116	1

Species names	Common names	Activity and time		
		Emergence from roost	Forage and feeding	Return to roost
		8.00 p.m. to 9.30 p.m.	9.30 p.m. to 4.30 a.m.	4.30 a.m. to 5.30 a.m.
Vespadelus darlingtoni / *Vespadelus regulus*	Large Forest Bat / Southern Forest Bat	2	4	0
Total calls		**87**	**320**	**21**

*Represents those species that are listed as Vulnerable under the BC Act

Table 7. Species activity during three broad time periods that was recorded at Site 5 (SYD01), which was located near the southern end of the coke ovens/kilns

Species names	Common names	Activity and time		
		Emergence	Forage	Return to roost
		8.00 p.m. to 9.30 p.m.	9.30 p.m. to 4.30 a.m.	4.30 a.m. to 5.30 a.m.
Austronomus australis	White-striped Free-tailed Bat	0	1	0
Chalinolobus gouldii	Gould's Wattled Bat	3	17	1
Chalinolobus gouldii / *Scoteanax rueppellii**	Gould's Wattled Bat / Greater Broad-nosed Bat	0	1	0
Chalinolobus gouldii / *Ozimops ridei*	Gould's Wattled Bat / Ride's Free-tailed Bat	1	0	1
*Miniopterus orianae oceanensis**	Large Bent-winged Bat	0	18	0

*Miniopterus orianae oceanensis** / *Vespadelus darlingtoni* / *Vespadelus regulus* / *Vespadelus vulturnus*	Large Bent-winged Bat / Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	53	1
Ozimops ridei	Ride's Freetail Bat	1	10	1
*Scoteanax rueppellii** / *Scotorepens orion*	Greater Broad-nosed Bat / Eastern Broad-nosed Bat	6	0	0
Vespadelus darlingtoni	Large Forest Bat	7	13	2
Vespadelus darlingtoni / *Vespadelus regulus*	Large Forest Bat / Southern Forest Bat	0	17	0
Total		**18**	**130**	**6**

*Represents those species that are listed as Vulnerable under the BC Act

Unresolved call profiles and survey limitations

A microbat species was deemed as being present when the recorded call characteristics matched those described in Pennay *et al.* (2004) and Reinhold *et al.* (2001). In the Sydney Basin biogeographic region of NSW there are several species that can have overlapping call profiles (Pennay *et al.* 2004). These overlapping calls can sometimes make it difficult to resolve a microbat call to a single species. If an overlap occurred, the call profile was given a multi-species complex label and those species in that complex are then determined to be 'potentially present' only. The following are examples of species recorded during this survey that can have overlapping call profiles.

- The calls of the non-threatened *Chalinolobus gouldii* (Gould's Wattled Bat) and *Ozimops ridei* (Ride's Free-tailed Bat) can overlap (see Figure 2 and Figure 8). See Figure 2 and Figure 8 for an example of a call profile for these two species.
- The calls of the threatened *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) and *Scoteanax rueppellii* (Greater Broad-nosed Bat), can overlap with the calls of the non-threatened *Scotorepens orion* (Eastern Broad-nosed Bat). See Figure 4, Figure 5 and Figure 9 for examples of the unresolved call profiles for these three species.
- The call profile of the threatened Large Bent-winged Bat can overlap with the non-threatened *Vespadelus darlingtoni* (Large Forest Bat), *V. regulus* (Southern Forest Bat), and *V. vulturnus* (Little Forest Bat). See Figure 6, Figure 10 and Figure 11 for resolved and unresolved call profiles for these four species.
- *Myotis macropus* (Southern Myotis) overlap with two non-threatened *Nyctophilus* (Long-eared Bat) species, *N. geoffroyi* (Lesser Long-eared Bat) and *N. gouldi* (Gould's Long-eared Bat). See Figure 7 for an example of an unresolved call profile for these three species.

- The calls of the non-threatened *V. regulus* (Southern Forest Bat) and *V. vulturnus* (Little Forest Bat) often overlap. See Figure 11 for an example of an unresolved call profile for these two species.

Unless otherwise specified the microbat species listed above were regarded as being potentially present only. To confirm the presence (or absence) of these species (as well as those species deemed to potentially present due to poor quality calls) within the study area, it would be necessary to undertake further survey effort that could involve the use of mist or harp traps to conduct live capture and release surveys.

An example of the species and species complex call profiles that were recorded during this survey, are shown in Figure 1 - Figure 11.

Disclaimer

The statements and/or recommendations made in this report are made only to inform EMM Consulting Pty Ltd. Rod Armistead Environmental Consultants will not be liable for any loss or damage that might arise from the use of this report by any third party.

Rod Armistead Environmental Consultants, if required, reserves the right to re-analysis, review and/or discuss the labeling and identification of the species identified in this assessment.

Examples of the recorded microbat call profiles in full spectrum

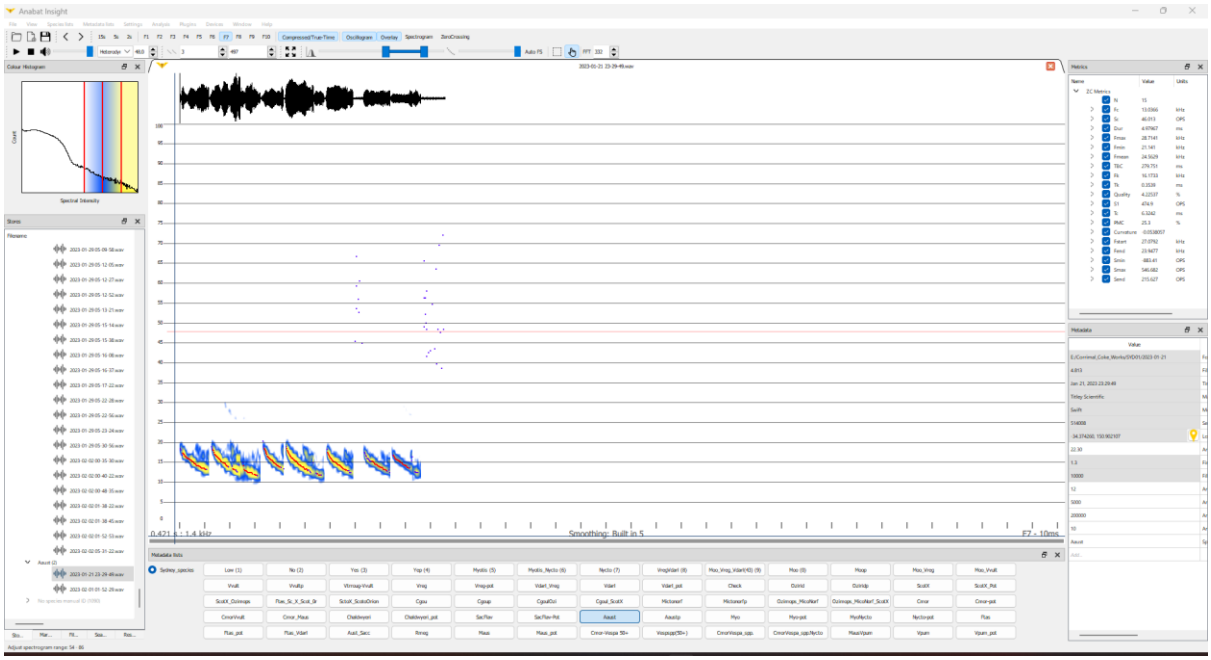


Figure 1. Call profile for *Austronomus australis* (White-striped Free-tailed Bat)

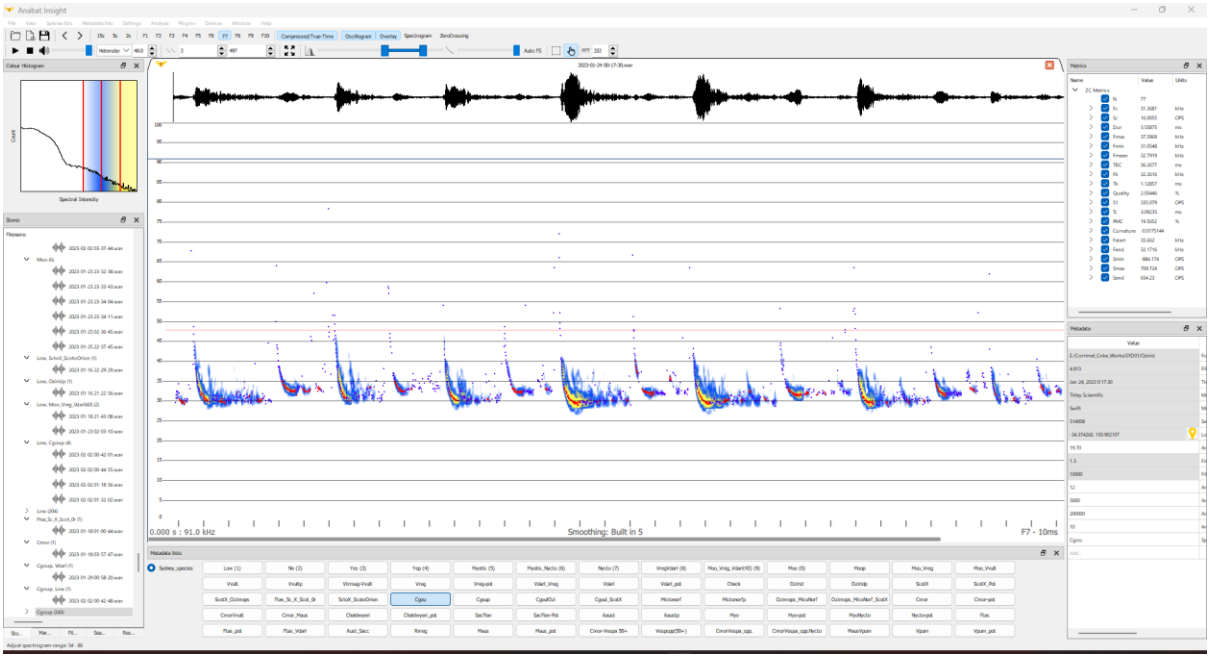


Figure 2. Call profile for *Chalinolobus gouldii* (Gould's Wattled Bat)

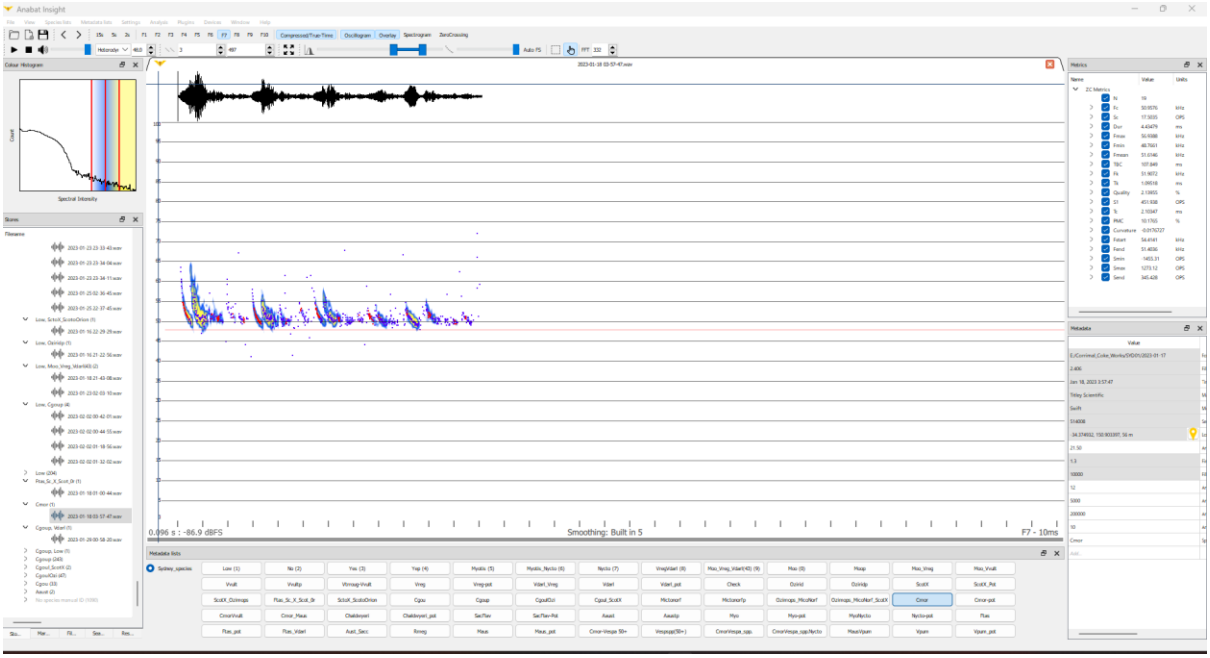


Figure 3. Call profile for *Chalinolobus morio* (Chocolate Wattled Bat)

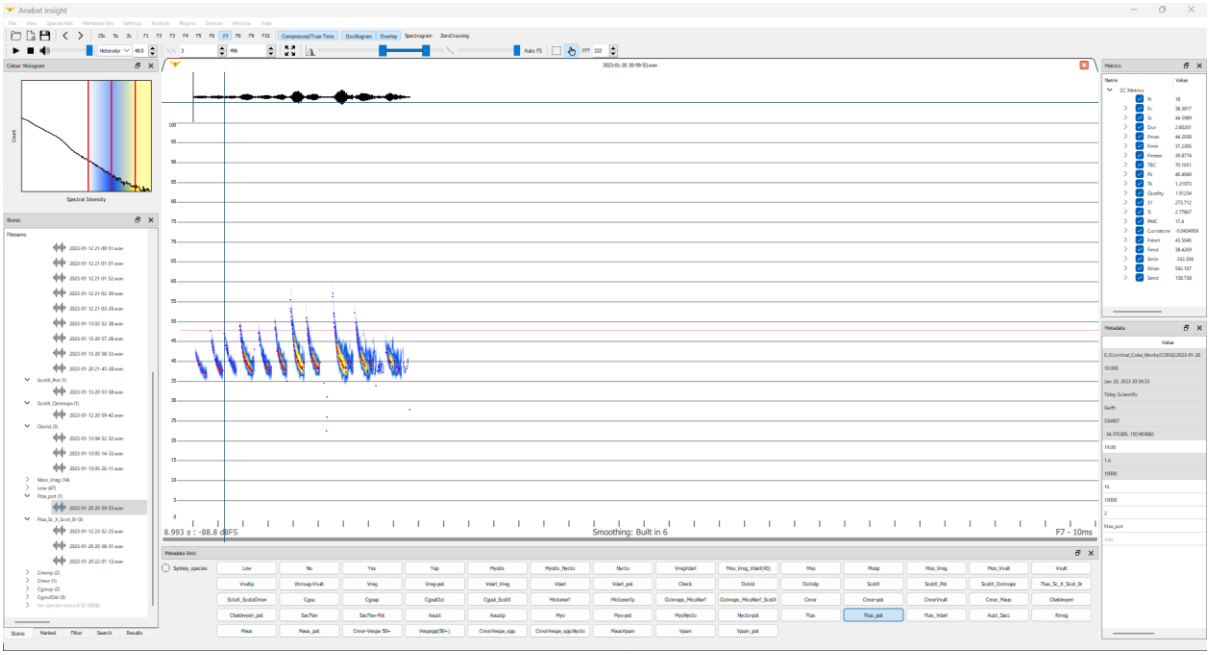


Figure 4. Potential (unresolved) call profile for *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)

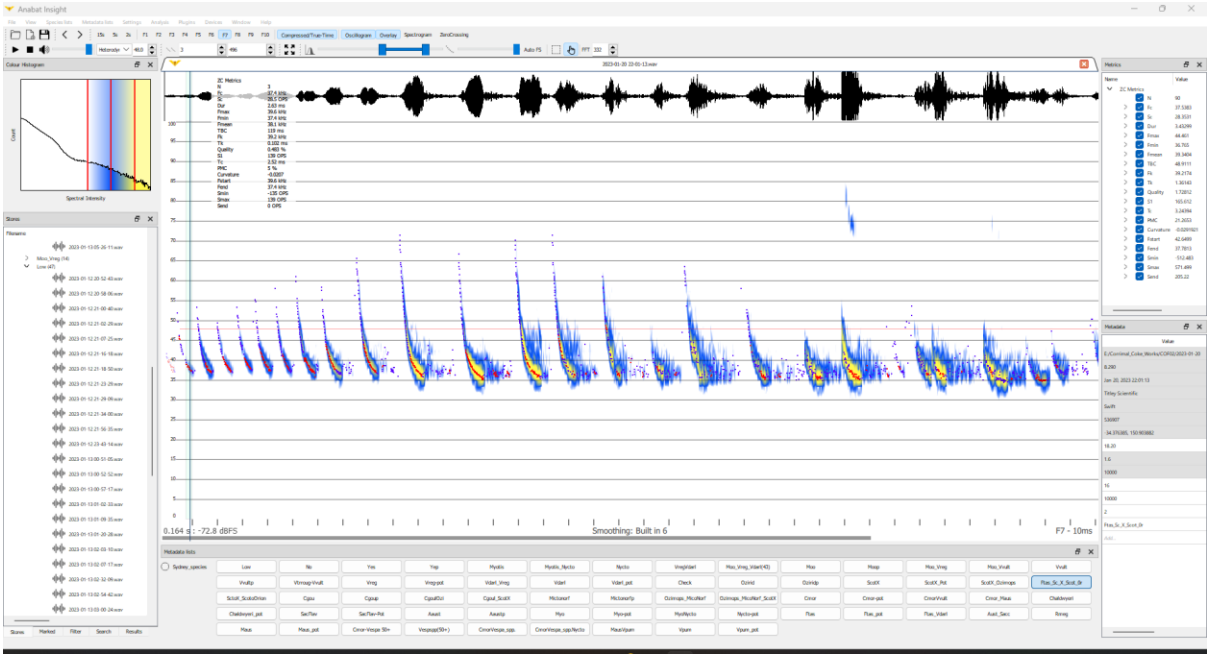


Figure 5. Potential (unresolved) call profile for *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Scoteanax rueppellii* (Greater Broad-nosed Bat) or *Scotorepens orion* (Eastern Broad-nosed Bat)

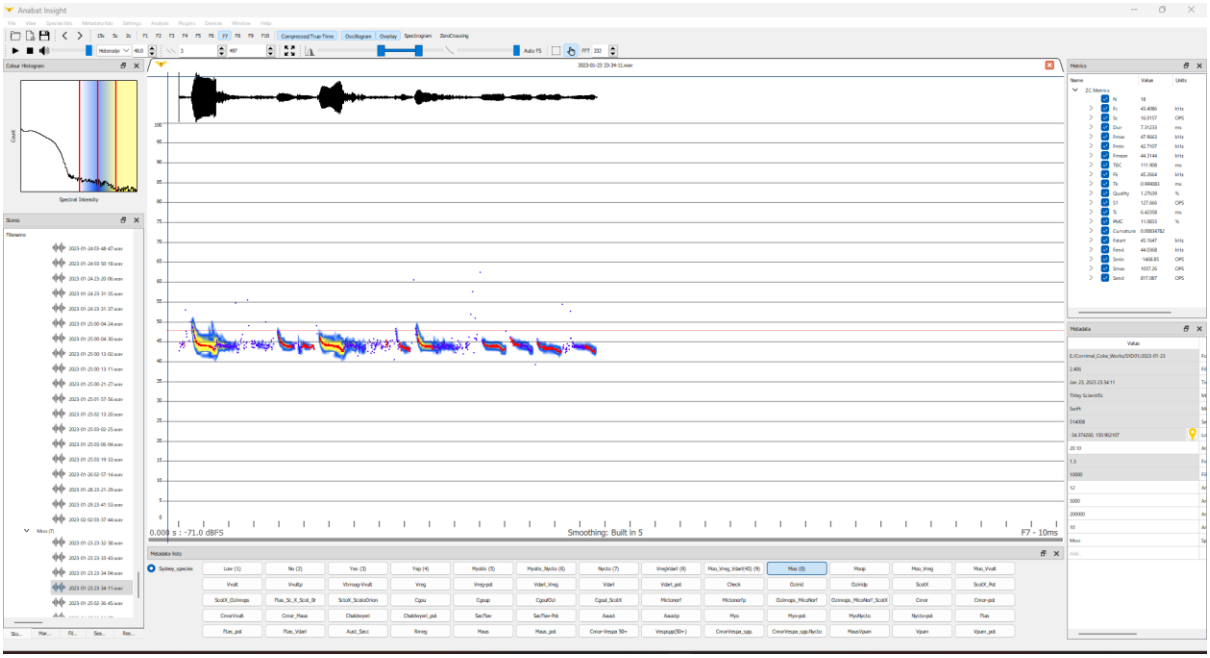


Figure 6. Call profile for *Miniopterus orianae oceanensis* (Large Bent-winged Bat)

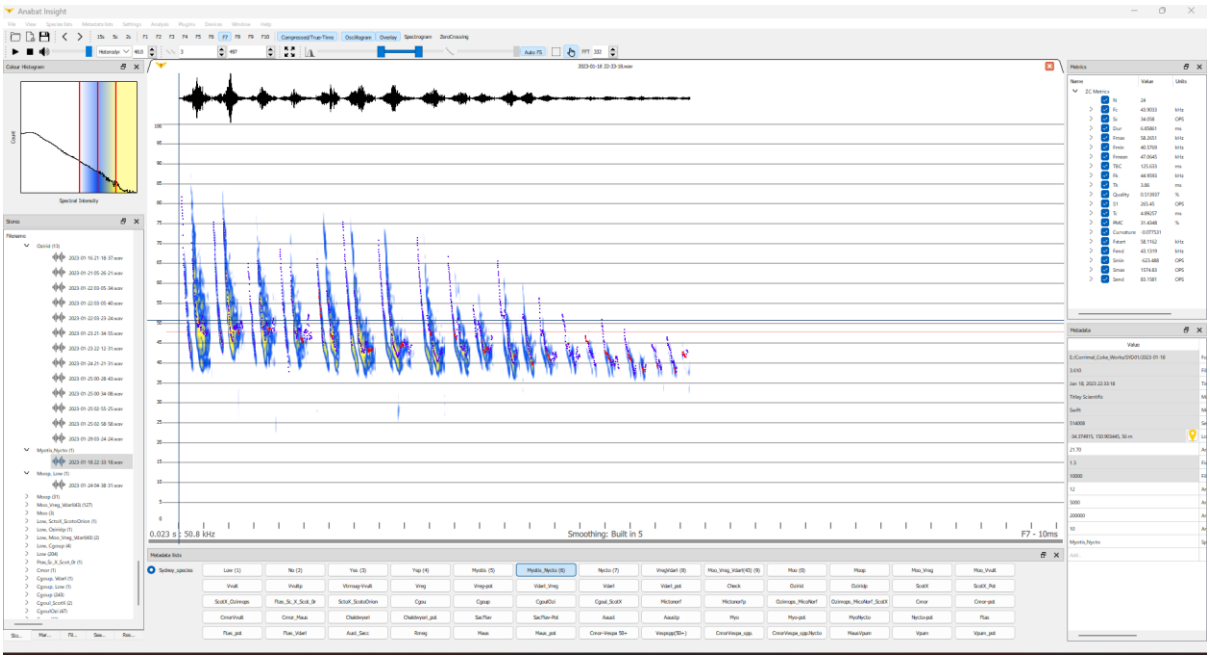


Figure 7. Potential (unresolved) call profile for *Myotis macropus* (Southern Long-eared Bat) / *Nyctophilus geoffroyi* (Lesser Long-eared Bat) / Nyctophilus gouldi (Gould's Long-eared Bat)

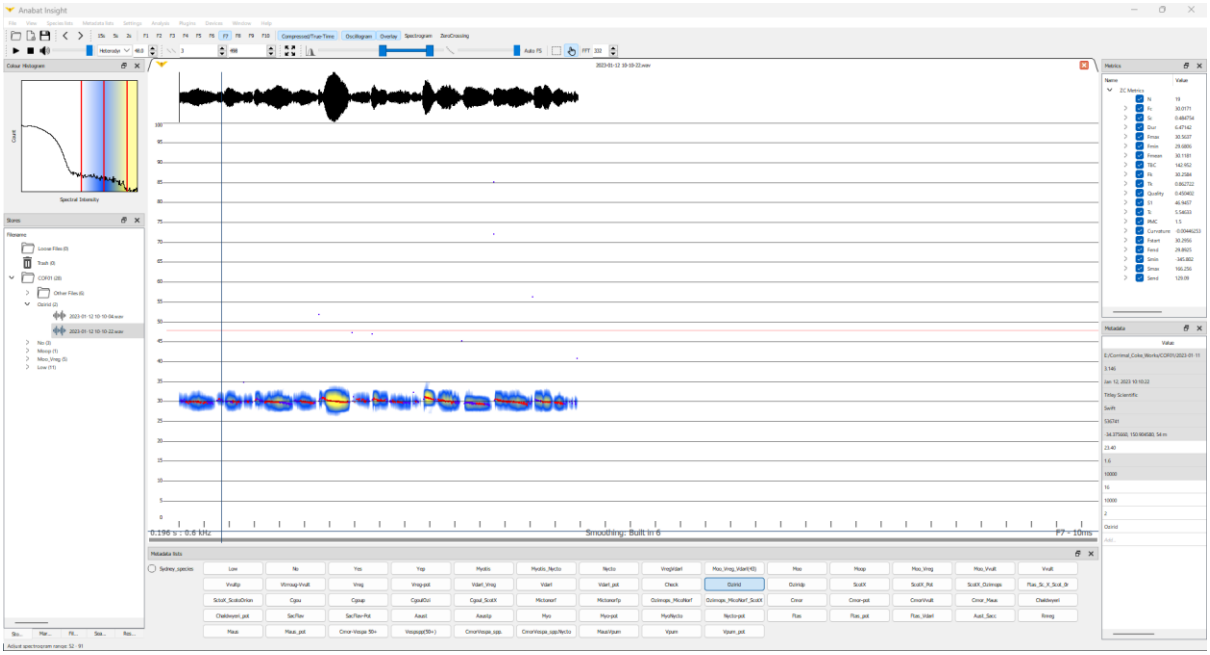


Figure 8. Call profile for *Ozimops ridei* (Ride's Free-tailed Bat)

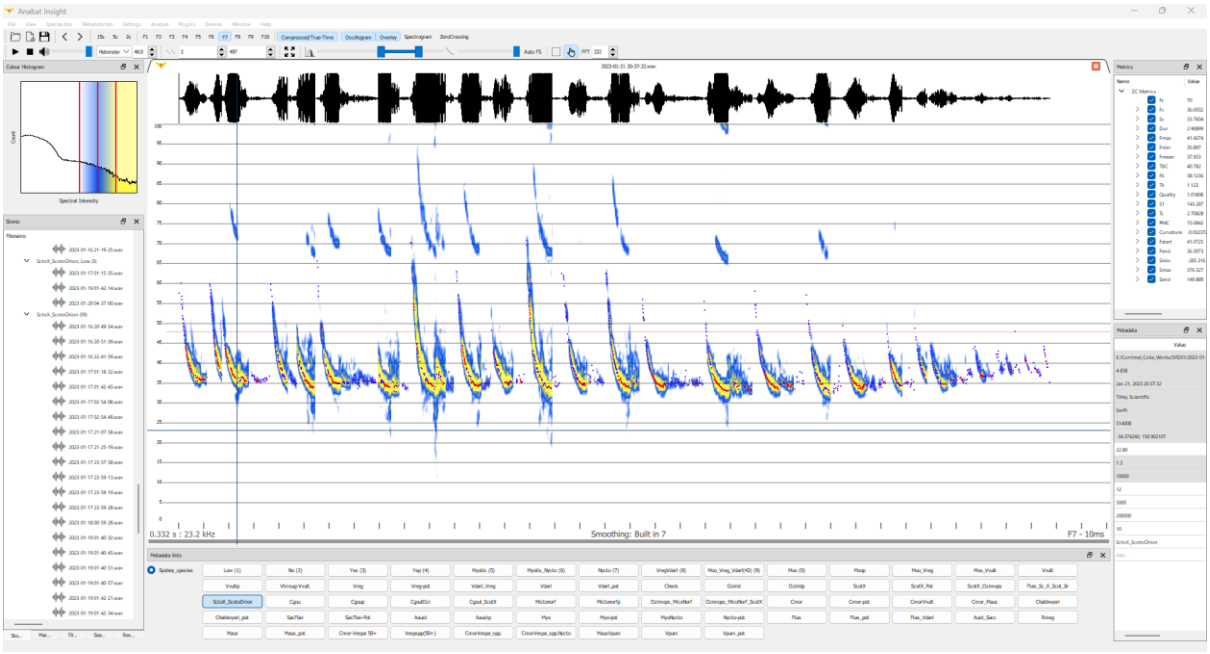


Figure 9. Potential (unresolved) call profile for *Scoteanax rueppellii* (Greater Broad-nosed Bat or *Scotorepens orion* (Eastern Broad-nosed Bat)

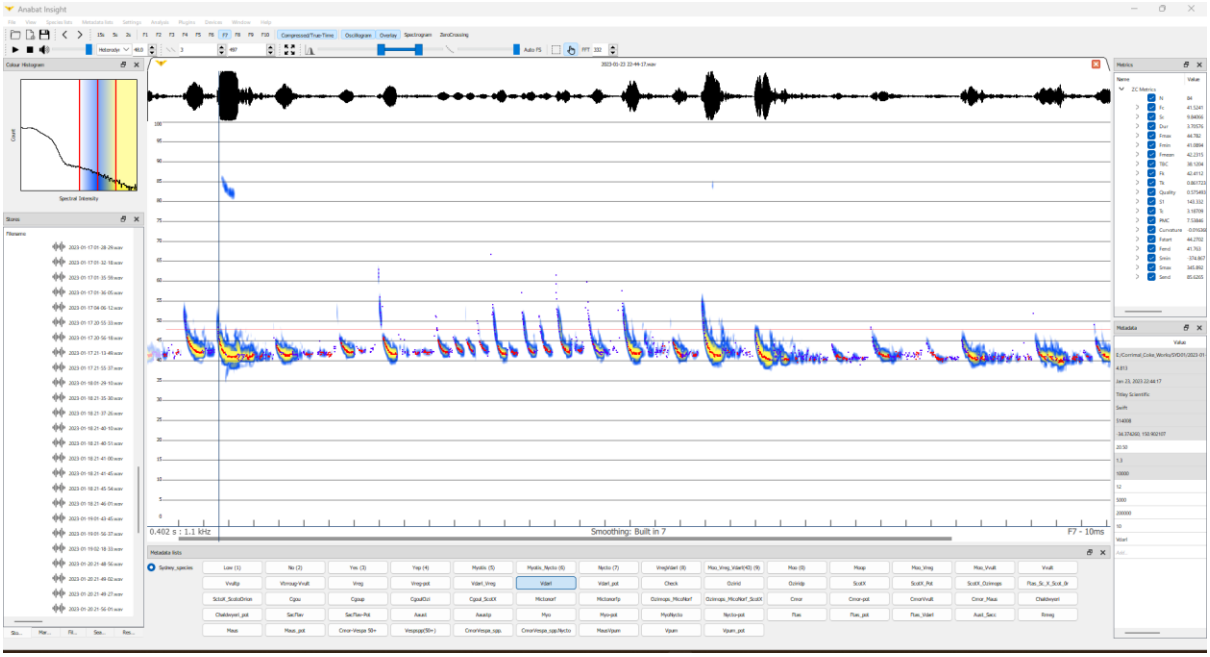


Figure 10. Call profile for *Vespadelus darlingtoni* (Large Forest Bat)

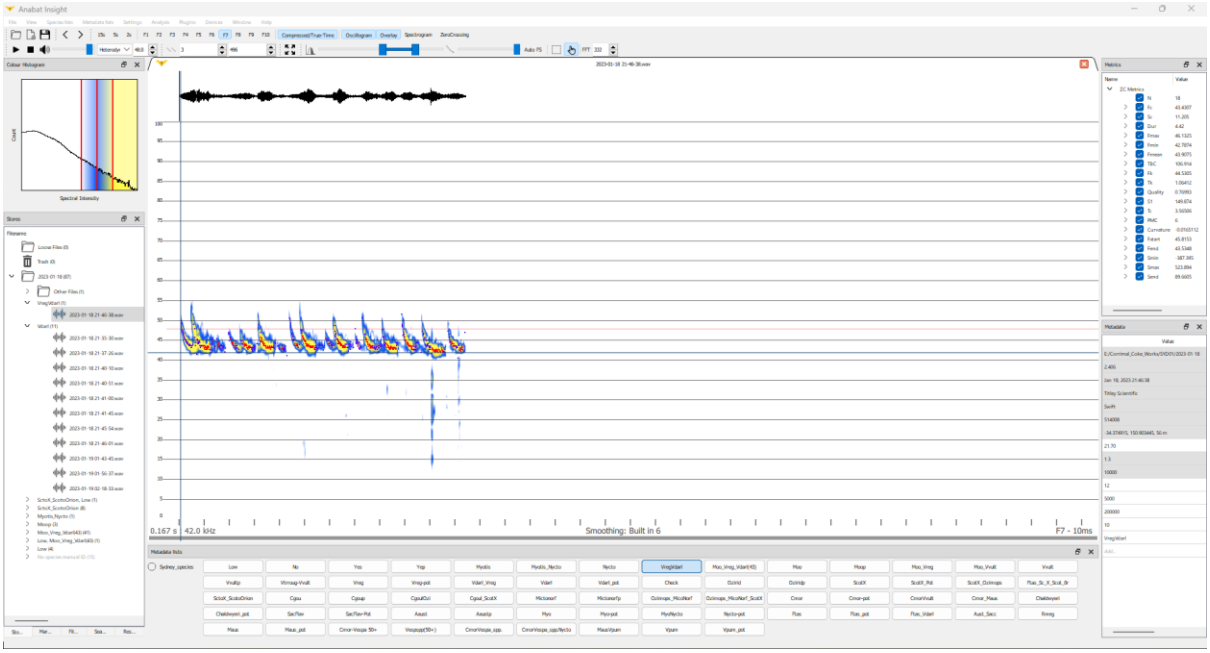


Figure 11. Potential (unresolved) call profile for *Vespadelus regulus* (Southern Forest Bat) or *Vespadelus vulturnus* (Little Forest Bat)

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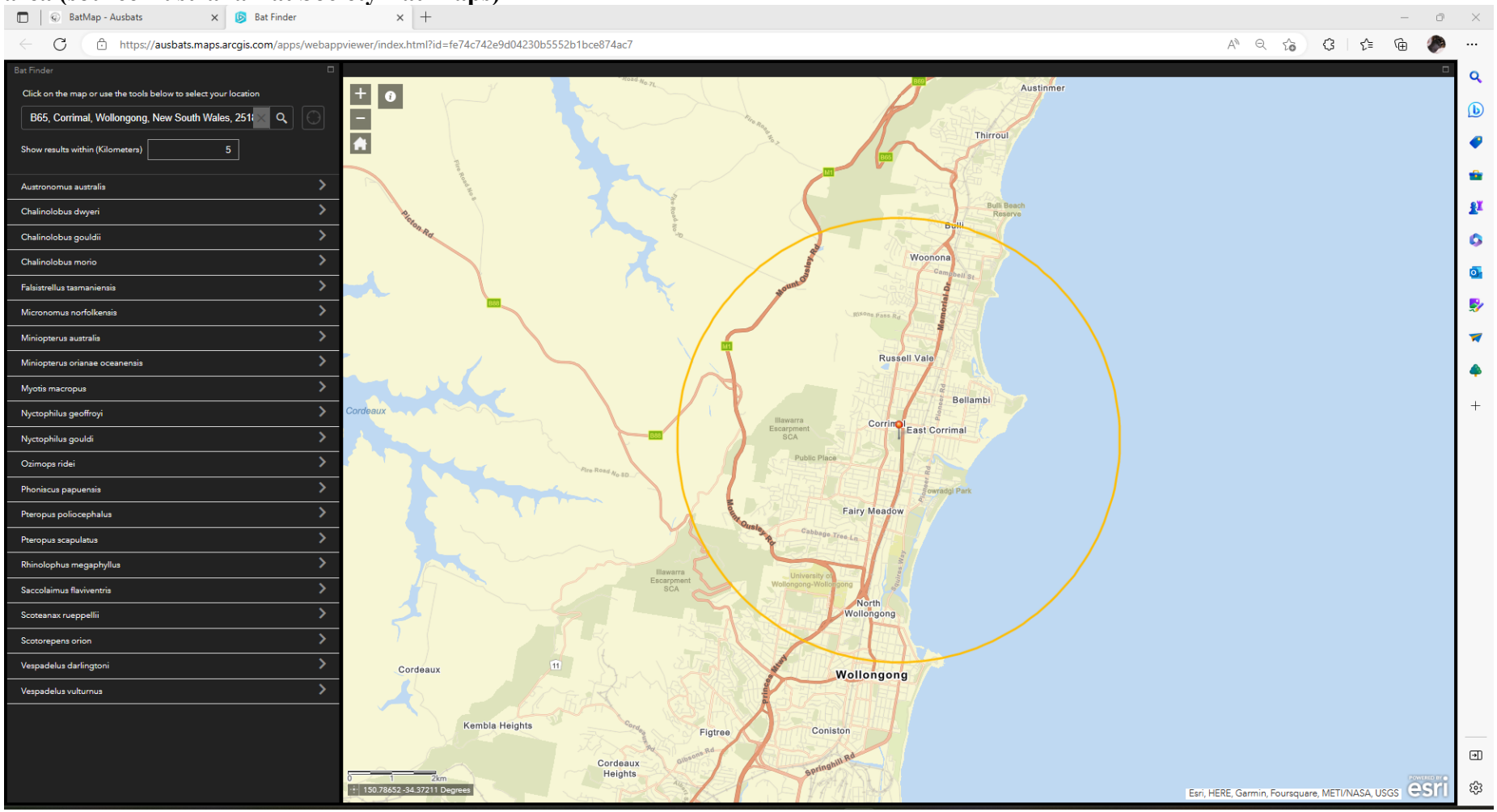
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Appendix 1. Candidate species list with species specific characteristic frequency range

Family and genus name	Common name	Characteristic Frequency Range (kilohertz (kHz)[1]
Family Emballonuridae		
Saccolaimus flaviventris[*]	Yellow-bellied Sheath-tailed Bat	17 – 22.5 kHz
Family Miniopteridae		
Miniopterus australis[*]	Little Bent-winged Bat	54.5 – 64.5 kHz
Miniopterus orianae oceanensis[*]	Eastern Bent-winged Bat	43 – 48 kHz
Family Molossidae		
Austronomus australis	White-striped Free-tailed Bat	10 – 15 kHz
Ozimops ridei	Ride's Free-tailed Bat	28.5 – 31 kHz
Family Rhinolophidae		
Rhinolophus megaphyllus	Eastern Horseshoe Bat	68 – 70 kHz
Family Vespertilionidae		
Chalinolobus dwyeri[*] and 2	Large-eared Pied Bat	21 – 26 kHz
Chalinolobus gouldii	Gould's Wattled Bat	27.5 – 32.5 kHz
Chalinolobus morio	Chocolate Wattled Bat	49.5 – 51.5 kHz
Falsistrellus tasmaniensis[*]	Eastern False Pipistrelle	35.5 – 39 kHz
Micronomus norfolkensis[*]	Eastern Coastal Free-tailed Bat	31 – 35 kHz
Myotis macropus[*]	Southern Myotis	-
Nyctophilus geoffroyi	Lesser Long-eared Bat	-
Nyctophilus gouldi	Gould's Long-eared Bat	-
Phoniscus papuensis[*]	Golden-tipped Bat	-
Scoteanax rueppellii[*]	Greater Broad-nosed Bat	32 – 36.5 kHz
Scotorepens orion	Eastern Broad-nosed Bat	36 – 37.5 kHz
Vespadelus darlingtoni	Large Forest Bat	40 – 43 kHz
Vespadelus regulus	Southern Forest Bat	43.5 – 46 kHz
Vespadelus vulturnus	Little Forest Bat	48.5 – 53 kHz

[1]Source Pennay *et al.* (2004) and Reinhold *et al.* (2001), and [*]represents those threatened species that are listed as Vulnerable under the BC Act, and [2] represents those threatened species listed as Vulnerable under the EPBC Act

Appendix 2. Microbat species that area predicted to occur, or have been previously recorded within a 10 km radius of the study area (source Australia Bat Society Bat Maps)



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Dear Alex,

Corrimal Coke Works Microbat Ultrasonic Call Assessment, May 2023

The aim of the current assessment was to evaluate if there are microbats still present at the Corrimal Coke Works.

The results of this assessment will inform the offset calculations in a Biodiversity Development Assessment Report (BDAR) and will contribute to a site-specific microbat management plan.

The data that was collected during this survey was done on two Song Meter Mini detectors (SYD_SM02 (reference # SMU08871) and SYD_SM06 (reference # SMU08622) (Wildlife Acoustics) that were:

- Used as hand-held devices to record microbat activity during the dusk emergence surveys.
- Then left unattended at two locations to passively record microbat activity throughout the entire night. The two locations included:
  - Inside the entrance of an underground tunnel.
  - The building that microbats had previously been observed emerging from.

A total survey effort of four survey nights was achieved during this survey. Three hundred and twenty-one files were recorded and presented for analysis. A review of the recorded data while using the software package Anabat Insight (Titley Scientific) identified 18 useful microbat call profiles. Seventeen of the useful call profiles were reliably or potentially attributed to the threatened Large Bent-winged Bat (Table 1, Figure 1 - Figure 4). The 'potential' call could also have been attributed to the non-threatened *Vespadelus regulus* (Southern Forest Bat) (Table 1 and Figure 4). The remaining call profile was attributed to the non-threatened *Vespadelus darlingtoni* (Large Forest Bat) (Table 1 and Figure 5).

At the time of the May 2023 survey, dusk occurred between 1701 (5.01 p.m.) and 1702 (5.02 p.m.) with the Civil Twilight occurring between 1728 (5.28 p.m.) and 1729 (5.29 p.m.) (source Sunrise and sunset times in Sydney, May 2023 (timeanddate.com)). The earliest Large Bent-

winged Bat call was recorded shortly after Civil Dusk at 1738 (5.38 p.m.) on 17 May 2023 (Table 1) (Figure 1). A further two Large Bent-winged Bat calls were subsequently recorded at 1753 (5.53 p.m.) and 1754 (5.54 p.m.) (Table 1). Considering that no emerging microbats were observed on the thermal cameras (Alex Gorey from ELA, *pers comm* 21 June 2023), the timing of these three calls suggests that these bats had emerged from a roost that is located either in the derelict buildings or somewhere nearby. The remaining Large Bent-winged Bat and Large Forest Bat calls were recorded between 1835 (6.35 p.m.) and 2212 (10.02 p.m.). No microbat calls were recorded after 2212 (10.02 p.m.).

An unusual microbat call was recorded on SYD_SM06, which was set at the entrance of a tunnel. This unusual call profile is shown in Figure 3. The call structure and characteristic frequency of this unusual call are identical to other Large Bent-winged Bat calls that were recorded inside a tunnel or another type of underground structure.

An overview of the methods used to analyze the recorded ultrasonic call data (see Appendix 1), the results (Table 1), and examples of the recorded call profiles are provided below (Figure 1 - Figure 5).

If you have questions regarding the results of this assessment, please do not hesitate to call me.

Kind regards

Rodney Armistead - Experienced Ecologist



0455 417 870

Table 1. The microbat species that were recorded during the survey during each 30-interval increment.

Species name	Common name	The time each call was recorded							
		17:30 - 18:00	18:30 - 19:00	20:00 - 20:30	20:30 - 21:00	21:00 - 21:30	21:30 - 22:00	22:00 - 22:30	Grand Total
Miniopterus orianae oceanensis[1]	Large Bent-winged Bat	3	2	1	4	2			12
Miniopterus orianae oceanensis[1]_potential	Large Bent-winged Bat-potential		1		1		1	1*	4
Miniopterus orianae oceanensis[1] / *Vespadelus regulus*	Large Bent-winged Bat / Southern Forest Bat							1	1
Vespadelus darlingtoni	Large Forest Bat					1			1
Grand Total		3	3	1	5	3	1	2	18

[1]Identifies those species that are listed as vulnerable under the New South Wales *Biodiversity Conservation Act* (2016).

*This ultrasonic microbat call was recorded on SYD_SM06. The reaming 17 microbat calls were recorded on SYD_SM02.

Examples of the call profiles

The following call profile examples are shown in the compressed zero-crossing format. The same call profiles can be presented in a full spectrum format upon request.



Figure 1. Call profile for the *Miniopterus orianae oceanensis* (Large Bent-winged Bat) call that was recorded at 1738 (5.38 p.m.) on SYD_SM02.



Figure 2. Call profile for *Miniopterus orianae oceanensis* (Large Bent-winged Bat) recorded on SYD_SM02 at 1754 (5.54 p..m.).

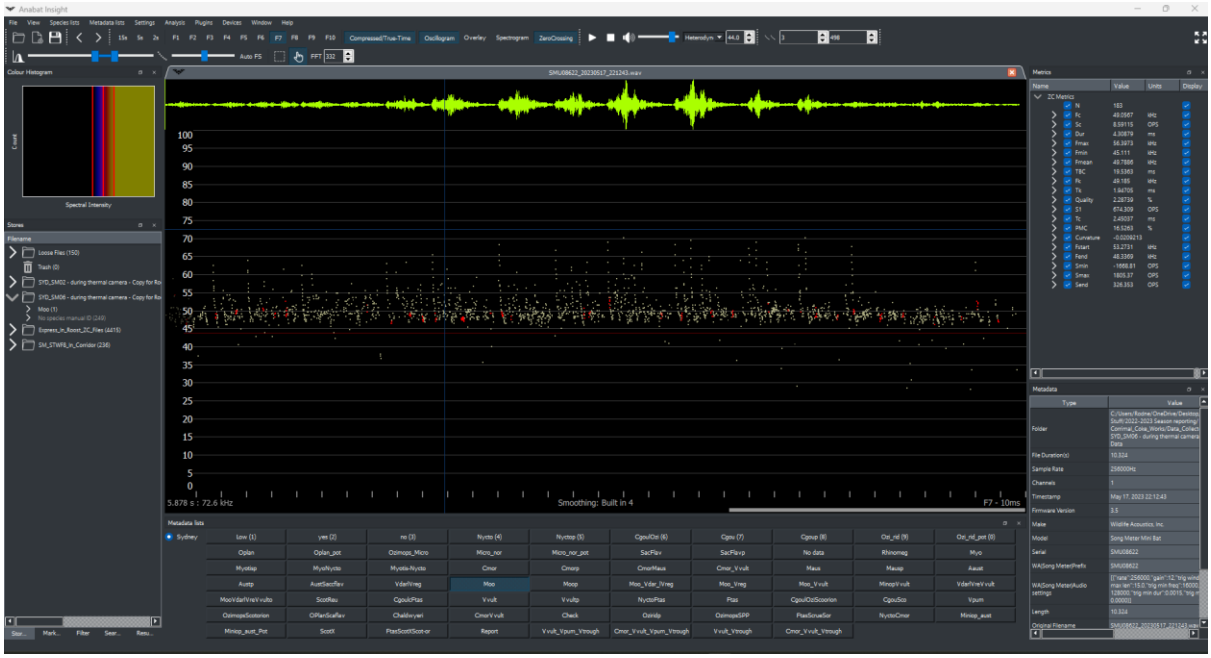


Figure 3. Potential call profile for *Miniopterus orianae oceanensis* (Large Bent-winged Bat) recorded on SYD_SM06.

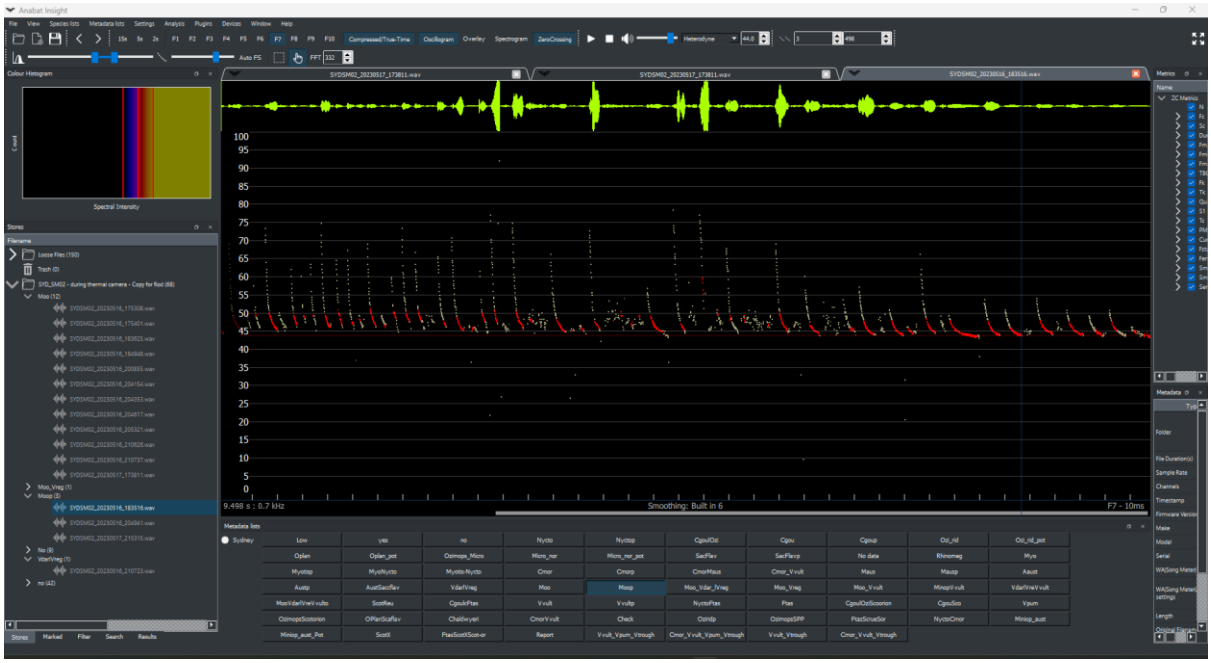


Figure 4. Potential call profile for *Miniopterus orianae oceanensis* (Large Bent-winged Bat) or *Vespadelus darlingtoni* (Large Forest Bat) recorded on SYD_SM02.

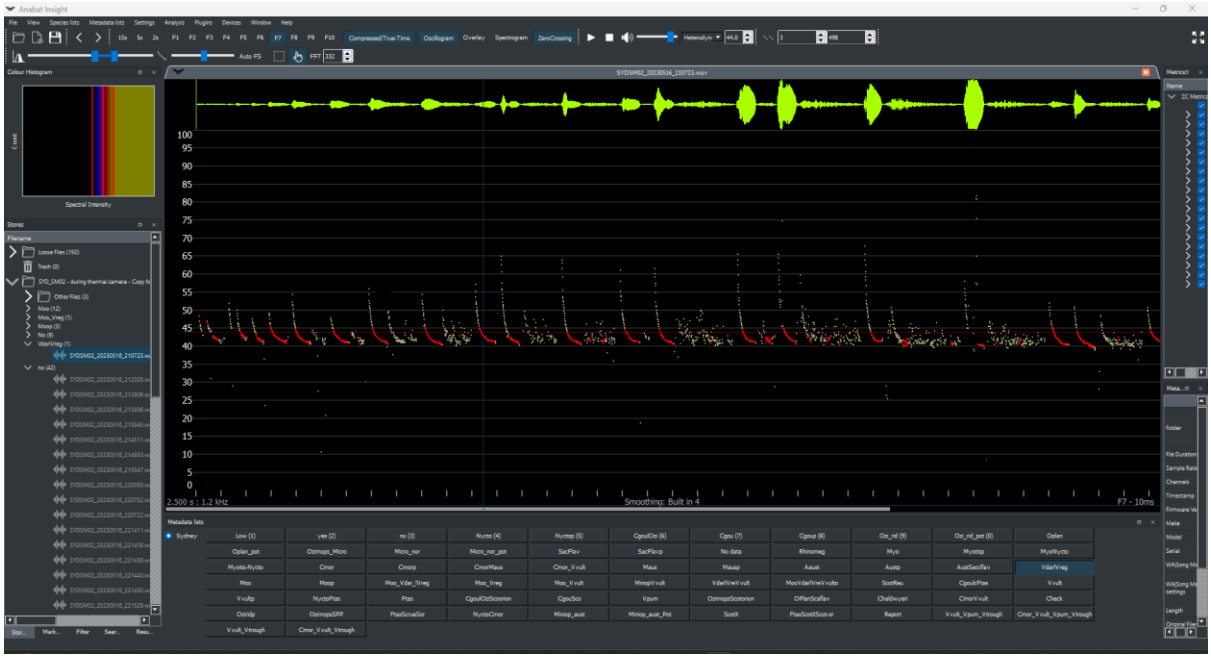


Figure 5. Call profile for *Vespadelus darlingtoni* (Large Forest Bat) recorded on SYD_SM02.

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Appendix 1. Data analysis

The data that was analysed during this survey was recorded on two Song Meter Mini devices (SYD_SM02 (reference # SMU08871) and SYD_SM06 (reference # SMU08622) (Wildlife Acoustics). The two detectors were used as handheld devices during the emergence surveys and then left attended to passively continue to record throughout the night by two ELA ecologists. A total of 321 WAV sound files were submitted for analysis. To exclude any non-microbat noise files from the analysis, the WAV files were subject to a generic noise removal filter using the software program Anabat Insight (Version 2.0.7.0-g26022) (Titley Scientific). The microbat call profiles passed by the noise filter were then subject to a Decision Tree (DT) analysis to:

- Separate the microbat call profiles into 5 to 10 kHz increments based on the average characteristic frequency (Fc), and then,
- Attach a label to each microbat call profile that best represents a species or a species complex that could be responsible for the call.

Following this process, the microbat call profiles passed and labeled during the DT analysis were manually reviewed. The species and species complex identifications were reviewed by Rod Armistead by comparing the features of the recorded call profiles to the published call parameters presented in the:

- *Region based guide to the echolocation calls of microbats in New South Wales* (Pennay *et al.* 2004) (Bat Calls of New South Wales (PDF - 1.4MB) (nsw.gov.au) and an accompanying reference library of over 200 calls collected from the Sydney Basin bioregion of NSW (http://www.forest.nsw.gov.au/research/bats/default.asp).
- *Key to the bat calls of south-east Queensland and north-east New South Wales* (Reinhold *et al.* 2001) (1) (PDF) Key to the bat calls of south-east Queensland and north-east New South Wales (researchgate.net).

- A collection of reference calls that were recorded in or at the entrance of the Middle Head and Cadigal Reserve Large Bent-winged Bat roosts.

While reviewing the recorded microbat calls, the following protocols (adapted from Lloyd *et al.* 2006) were applied:

- Recorded calls containing less than three pulses were excluded from the analysis as they can often be too short to confidently determine the identity of the species making the call (Law *et al.* 1999). These short sequences were removed from the data either during the DT analysis or the manual review.
- For those calls that can be used to identify the species or species complex responsible for the call, two categories of confidence are used (Mills *et al.* 1996):
    - Present – the Fc, quality, and structure of the call profile features (as per Pennay *et al.* 2004 and Rheinold *et al.* 2001) are such that the identity of the microbat species making the call can be determined with a relatively high degree of confidence.
    - Potentially present – the quality and structure of the call profile are such that there is some uncertainty about the identity of the species making the call, or there is some likelihood of confusion with another species that produces a similar call profile.
- Unusual calls (e.g., possible social calls, intra, and inter-species interaction calls, forage or feeding buzzes) that cannot be used to identify a microbat species were labeled as being of 'low' quality or dismissed from the analysis.
- Sequences that cannot be attributed to microbat echolocation calls (e.g. insect buzzes, wind, train, and vehicle movements), were dismissed from the analysis.

Reporting and nomenclature

This report follows the recommended reporting requirements provided by the Australian Bat Society (Reardon 2003). Microbat species and common names follow Jackson and Groves (2015) and Armstrong *et al.* (2020), except for *Miniopterus orianae oceanensis*, which follows the nomenclature dictated by the New South Wales Office of Environment and Heritage (2019) Large bent-winged Bat – profile web page (Large Bent-winged Bat - profile | NSW Environment, Energy and Science).

Appendix K Green and Golden Bell Frog Expert Report (ELA 2023)

Corrimal Coke Works – Green and Golden Bell Frog Expert Report

Legacy Property



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Template 2.8.1

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1. Introduction

Legacy Property is planning to undertake a re-development of the old Corrimal Coke Works located on Railway Street, Corrimal into residential dwellings and commercial buildings. The development site for this report consists of four lots (Lot 11 DP749492, Lot 5 DP749492, Lot 126 DP598190 and Lot 1 DP 795791) with a combined area of 18.16 ha, with a study area that covers the development site and a 200 m buffer (Figure 1; Figure 2). The study area is within the Wollongong Local Government Area (LGA) and is located approximately 5 km north of the Wollongong city centre (Figure 1). The approved rezoning covers land zoned as R3 Medium Density Residential and RE1 – Public Recreation.

The development site is bounded by Memorial Drive on the western side, Railway Street and residential housing to the north, the railway line and residential housing to the east, and the vegetated riparian area of Towradgi Creek to the south. The site is generally flat with a gentle slope towards Towradgi Creek in the south east. A large portion of the development site is cleared and landscaped land as part of the previous use of the study area by Illawarra Coke Company as a Coke Works facility.

One species needing consideration is *Litoria aurea*, the Green and Golden Bell Frog (GGBF), which is a species credit species that is listed in the endangered category of the BC Act. This frog was historically recorded broadly across the Wollongong region (Figure 3) and habitat that the species is known to use is present within the subject land. This expert report has been included as a component of the Biodiversity Development Assessment Report (ELA 2023) to adequately assess this species. The subject site is defined as the area covered by the proposed development. The study area includes the subject site and a buffer of 200 m as well as any identified migratory and/or shelter habitat for GGBF that could interact with the study area (discussed in more detail in following sections).

1.1 Purpose of the expert report

Section 6.5.2 of the Biodiversity Assessment Method (BAM) sets out the following essential requirements for the preparation of an expert report:

- identify the relevant species or population
- justify the use of an expert report
- indicate and justify the likelihood of presence of the species or population
- estimate the number of individuals or area of habitat (whichever unit of measurement applies to the species/individual) for the biodiversity certification assessment area, including a description of how the estimate was made
- demonstrate what information was considered, rejected and discounted in relation to the determination made in the expert report
- identify the expert and provide evidence of their expert credentials.

The report needs to determine whether:

- The species is unlikely to be present, in which case no further assessment is required, or

The species is likely to be present in which case the expert report must provide estimates of habitat area within the development footprint.

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Figure 1: Location of Development Site in NSW

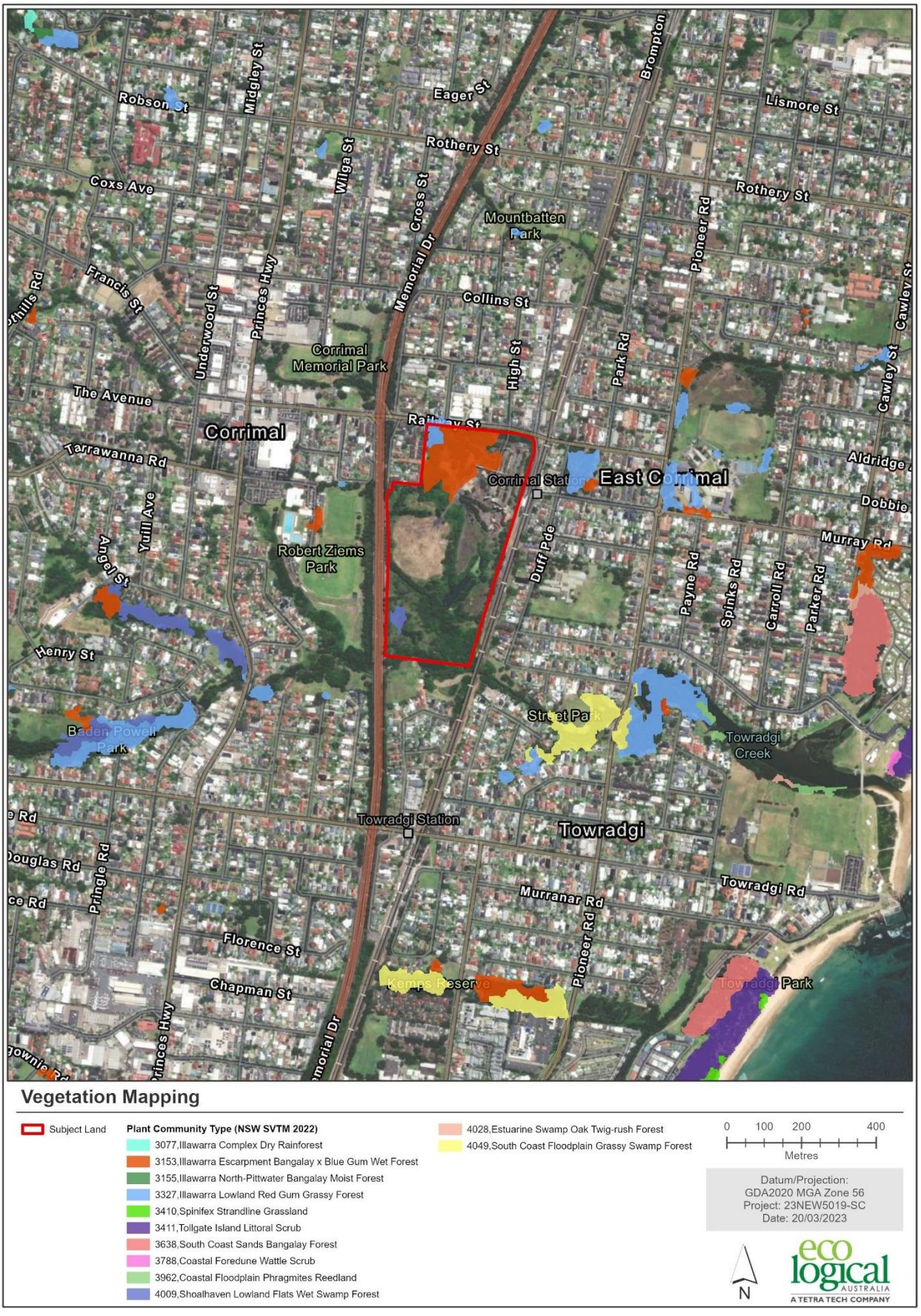


Figure 2: Development Site footprint showing vegetation extent and broad location of water bodies (STVM 2022)

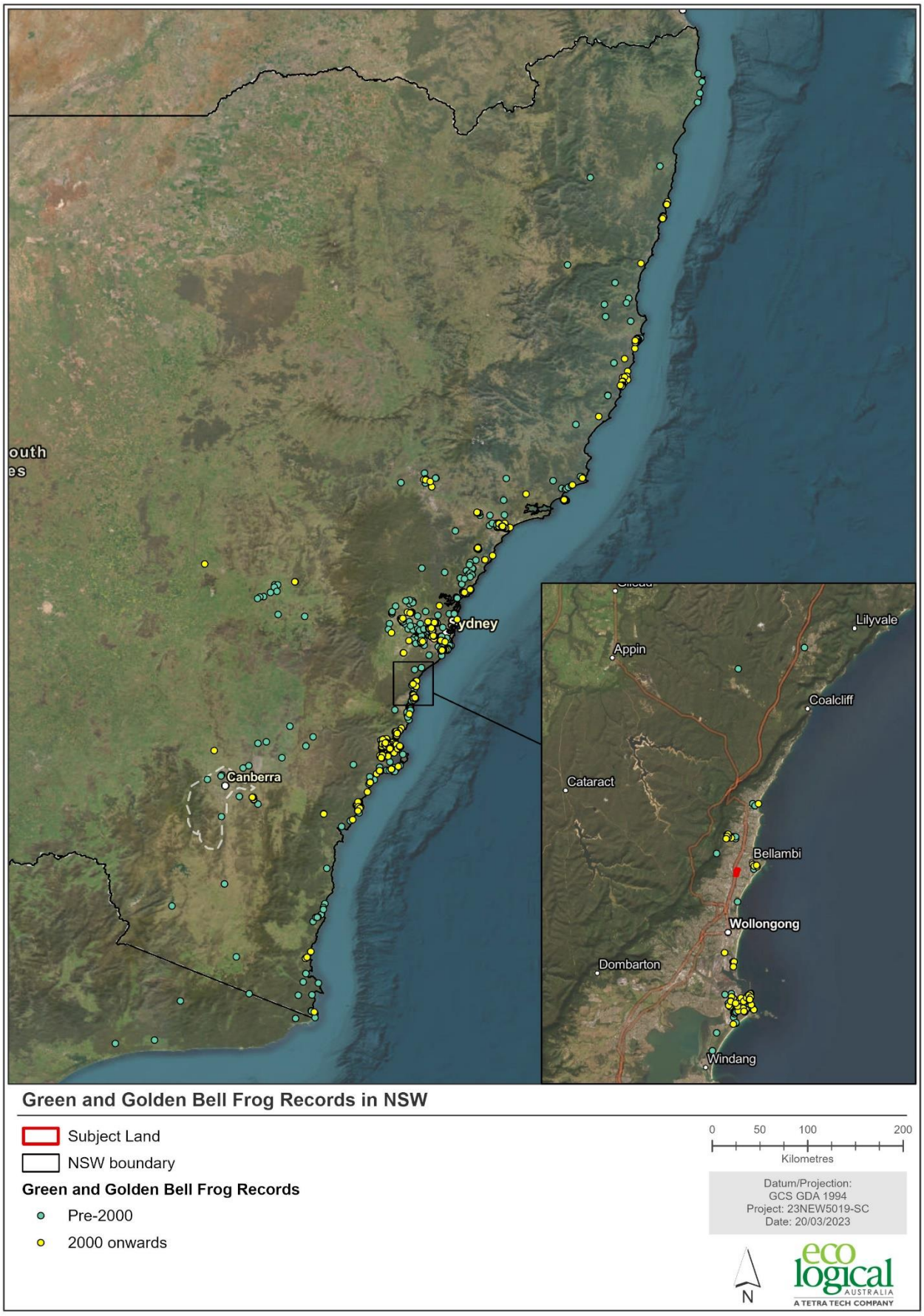


Figure 3: Records for the Green and Golden Bell Frog across NSW and the Wollongong area (BioNet 2023).

1.2 Project context

The proposed development is seeking approval for the Corrimal Coke Works subdivision. The proposed development includes:

- Bulk earthworks
- Tree and vegetation removal
- Ancillary works including compounds, access, parking, fencing and sediment management.

The subject land boundary and development footprint are presented in Figure 2 and will comprise three bulk earthworks and demolition stages.

1.3 Assessment Area

The BDAR produced uses the site-based method for its assessment and so the Assessment Area for the BDAR itself is the 1,500 m buffer surrounding the edge of the boundary of the development site. The individual components for proposed development are described in section 1.2. Information for this area was obtained from a range of data layers including:

- Aerial mapping (SIXMaps and Nearmap)
- Biodiversity Assessment Method Calculator
- BioNet Vegetation Classification
- Biodiversity Values Map and Threshold Tool
- BioNet Threatened Biodiversity Data Collection (TBDC DPE 2023a)
- BioNet / Atlas of NSW Wildlife 10 km database search (NSW Department of Planning and Environment (DPEc) accessed 7 September 2021 and September 2022)
- EPBC Act Protected Matters Search Tool 10 km database search (DCCEEW), accessed 7 September 2021 and September 2022)
- NSW Survey Guide for Threatened Frogs A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE 2020a)
- Sussex Inlet Golf Village Stage 2 – BDAR (ELA 2021a)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (Department or Environment and Conservation (DEC) 2004)
- Eco Logical Australia 2021b. Sussex Inlet Biodiversity Certification Assessment Report. Prepared for Taliac Pty Ltd
- Geographic information system (GIS) datasets including soil, topography, geology and drainage.

The majority of the development site consists of hardstand surfaces, disused cokeworks infrastructure and planted or regrowth native and exotic vegetation. There are two patches of remnant native vegetation at the north and south of the development site, two dams and two streams.

1.4 Reasons for use of an expert report

Section 6.5.2.8 b of the Biodiversity Assessment Method (OEH 2017) places two specific requirements for where an expert report can be used instead of surveys:

- an expert report can only be used instead of a survey for species to which species credits apply
- an expert report may be obtained instead of undertaking a species survey at a development site,

clearing site, land to be biodiversity certified or a biodiversity stewardship site.

The GGBF meets the first criteria, being listed as a species credit species under the BC Act.

The GGBF is known to be able to use the types of landscapes present within the study area (see Section 2.4) and there are records of the frogs present within the adjacent residential subdivision and two records in the broader BCAA from within the last five years (Figure 3). Field survey has not been undertaken to adequately assess the presence of the GGBF within the subject land for the purposes of understanding its use as a movement corridor.

On that basis, an expert report was determined to be required for this species.

CREDENTIALS OF EXPERT

Dr Lemckert is an Ecologist that has been undertaking studies into the ecology and management of frogs since 1986 and has been a principal ecological consultant since 2011. His skills include survey design / implementation / targeted species surveys, data handling, analysis and interpretation and the production of high level reports including papers published in international peer-reviewed journals and technical reports and recovery plans for the Commonwealth and NSW Governments.

He has also been an expert witness for the assessment of the impacts of alleged illegal clearing for the Commonwealth, NSW and Local Governments and provided an expert review of the developed assessment process for impacts on Matters of National Environmental Significance for two proposed Coal Seam Gas Developments in Queensland. Dr Lemckert represented Forests NSW (now Forestry Corporation NSW) as a reptile and amphibian expert in the Comprehensive Regional Assessments and Regional Forest Agreement Process carried out between 2000 and 2002, as an expert in fauna management for negotiations over a new Threatened Species License for harvesting operations in 2014 and again as part of a team developing a historic assessment of forestry impacts and monitoring for the Integrated Forest Operations Agreement in 2022.

He and has completed two rounds of expert review of the status of Australia's amphibians for the IUCN and lead a team reviewing prescriptions protecting threatened species for the NSW Private Native Forestry Codes of Practice (2022).

Dr Lemckert is an acknowledged expert on eastern Australian frogs having completed his MSc and PhD on the ecology and management of frogs in this region and has published over 70 papers (or book chapters) in Australian and International peer-reviewed journals. He has been used by both the NSW and Commonwealth Governments as an expert witness in court cases assessing the impacts of land clearing on threatened frogs.

He is a member of the Amphibian Specialist Group of the IUCN, secretary of the NSW Declining Frog Working Group of NSW and past president of the Australian Society of Herpetologists. He co-supervised two PhD students, a Master of Applied Science Student and three Bachelor of Science (Honours) students who completed theses addressing issues of frog biology and conservation. He is listed as an accredited expert by the NSW Department of Planning and Environment (DPE) to provide expert reports for multiple frog species under the Biodiversity Assessment Method (BAM), including the GGBF. He has produced expert reports for the GGBF for the Warragamba Dam raising project, for the Strategic Assessment for the Cumberland Plain Conservation Plan and the Advanced Water Recycling Centre in Western Sydney. He has recently written the survey guidelines for NSW threatened frog species to be used in assessments under the Biodiversity Assessment Method (BAM).

Dr Lemckert can demonstrate his expertise on the GGBF through the following publications and reports:

- Gillespie, G.R., Roberts, J.D., Hunter, D., Hoskin, C.J., Alford, R.A., Heard, G.W., Hines, H. **Lemckert, F.**, Newell, D. & Scheele, B.C. 2020. Status and Priority Conservation Actions for Australian Frog Species. Biological Conservation 247, 108543. https://doi.org/10.1016/j.biocon.2020.108543.
- **Lemckert, F.L.**, & Mahony, M.J. 2018. The status of Decline and Conservation of Frogs in Temperate Coastal South-eastern Australia. **Pp 59-72** In: *Amphibian Biology Volume 11 - Conservation and Decline of Amphibians: Eastern Hemisphere (Australia, New Zealand and Pacific Islands)*. H. Heatwole and J. Rowley (Eds.). CSIRO Publishing, Melbourne.
- **Lemckert, F.L.** 2017 and 2021. Surveys for the Green and Golden Bell Frog at Meroo for the Saving our Species Research Program. Report to NSW Office of Environment and Heritage.
- Mahony, M.J., Hamer, A.J., Pickett, E.J., McKenzie, D.J., Stockwell, M.P. Garnham, J.I., Keely, C.C., Deboo, M., O'Meara, J., Pollard, C.J., Clulow, S., **Lemckert, F.L.**, Bower, D.S., & Clulow, J. 2013. Identifying conservation and research priorities in the face of uncertainty: a review of the threatened bell frog complex in eastern Australia. *Herpetological Conservation and Biology* **8:**519-538.
- Penman, T.D. & **Lemckert F.L.** 2008. Monitoring the green and golden bell frog: current problems and an alternative approach. *Australian Zoologist* **34:**373-378.
- Hero, J-M., Gillespie, G., Cogger, H., **Lemckert, F.** & Roberston, P. 2008. *Litoria aurea*. Pp 256 In: *Threatened Amphibians of the World.* S.N. Stuart, M. Hoffman, J.S., Chanson, N.A. Cox, R.J. Berridge, P.J. Ramani & B.E. Young (Eds). Lynx Edicions, Barcelona, Spain.
- Hero, J-M., Gillespie, G., Cogger, H., **Lemckert, F.** & Robertson, P. 2004. *Litoria aurea*. The IUCN Red List of Threatened Species 2004: e.T12143A3325402. http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T12143A3325402.en. Downloaded on 17 May 2018.
- **Lemckert, F.L.** 1998. Survey report for the green and golden bell frog at Badgerys Creek, NSW. Unpublished report for Biosis Pty. Ltd.
- **Lemckert, F.L.** 1996. Surveys for the green and golden bell frog, *Litoria aurea*, by the State Forests of New South Wales. *Australian Zoologist* **30:**208-213.

In addition, he is recognised as an expert in the species having been engaged by:

- Remara Property to provide expert assessment of site presence of the GGBF at a development at Sussex Inlet (2023).
- Ford Civil to manage impacts of the development of the Barton Park Precinct development on the local population including survey and monitoring programs (2022-23).
- Sydney Olympic Park Authority as an invited speaker at the GGBF Management Workshop held at Sydney Olympic Park (2022).
- NSW Roads and Maritime Services to conduct expert surveys for this species for the Princes Highway-Jervis Bay Road Upgrade (2021-2022).
- Kooragang Island KIEP site (contaminated lands) pre-clearing management and relocation of the Green and Golden Bell Frog population on the development site during the vegetation clearance program prior to capping of the site (2021-2022).
- Expert assessment on the presence of the GGBF for the Kurri Smelter re-development project (2021).

- Kooragang Island KIWEF facility survey and relocation of Green and Golden Bell Frogs from five separate areas requiring the relocation of over 1000 juvenile Green and Golden Bell Frogs into selected translocation ponds (2020).
- Blacktown Council to complete surveys for the Green and Golden Bell Frog in around the old Riverstone Meat Works to determine potential presence of the species for future development of the site (2020).
- NSW Office of Environment and Heritage (now DPIE) to complete a baseline survey for the Meroo Lake population of the GGBF for the Saving Our Species (SOS) program (2016-2017 and 2021).
- NSW Office of Environment and Heritage to be part of the expert panel determining the categorisation of this species under the SOS program and in determining the populations requiring specific management to meet the SOS requirement to have a viable population maintained 100 years into the future.
- Daracon to provide expert advice and survey for this species at Kooragang Island for a soil emplacement facility (2019-2020).
- NSW Roads and Maritime Services to conduct expert surveys for this species for works at Sydney Airport, Shortland to Sandgate and Berry to Bomaderry (various since 2014).
- NSW Roads and Maritime Services to conduct expert surveys for this species in the area around South Nowra (2011-2016).
- Port Kembla Coal Terminal to conduct annual ongoing monitoring of this species as part of a Green and Golden Bell Frog Management Plan (2014-2017).
- John Holland Group and Daracon to provide expert advice and survey for this species at Kooragang Island for a rail and road corridor upgrade (2015-2016).
- EPBC surveys for the GGBF at Port Kembla to determine the presence/absence of this species in relation to a proposed development along Masters Road (2014).
- Wollongong Golf Club to complete repeat surveys at Wollongong Golf Course as part of pre- clearing of drainage culverts (2013).
- Provided expert opinion on the status of this species during assessments undertaken for the IUCN in 2001 and 2016.
- Provided expert opinion on the habitat requirements, sub-population status and reservation requirements for the Green and Golden Bell Frog during the NSW Government's Comprehensive Regional Assessment program (2000-2001).
- Distribution surveys through its historic range between Sydney, NSW, and the Gippsland area of eastern Victoria, as part of a project to look at overlap zones and pre-mating isolating mechanisms between the Green and Golden Bell Frog and Southern Bell Frog (*Litoria raniformis*) (1986-1987).

Dr Lemckert's full CV is provided as Appendix A of this report.

2. Species information

2.1 Species description

The GGBF is an endemic Australian tree frog that is a member of the Australian frog family Pelodryadidae (formerly Hylidae). It is one of the largest tree frog species in Australia, with adult males ranging in snout-urostyle length from 55-80 mm and females 65-100 mm snout to vent length (Tyler and Knight 2009; Clulow and Swan 2018). The species gets its name from the typical dorsal body colour seen for the species which a vivid green splotched with gold (Plate 1). However, in some individuals the back may be almost entirely green whereas other have dominant gold markings. There is a pale creamish-white stripe extending from the upper eyelids usually almost to the groin and a cream stripe along the top lip. The frog also characteristically has blue or bluish-green markings in the thighs and groin. The snout is relatively pointy and the belly granular. There is rarely a mid-dorsal stripe, which typically distinguishes this frog from *Litoria raniformis* (Southern Bell Frog).



Plate 1*: Typical adult Green and Golden Bell Frogs (second frog is basking on emergent vegetation)*

2.2 Life cycle

The GGBF is considered to have a calling season that extends from Spring to Autumn (Lemckert and Mahony 2008). Within that period of time calling is usually initiated by rainfall events. The males produce an advertisement call sounding like “whaaark whaark whark” along with a growling territorial call. Calling occurs mainly at night, but occasionally males will call during the day when conditions are favourable (DEC 2005). The males call in groups floating on the surface of the water usually holding on to emergent vegetation, with males synchronising their calls with a lead calling male so that they all call essentially at the same time (Barker et. al. 1995; Pyke and White 2001). This may help to confuse predators by masking individual calls.

Male GGBF show signs of sexual maturity, in the form of nuptial pads and a darkened through area, at around 45–50 mm snout-vent length (DEC 2005). These features become evident usually a year after metamorphosis. Females reach sexual maturity at a snout-vent length of around 65 mm, which typically takes to the second season after metamorphosis (DEC 2005).

Female GGBF produce a large number of eggs for an Australian species, with Pyke and White (2001) indicating an average clutch size is about 3,700 eggs, but with van de Mortel & Goldingay (1996) recording a maximum

clutch of 11,682 eggs. Egg size is around 4 mm in diameter. Spawn is laid among aquatic vegetation, with it initially floating on the water surface as a mass, but sinking within 24 hours of being laid. Eggs typically hatch 2–5 days after ovipositing/fertilisation (Anstis 2013) with water temperature playing a role in development time (eggs hatch faster in warmer water) and can hatch in less than one day.

Tadpoles grow at variable rates depending on conditions and availability of food. They can reach up to 80 mm in length before metamorphosis, although they will metamorphose at smaller body lengths. Time to metamorphosis is variable and dependent on conditions and time of year, taking between two and eleven months, but with a mean of three months (Anstis 2013). Tadpoles may overwinter if breeding occurs late in autumn. They should typically eat algae and other aquatic vegetation and can often be seen sucking at the surface of the water, presumably to take in organic material floating on the water surface. But their actual diet has not been studied. As for most species, it is likely that tadpoles will also eat dead animal material if it is available, including other tadpoles.

The tadpoles can tolerate salinity levels of six parts per thousand (ppt) without any apparent negative effects (Kearney et al. 2012), while salinity of 8 ppt or higher decreases growth rates and increases mortality rates (Christy and Dickman 2002), although adults can tolerate much higher salinity levels over short time periods. The pH of a pond does not appear to affect the likelihood of the eggs to hatch (Pyke and White 2001). These are important points regarding the observed impacts of the amphibian chytrid fungus (see Section 2.4).

2.3 Distribution and abundance

2.3.1 Broad distribution

The species has been recorded from Yuraygir National Park on the far North Coast of NSW to around Lakes Entrance in south-eastern Victoria (White and Pyke 2008), with their being suggestions that they may once have reached as far north as the NSW/Queensland border. Courtice and Grigg (1975) completed a detailed study of the distribution of the GGBF and in Gippsland and found it only as far west as Marlo, where it abutted and had a potential hybrid zone with *Litoria raniformis* (Growling Grass Frog). In the mid-1980s the species was recorded at least 60 km further west at Nowa Nowa and the Growling Grass Frog were no longer present in that location (F. Lemckert Pers. Obs.).

The range was extended 15 km further west at Lakes Entrance by White and Pyke (2008). By 2011 they had been recorded another 70 km to the west at Dutson Downs (Gippsland Water 2021). This may suggest a westward expansion of the species in Victoria since the 1970s. Historically the species was known from a number of sites at least 50 km inland into the NSW ranges including at Bathurst (White and Pyke 1999), Bungendore (Humphries 1979) and 30 km inland at Ulong on the NSW north coast (Moore 1961). The furthest and now only extant "inland" population is near Hoskinstown in the Southern Tablelands of NSW (Osborne et al. 2008). Natural GGBF populations are also known from three islands off the coast of NSW; Bowen Island, Kooragang Island and Broughton Island (DEC 2005). Extra-limital populations have been introduced to New Zealand (Pyke et. al. 2002), and New Caledonia and Vanuatu (Pyke and White 2001) with the species occurring in high densities in some areas on these islands (M. Mahony Pers. Comm.).

The extent of occurrence of the species in Australia was estimated to be approximately 150,000 km² (Mahony 1999). The extent of occurrence has declined further since that time and is continuing to reduce as populations are also known to have continued to decline (Mahony et. al. 2013). Using the Atlas of Living Australia data, the extent of occurrence using records obtained since 2000 is approximately 9750 km^2.

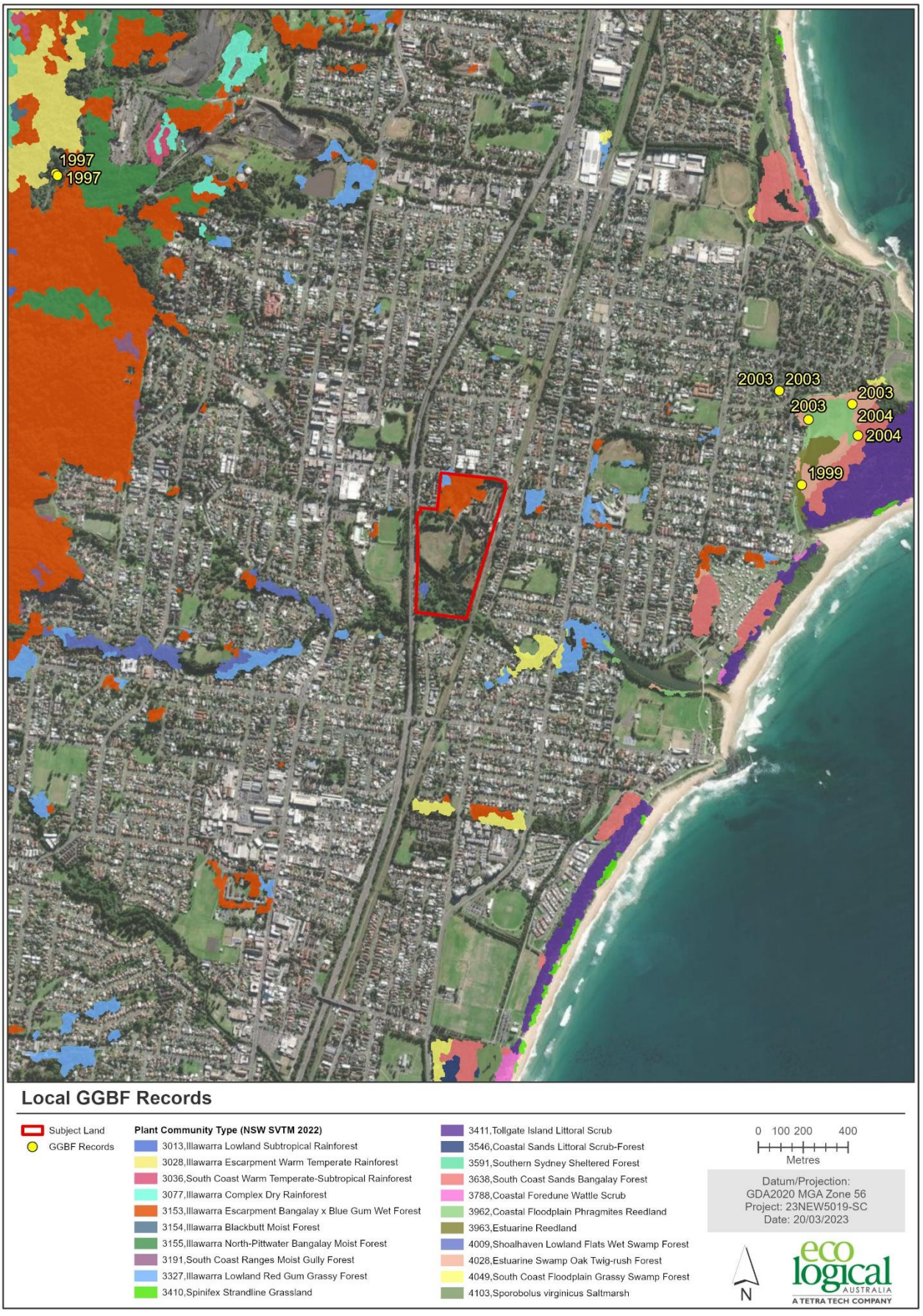


Figure 4: Location of Green and Golden Bell Frog records relative to the development site

2.3.2 Population around Corrimal

The Draft Recovery Plan for the GGBF (DECC 2004) provides the following information on the GGBF in the Wollongong area.

The Illawarra region, as here defined, includes the LGAs of Wollongong, Shellharbour, Kiama, Wollondilly and Wingecarribee. Historically the species was well represented and was frequently encountered at least up until the late 1960s and early 1970s. In the north the species was recorded at Wollongong from about 1890, Woonona from 1910 and Thirroul from 1920. Records from Fairy Meadow date to the early 1970s. In the Shellharbour/Warilla area during the 1970s a population occurred around the Little Lake coastal lagoon catchment and including wetlands between Shellharbour township and Bass Point (R. Wellington unpublished; G. Daly pers. comm., Lewis, 1997). In the Kiama/Jamberoo area a population occurred in the floodplain wetlands associated with the Minnamurra River and also at Albion Park in farm dams and wetlands associated with the Macquarie Rivulet flood plain (R. Wellington unpublished; M. Robinson pers. comm.). These populations had apparently declined by the early 1980s.

The Draft Recovery Plan lists four Key Populations within the Wollongong region: Woonona, Port Kembla, Shellharbour and Kiama. The relevant one for this project is the one listed as occurring at Woonona, which is still over 2.5 km to the north of the subject site. The other three are too far away at over 10 km to be relevant.

The Woonona population, at least at the time of the Recovery Plan, was associated with the old Boral brickpit and the drainage lines of Collins Creek and the Bellambi Creek system (Farrahers, Hollymount, Cawley, Russell Vale and Rixon's Pass Creeks). This population was thought to use the coastal lagoons and wetland remnants and these drainage lines as connective corridors to other required habitat components towards the escarpment.

Figure 4 indicates the records obtained for the species in close proximity to the development site. It shows that there are no historic records from within the development site and only two clustered groups of records anywhere else within the map area. The closest of these is a cluster of six records at least 1.3 km away to the east at Bellambi Lagoon recorded between 1999 and 2004. The other site covers two records from 1999 located over 2 km to the west on the Illawarra escarpment. Survey work completed by ELA as part of the assessment for the proposed development did not locate any individuals, although surveys did not meet BAM requirements.

2.3.3 Abundance

The GGBF was recorded as once being a very abundant and widespread frog (Goldingay 1996). Fletcher (1889) stated that this species was commonly be encountered in the Sydney area and Harrison (1922) noted that this species was "probably our best known frog" and was "known to me since childhood". Extensive surveys for the species by Courtice and Grigg (1975) in the early 1970s recorded it very regularly and abundantly across coastal NSW and into southeast Victoria. However, there was a serious decline of the species in the 1980s, with the timing being uncertain, but with frogs having disappeared from many historic sites by 1987 (F. Lemckert Pers. Obs.). By 1996 the GGBF was regarded as rare by White & Pyke (1996) and its recorded declines recognised to be of concern (White 1995).

The recovery plan written for the species (DEC 2005) found the GGBF to have declined to less than 50 populations in NSW and the declines have been continuing (Mahony et. al. 2013) with accounts such as that by Daly (2014) noting that the population known from Nowra has apparently continued to contract from a previous expansion. Populations of over 1,000 frogs were (and likely still are) present at Kooragang Island,

Broughton Island and perhaps Homebush (Hamer et. al. 2002) and Meroo (F. Lemckert Pers. Obs.), but the other core populations known around the state are generally much smaller (DEC 2005).

The amphibian chytrid fungus has been implicated as the main driver of these severe declines (Mahony et. al. 2013), although habitat loss (Goldingay 1996) and introduced predatory fish (Pyke and White 1999, Goldingay 2008) have also been suggested to have played significant roles in population declines and losses. Current populations are almost exclusively found within 10 km of the coastline (Mahony et. al. 2013) with the impacts of salinity attenuating the effects of the fungus. Similarly there are indications that populations at Homebush and near Captains Flat (ACT) have persisted because of chemical pollutants that have stopped the growth of the chytrid fungus, but are still tolerable to the frogs and tadpoles (Threlfall et al 2008). Such conditions are likely less than optimal, but still represent the only areas where populations are able to persist because the fungus has minimal impact.

Over the short-term the GGBF can exhibit significant local population fluctuations when conditions result in high tadpole survivorship (e.g. Daly 2014). The GGBF has a life cycle that fits what is termed to be an R-selected species (Hamer and Mahony 2007), producing large numbers of offspring and adults have relatively shorter lifespans. Hence, there is a relatively rapid turnover of individuals and survival of the local population depends on occasional very successful seasons, when population size and area utilised rapidly increase, interspersed with years of low recruitment when numbers fall away and there are local extinctions in less favourable areas of habitat. This is considered a typical pattern for amphibians (Alford and Richards 1999). In fact, The GGBF has been suggested to be a colonising species with a series of its attributes suit this lifestyle: habitat generalist, high fecundity, rapid growth, early sexual maturity, and relative high dispersal ability (Hamer & Mahony 2007). White and Pyke (1999) suggest that the GGBF rapidly move into areas of newly created breeding habitats that have little competition from tadpoles from other species, are open to sunlight to increase water temperatures to provide good thermal environments and lack or have minimal predators present such as dragonfly larvae or fish.

As noted above, only eight records are available for the study area and its immediate surrounds, all of which were recorded prior to 2005. The coastal swamp at Bellambi represents historically typical habitat for the GGBF in coastal NSW (Mahony et al. 2013). The species is far less recorded amongst developed areas, although it can still be present, as is evident in the records at Port Kembla. The absence of any records for the local area since 2004 strongly indicates that if a local population remains then it is only very small and likely restricted to the Bellambi area. This is like most populations for the species which are small and localised (DECC 2005) and such small populations are considered more vulnerable over the long term. It is quite possible that the population has suffered at least a short-term extinction for the Corrimal area. The population might normally be expected to be “rescued” by colonisation, as happens with metapopulations, but the impacts of the chytrid fungus and the severe urbanisation of the surrounding area makes this increasingly unlikely to happen once extinctions occurs (see Section 2.5).





Plate 2: Examples of typical permanent pond breeding habitat used by the Green and Golden Bell Frog (Kioloa, NSW).



Plate 3: Green and Golden Bell Frog coastal inlet breeding habitat, flooded fringe after heavy rains (Meroo Lake).

2.4 Habitat requirements

2.4.1 Breeding Habitat

GGBF breed in a wide range of water bodies and the species has been recorded inhabiting all but fast flowing streams (Pyke & White 1996). It inhabits many human- created environments, including highly disturbed sites such as abandoned mines and quarries (Pyke et. al. 2002), as well as artificial wetlands created for the GGBF at places such as Kooragang Island (Hamer et. al. 2002) and Sydney Olympic Park (Darcovich and O'Meara 2008).

Pyke & White (1996) undertook a review of the known breeding habitat of the GGBF and found that they preferred to breed in water bodies that were still, shallow, ephemeral, unshaded, with aquatic plants and free of the Plague Minnow (*Gambusia holbrooki*) and other predatory fish. This study also found that breeding occurs in a significantly higher proportion of sites with ephemeral (temporary) ponds, rather than sites with fluctuating or permanent ponds. Hamer et. al. (2002) found a similar result for the GGBF populations at Kooragang Island where larger males would move to ephemeral water bodies to breed, when they were

available, although reproduction was also associated with permanent water bodies. The frogs in that study tended to remain relatively faithful to one water body. Ongoing monitoring of frogs in the area of Meroo Lake has provided similar results (F. Lemckert Pers. Obs.) with calling and breeding most typically being associated with flooded freshwater fringes of otherwise saline coastal lakes, but calling also being heard less frequently in permanent ponds.

The presence of the Plague Minnow does not exclude GGBF from breeding in a water body, but success is likely low and appears to be dependent on the presence of more complex aquatic vegetation, which allows the GGBF to breed successfully (Hamer et. al. 2002). Hence the Plague Minnow is not a sole determinant of the likely presence of the GGBF in most situations.

2.4.2 Non-breeding habitat

A review of movements of frogs indicated that they generally migrate 100-300 m from the breeding site to settle into recognisably different complementary non-breeding habitat (Lemckert 2004). The GGBF is a slightly unusual frog in that non-breeding habitat is another water body rather than dispersing away into terrestrial environments to undertake foraging and find shelter (Lemckert 2004). When the do move out into surrounding vegetation it is usually only a relatively small distance (< 50 m) and for short times (days) and preferably into grassy areas and areas of open vegetation that contain a range of diurnal shelter sites such as logs, rocks or dense vegetation (Pyke and White 1996). There are observations though, of GGBF at least being willing and able to forage in taller forests with denser understorey (e.g. dry sclerophyll forest at Nowra; M. Greenlees Pers. Comm. and dense woodlands at Meroo; F. Lemckert Pers. Obs.) and even foraging in suburban backyards (DEC 2005). This again demonstrates the observed adaptability of the species to a range of environmental conditions and a lack of habitat specificity.

Adult frogs show a strong site fidelity, returning to the same ponds over time (Hamer et al. 2008), but their movements around those ponds and immediately adjacent areas appear to be relatively random for most individuals and especially juveniles (F. Lemckert Pers. Obs.). Females though, have been observed to congregate together into specific shelter and foraging sites in areas immediately adjacent to breeding sites (Hamer 1998, Pyke and White 2001).

Shelter sites are used when GGBFs are inactive and vulnerable and of most importance in providing secure over-wintering locations. This is typically into positions that provide secure protection such as rock piles, logs or in the base of grass tussocks (Mahony et. Al. 2013). Studies at Kooragang Island have suggested that females may use slightly different non-breeding areas to males and may have very important and specific over-wintering areas located in dense vegetation (M. Mahony Pers. Comm.). Whether this is the same for other populations is unknown, but there is evidence from Sydney Olympic Park that females there also concentrate in specific locations (J. O'Meara Pers. Com.).

Another unusual aspect of the GGBF is its habit of basking, typically within areas of aquatic vegetation (Plate 2), apparently to increase body temperatures (Pyke and White 2001). Basking in frogs is unusual, but such activities in ectotherms typically allow for periods of greater activity or faster digestion of food items. Whilst the importance of this activity for its physiological requirements is not known, individual GGBF appear to bask regularly and so it is likely an important activity. Basking on emergent aquatic vegetation likely allows individuals the option to make a rapid escape from diurnal predators by diving into the water. The presence of water bodies that contain emergent vegetation are known important determinants of the presence of GGBF (Pyke and White 1996; Hamer et al. 2002).

Whilst GGBF may retain a closer association with water bodies and appear to generally be faithful to a single water body for their general activities, they can move along and between different water bodies, particularly as part of migrations to and from breeding sites (Hamer et al. 2002). Hamer et al. (2008) noted that male GGBFs at Kooragang Island often moved > 200 metres to reach an ephemeral breeding site, crossing over extended grassland areas and other habitats including disturbed habitats. Studies have found that occasionally an individual may move longer distances of over time including distances of more than 1 km (Hamer et. al. 2008), up to 3 km (Pyke & White 2001) and even dispersals as far as 10 km (White & Pyke 2008). These longer distance movements may represent occasional dispersal events that provide for colonisations of new habitats, but are undertaken by few individuals and do not form part of regular movements that keep a local population connected. It is likely that most such movements end up with the death of the frog as it moves into areas without suitable resources.

2.4.3 Migratory habitat

Christy (2001) and Muir (2008) state that terrestrial movements of the GGBF are primarily undertaken through open environments such as grasslands and mown areas rather than adjacent areas with denser vegetation cover. These open habitat also preferably contain patches of shelter within them such as rocks, logs or ponds or areas of thick vegetation. Such habitats provide relatively little impediment to the movements of frogs but allow for individuals to seek shelter as required during the period of movement. Terrestrial movements are typically undertaken at night and are most likely associated with rainfall events (F. Lemckert Pers. Obs.) which would provide protection against desiccation when traversing the preferred open environments. As previously noted, the GGBF is strongly associated with water bodies through all parts of its life cycle and presumably the species is relatively less tolerant of desiccation than species that use terrestrial environments when not breeding. Thus movements along corridors are strongly associated with either streams that contain water or along lines of pools/ponds that provide stepping stones of shelter between start and end water bodies (Muir 2008; DECCW 2009). This follows the findings of Hamer (2002) who showed that most of the water bodies where GGBF persisted at Kooragang Island within water bodies that had another occupied water body within. Water bodies where the species did not persist were isolated from other occupied water bodies by a distance of over 500 m and it was concluded that movements of GGBF between ponds was most likely dependent on distance to the nearest suitable pond rather than physical barriers.

Mahony (1999) cautions that the studies that have been carried out since the declines of the GGBF do not necessarily identify the actual preferred requirements of the species. He notes that the changed environment and factors causing the declines may have “altered” the optimal habitats for the species in comparison to their habitat use patterns prior to the declines. This is based on the fact that the use of ephemeral breeding sites was not noted for the bell frog group in earlier habitat descriptions. Such altered habitat use has been noted for other species such as the Armoured Mist Frog (*Litoria lorica*) that now is only present in open rocky streams whereas it was once known as a rainforest stream species (Puschendorf 2011). This change is attributed to the impacts of the chytrid fungus, with the frog only surviving in a relatively extreme environment where the fungus is affected by the hotter conditions. Given the chytrid fungus appears also to have been the major cause of the decline of the GGBF, there is a significant potential that the GGBF is now persisting in different environments to those it historically preferred. However, that is unlikely to ever be confirmed.

2.5 Metapopulation dynamics

A critical consideration in the likely presence/absence of the GGBF are metapopulation dynamics. The GGBF is considered to follow a classical metapopulation structure with the “local” population consisting as a series

of patchy populations within the larger single metapopulation. Individuals move regularly between a mosaic of wetlands across a broad area throughout a single breeding season (Hamer et al. 2008; Hamer & Mahony 2010). There is high site-specific population turnover with local extinctions being balanced by colonisations of other ponds or parts of the local area by regularly dispersing individuals, but with the overall metapopulation remaining stable. There are core sites that provide ongoing and regular reproductive success and that maintain long-term populations, but the major part of the population dynamics is driven by inter-year success of breeding at a range of available breeding sites, with years of very good reproductive success leading to opportunities to expand ranges and colonise new sites. On Kooragang Island, GGBF typically reside in permanent waterbodies where they exhibit high site fidelity, but during periods of high rainfall disperse over several hundred metres to breed at ephemeral water bodies that have flooded (Hamer et al. 2008). Reproductive activity (e.g. calling) typically occurs over several nights at these ephemeral waterbodies, with individuals returning to core permanent waterbodies. In times of poor rainfall, the core sites become the refuges for the species and Valdez et al. (2015) found that probability of occupancy of a site increased at large and permanent wetlands.

Following on from this is the identified need for connected sites to allow this population interaction. Hamer (2016) found that the presence of the GGBF at sites at Nowra was dependent on accessibility of ponds, a factor mediated both by the presence of vegetation and the extent of roads in the area, with the presence of roads providing a likely serious barrier to pond use. The presence of vegetation directly around ponds correlated significantly with the potential for greater species diversity. The type of pond available also was important, with the species avoiding steep sided concrete ponds. The apparent negative impacts of roads was confirmed in follow up work (Hamer 2018) where it was again found that the extent of accessible habitat (habitat close to ponds and not isolated from the pond by a road) positively influenced the likelihood of pond occupancy. Extinctions of GGBF were significantly more likely to occur at ponds in areas with higher densities of roads. Similar findings have been obtained for pond occupancy by frogs in the United States (Marsh et al. 2017).

The spatial arrangement of wetlands and the extent of wetlands measured in a 1 km radius has been found to be an important predictor of pond occupancy by GGBF in studies by Hamer et al. (2002), Hamer and Mahony (2010) and Valdez et al. (2015) with more ponds, ponds in closer proximity and already occupied ponds increasing the potential for the GGBF to be present or occupy a previously unoccupied pond (Puschendorf et al. 2011).

The Corrimal Coke Works development site has several permanent water bodies present along with a creekline, which provides some potential connectivity. However, the urbanisation around and particularly the presence of an extensive road network has probably created very significant barriers to regular movements of frogs across the broader area and it is very likely that there is now minimal connectivity to Bellambi Lagoon to the east or the area of the escarpment to the west with records from 1999.

2.6 Vegetation associations

The OEH profile records the GGBF to be associated with a broad range of vegetation formations and classes within the Sydney Basin Interim Biogeographic Region, the location of the AWRC and infrastructure (https://www.environment.nsw.gov.au/threatenedspeciesapp/profileData.aspx?id=10483&cmaName=Sydney+Basin). These are:

1. Dry sclerophyll forests (shrub/grass sub-formation)
    - Clarence Dry Sclerophyll Forests

- Cumberland Dry Sclerophyll Forests
- Hunter-McLeay Dry Sclerophyll Forests
- North-west Slopes Dry Sclerophyll Forests.

2. Dry sclerophyll forests (shrubby sub-formation)
    - Coastal Dune Dry Sclerophyll Forests
    - South Coast Sands Dry Sclerophyll Forests
    - South Coast Wet Sclerophyll Forests
    - South East Dry Sclerophyll Forests
    - Southern Tablelands Dry Sclerophyll Forests
    - Sydney Coastal Dry Sclerophyll Forests
    - Sydney Hinterland Dry Sclerophyll Forests
    - Sydney Sand Flats Dry Sclerophyll Forests.
3. Forested wetlands
    - Coastal Floodplain Wetlands
    - Coastal Swamp Forests
    - Eastern Riverine Forests
    - Inland Riverine Forests.
4. Freshwater wetlands
    - Coastal Freshwater Lagoons
    - Coastal Heath Swamps
    - Montane Bogs and Fens.
5. Grasslands
    - Maritime Grasslands
    - Temperate Montane Grasslands.
6. Grassy woodlands
    - Coastal Valley Grassy Woodlands
    - Southern Tablelands Grassy Woodlands
    - Tableland Clay Grassy Woodlands
    - Western Slopes Grassy Woodlands.
7. Heathlands
    - Coastal Headland Heaths
    - Sydney Coastal Heaths
    - Wallum Sand Heaths.
8. Miscellaneous ecosystems
    - Highly disturbed areas with no or limited native vegetation
    - Marine environments
    - Rocky islands
    - Water bodies, rivers, lakes, streams (not wetlands).
9. Rainforests
    - Dry Rainforests.
    - Littoral Rainforests

- Subtropical Rainforests.

10. Saline wetlands
    - Mangrove Swamps
    - Saltmarshes.
11. Wet sclerophyll forests (grassy sub-formation)
    - Northern Hinterland Wet Sclerophyll Forests
    - Southern Lowlands Wet Sclerophyll Forests
    - Southern Tableland Wet Sclerophyll Forests.
12. Wet sclerophyll forests (shrubby sub-formation)
    - North Coast Wet Sclerophyll Forests.

An important point to come out of this list of vegetation associations is the very broad variety of vegetation (and non-vegetation) types the frogs are associated with, ranging from rainforests to heathland to swamps to dunes. That is essentially all possible environments present within the Sydney Basin IBRA Region and reflects the understanding that the GGBF is a very adaptable species with little in the way of habitat limitations. This also conforms with the GGBF being recognised for its use of highly disturbed environments and areas without native vegetation. In the context of assessing the likely presence/absence and, if present, the abundance of this species, the type of vegetation present has limited relevance. The value of vegetation is being present to provide GGBF shelter and locations where food may be found and the potential for movements to be inhibited by the presence of dense vegetation.

2.6.1 Threats

The OEH profile for this species lists the following as threats to this species:

- Alteration of drainage patterns and stormwater runoff.
- Frog Chytrid Fungus, a fungal pathogen.
- Predation by feral animals such as foxes.
- Herbicides and other weed-control measures.
- Road mortality, where populations are already small due to other threats*.
- Predation by exotic fish such as Plague Minnow.
- Loss of suitable breeding habitat through alteration by infilling and destruction of wetlands.
- Current knowledge of the status of the population and threats to the population is poor*.
- Species occurs on private land where land management practices may not be suitable for the species, e.g. grazing and loss of breeding habitat*.
- Changes in salinity due to sea level rise. Frogs are unable to breed in waters with salt concentrations of greater than 6 parts per 1,000.
- Overgrowth of pond vegetation leading to declining water temperature.
- Small population size*.
- Lack of information regarding habitat permanency.
- Drying of breeding habitat and refuge habitat as a result of increased temperatures and more frequent droughts, potentially leading to wetlands becoming hypersaline.
- Lack of landscape connectivity leading to isolation of small populations*.
- Heavy metal pollution.
- Four-wheel drives impacting habitat.

- The introduced frog species, Green Tree Frog, on Broughton Island potentially competing with the species and representing a reservoir for chytrid fungus.
- Invasion of habitat by Salvinia (*Salvinia molesta*).

The threats denoted with an * are those that are considered the most relevant to this report,

The Australian Government's Species Profile and Threats Database (SPRAT) (https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1870) lists the following threats for GGBF:

- Habitat removal.
- Habitat degradation (which includes siltation, changes to aquatic vegetation diversity or structure reducing shelter, increased light and noise, grazing, mowing, fire).
- Habitat fragmentation.
- Reduction in water quality and hydrological changes (for example, pollution, siltation erosion and changes to timing, duration or frequency of flood events).
- Disease (for example, infection of the frog with chytrid fungus (*Batrachochytrium dendrobatidis*) resulting in chytridiomycosis).
- Predation (for example, by the introduced Mosquito Fish [NSW Plague Minnow, *Gambusia holbrooki*], Cats (*Felis catus*) or Foxes (*Vulpes vulpes*).
- Introduction or intensification of public access to GGBF habitats.

The IUCN Redlist profile for the GGBF (Hero et al. 2004) notes the following for the GGBF: *"The cause(s) of the apparent declines observed in populations of all taxa within the L. aurea complex are unclear (Gillespie et al. 1995). Investigations of disappearances among the group have primarily focused on L. aurea and L. castanea and two major directions in research have been pursued: the role of increased ultraviolet radiation; and the impact of the introduced fish, Gambusia (Mahony 1999). It is also possible that disease, such as a viral infection or chytrid fungus, might have contributed to the decline of this species (W. Osborne pers. comm.). Chytrid fungus was detected in this species in Hoskinstown and Homebush Bay in Sydney, New South Wales".* This information can be considered to be relatively dated.

In regard to the Project Area, many of these threats would already be in place and not significantly added to by the proposed development. The following are considered to be of relevance to the proposed development:

- habitat removal (through the construction of the subdivision)
- habitat fragmentation (through construction of the subdivision)
- spread of the amphibian chytrid fungus (vehicle movements)
- hydrological changes (through the alteration of the stream location and loss of water bodies).

The at best very small size of any local population is also a consideration in the long-term management of the species.

2.6.2 Variables determining GGBF presence

This information provides the following important points when trying to assess the potential presence of the GGBF in any area:

- The GGBF is more likely to be present where multiple suitable breeding sites are within a close

enough proximity for frogs to migrate between them with relative ease.

- The GGBF is more likely to be present where multiple non-breeding water bodies are present in an area and within close enough proximity to allow migration between them (and breeding sites) with relative ease.
- The GGBF is more likely to be present where the connectivity of breeding and non-breeding habitat contains a matrix (vegetation and shelter) that facilitates migration.
- The GGBF is more likely to be present at a location when there are other GGBF occupied ponds in close proximity.
- The GGBF is unlikely to be present within areas containing a large number of introduced fish.
- The GGBF is unlikely to be present in areas that are more than 10 km from the coast unless those areas have a history of human development that may have led to land contamination.

3. Description of the study area

3.1 Land use history

Existing land uses through the development site and surrounds include:

- Coke Works on the development site itself.
- Residential lands through the majority of the surrounding area.
- Various recreational fields including directly to the west.
- Large numbers of roads of varying sizes fragmenting the landscape.
- Minimal retained vegetation outside of the Coke Works itself.
- The closest significant area of conserved vegetation starts 1.3 km to the west where the escarpment forest is retained and is contiguous with the Upper Nepean State Conservation Area (see Figure 1).
- The Pacific Ocean is 1.5 km to the east.

3.2 Landscape features

The following landscape feature, as defined by the BAM, are relevant to the project.

3.2.1 Bioregions

The impact area and impact assessment area occur within the Sydney Basin IBRA bioregion and the Illawarra IBRA subregion.

The Sydney Basin Bioregion lies on the central east coast of NSW and covers an area of approximately 3,624,008 hectares. It occupies about 4.53% of NSW and is one of two bioregions contained wholly within the state. The bioregion extends from just north of Batemans Bay to Nelson Bay on the central coast, and almost as far west as Mudgee. The bioregion is bordered to the north by the North Coast and Brigalow Belt South bioregions, to the south by the South East Corner Bioregion and to the west by the South Eastern Highlands and South Western Slopes bioregions. The Sydney Basin Bioregion is one of the most species diverse in Australia. This is a result of the variety of rock types, topography and climates in the bioregion (OEH 2016).

The Illawarra IBRA subregion occurs at the very southern end of the Sydney Basin Bioregion and covers an area of 1344 km^2 of the Bioregion. Herron et al. (2018) provide the following landform and geological characteristics:

> *Vegetated cliff faces on coastal escarpment with waterfalls and steep streams. Bouldery debris slopes with sandy clay matrix and low hills and alluvial valleys on coastal ramp. Barrier systems at Lake Illawarra and Nowra.*
>
> *Permian siltstones, shale, sandstones and interbedded volcanics on and below the coastal escarpment. Quaternary alluvium and coastal sands.*

3.2.2 NSW (Mitchell) Landscape

The development site falls within the Lake Illawarra Barrier Mitchell Landscape, but the study area also includes the Dapto – Wollongong Coastal Slopes Mitchell Landscape that abuts the development site to the north (Mitchell 2002).

Lake Illawarra Barrier Mitchell Landscape

This landscape is substantially altered by urban and industrial development but would originally have a very similar structure and composition to the Seven Mile Barrier Landscape. General elevation 0 to 25 m, local relief 5 m. Eel grass (Zostera capricorni) on the lake floor, common reed (Phragmites australis) in fresh swamps and lakes margins, limited grey mangrove (Avicennia marina) and saltmarsh near lagoon mouths and in more open estuaries.

This high level of landscape alteration is evident in Figure 2.

Dapto-Wollongong Coastal Slopes Mitchell Landscape

Hilly forestland lying between the steep rubble slopes of the escarpment and valley floors or coastal barriers. A narrow landscape lying between the coast and the escarpment. Formed on Permian sandstone and shale with areas of interbedded basalt. Slopes range from 3 to 270 with thin stony soils on crests and upper slopes. Deeper well-structured red and red brown loam and clay loam with some areas of mellow texture-contrast soils of high fertility high and good water holding capacity on mid and lower slopes. Yellow solodic soils with bleached A2 horizons common on the lowest slopes and stream terraces. Open forest dominated by forest red gum (Eucalyptus tereticornis), yellow stringybark (Eucalyptus muelleriana), gully gum (Eucalyptus smithii), stringybark with rainforest elements along streamlines. Extensively cleared, former areas of coastal brush may be indicated by remnant cabbage-tree palms (Livistona australis) and Port Jackson figs (Ficus rubiginosa).

3.2.3 Soil

Heron et al. (2018) provides the following soils for the Illawarra IBRA subregion:

Structured red and red brown loams and clay loams with some areas of mellow texture contrast soils. Fertility high and good water holding capacity. Siliceous sands on beaches and dunes, podzol profiles in older dunes, peaty sands and organic silts in swamps and estuaries.

3.2.4 Native vegetation

ELA (2023) identified the following plant communities present on the subject land (Table 6) with the mapped location being shown in Figure 2. This PCT is listed as being used by the GGBF (see Section 2.4.4).

Table 1: Plant Community Types (PCT) in the development footprint

	PCT ID	PCT Name	Condition	Area (ha)
1	838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Good	0.72
2	838	Forest Red Gum - Thin-leaved Stringybark grassy woodland	Degraded	0.73

PCT ID	PCT Name	Condition	Area (ha)
	on coastal lowlands, southern Sydney Basin Bioregion		
	Planted native vegetation	-	4.22
	Exotic	-	2.50
	Cleared land	-	6.67
	Dams	-	0.40
		Total	**15.24**

3.2.5 Rivers and streams

The study area includes un-named first and second order tributaries of Towradgi Creek along with several other unnamed first, second and third order watercourses (Figure 5). One of the tributaries of Towradgi Creek runs north to south through the development site and forms an identifiable water course. This tributary is however, overgrown with vegetation and typically the channel is no more than 1-2 m in width with water < 100 cm in depth. It may not flow during dryer periods. Notably, this tributary of Towradgi Creek is planned to be re-directed as part of the development of the site and be moved to the west of its current path (Figure 6). It is expected that this will not change greatly the extent of water flow of the tributary over the longer term, but will create a significant short term impact at least for any fauna associated with this water course and presumably immediately downstream.

3.2.6 Wetlands

There are no wetlands mapped or recorded to occur within the subject land.

The main human-created ponds of note within the subject land are two large ponds associated with a pump house (Plate 4) that occur past the southern end of the Coke Works area (Figure 5), and several artificial pools have also been created within the Coke Works themselves in the form of concrete settling ponds (Plate 5). This consists of three large (approximately 15 m X 24 m) concrete lined rectangular pondages occurring in parallel in one part of the Coke Works the in one location and two smaller (approximately 3 m X 8 m) ponds forming in concrete bays (Plate 6) within 50 m to the north. It is not clear whether these were intended to be permanent water sources or if that has occurred with the shutting down of the Coke Works. These ponds are now permanent in nature and were inspected to assess their potential as habitat for the GGBF. All provide suitable potential breeding habitat and have emergent vegetation of varying extents. The larger ponds contained tree frog tadpoles that were considered to be *Litoria peronii* (Peron's Tree Frogs).

3.2.7 Connectivity features

The broader area around the development site is highly urbanised with extensive housing, roads and a railway line. The vegetation within the development site forms an island of retained native vegetation in an otherwise highly modified landscape. The main form of connectivity present between the development site and areas to the east and west is Towradgi Creek and the unnamed tributaries. These form a riparian corridor that GGBF could follow to move through the broader landscape (Figure 5), although the creek itself is highly disturbed and heavily shaded through much of the development site (Plates 7 and 8). The creek contains a high density of Gambusia holbrooki (Plague Minnow) and the water quality is poor. The creek connects to Bellambi, but not to Woonona.

An extensive network of roads dissects the landscape all around the development site and includes the major road, Centennial Drive immediately to the west This road forms a severe barrier to movement for terrestrial fauna, including the GGBF, along a north-south axis and it is unlikely that the GGBF could successfully attempt to cross this road. Smaller roads in the area are still moderately travelled and are all likely to form significant barriers to movement (see Section 2.5).

3.2.8 Areas of geological significance

There are no recorded areas of geological significance within the study area and the area itself has little rock exposure.

3.2.9 Climate

Key climate statistics for the weather at Bellambi (east of Corrimal) and Woonona (south of Corrimal) are shown in Table 1. The indications is that the site has a mild climate with moderate rainfall, as it typically for a coastal location within NSW.

Table 2*: Key climatic statistics for the AWRC infrastructure footprint (taken from en.climate-data.org)*

Weather station	Mean total rainfall (mm)	Mean January maximum (°C)	Mean July minimum (°C)
Bellambi	1,128	24.9	10.2
Wollongong	1,129	26.0	7.9




Plate 4: Large permanent ponds associated with old pumping station.




Plate 5. Large pools formed in concrete wells in Coke Works




Plate 6. Smaller concrete ponds formed in coke works



Plate 7. Creek and associated vegetation



Plate 8. More images of the creek and associated vegetation. Note the heavy shading and poor water quality.

4. Assessment of GGBF to be present on the Development Site

4.1 Green and Golden Bell Frogs in the region

The available records indicate that the GGBF has not been recorded within the development area or immediate surrounds. It has been recorded a three locations within a 5 km radius including the Woonona population. However, all records for the species are prior to 2010 and the indication is that the species was never common in this area of Wollongong. It is not clear that a population still exists anywhere within a 5 km radius, which is well beyond the distance that frogs will typically travel to re-colonise sites. The only significant population remaining is that at Port Kembla, over 7 km to the south of Corrimal and the other side of the city of Wollongong and very disconnected from Corrimal. Evidence suggesting that population appears to have declined in recent years and it long-term status is uncertain.

4.2 Subject land as potential habitat

4.2.1 Breeding habitats

There is no recorded breeding site for this species within the development site. The closest location would be the records at Bellambi.

There are several water bodies present within the development site that form potential breeding habitat. The most obvious are the three large, rectangular concrete pondages that have been created within the Coke Works. These permanent ponds have some emergent vegetation and are reasonably exposed and contain no apparent predatory fish. Thus they form good breeding habitat for the GGBF, although they would be better habitat if at least one was ephemeral. The two smaller concrete pondages located to the north also appear to be suitable breeding habitat as they are permanent, without fish and contain emergent vegetation. But their smaller size makes them less likely to be used as they may not provide as good a source of food for developing tadpoles.

There are no indications of any ephemeral water bodies forming anywhere on the development site. There are no obvious depressions present where water would pool and no instances of vegetation that grows typically where water pools or grounds remain wet for extended periods of time.

The two large ponds associated with the pumping station provide much less favourable breeding habitat for the GGBF. Both are strongly shaded, tend to be covered in a film of floating water plants, do not have any significant areas of emergent vegetation for basking and contain at least the Plague Minnow as an exotic fish predator. All of these factors make these ponds far less suitable for egg deposition and tadpole development for the GGBF and they typically avoid such locations (Pyke and White 2001).

These tributary of Towradgi Creek is not favourable breeding habitat at any point. The GGBF typically only breeds in larger still or very slow flowing pools in creeks and none are present on this tributary. The creekline is typically heavily shaded by vegetation, which makes it unfavourable for the GGBF as it drops water temperatures below the preferred lower limits for tadpoles. It also contains a high density of *Gambusia holbrooki* (Plague Minnow) that, when present, GGBF avoid (Pyke and White 2001). The end closest to Railway Parade also looks to be affected by runoff from the surrounding areas, which may also be detrimental to tadpole development.

4.2.2 Sheltering and foraging habitat

The above described water bodies and riparian areas form the most important shelter habitat for the GGBF given their preference to remain around water bodies for most of their activities.

The three large, rectangular concrete pondages within the Coke Works form good shelter habitat as they have emergent vegetation and are reasonably exposed to sunlight. The emergent vegetation provides good protective shelter for the GGBF and they are still able to bask and can jump into the water to avoid predators as needed. Similarly, the two smaller concrete pondages are permanent, sunny without fish and contain emergent vegetation. Their presence within 200 m of the three larger ponds is well within the typical inter-pond movement distances of frogs and so they form good alternate ponds to maintain metapopulation processes. There is ground cover present in the form of building debris and materials, although that is limited and scattered. So frogs may find it difficult to locate good areas of shelter within the immediate vicinity of the ponds.

The main negative for these ponds is the absence of vegetated areas immediately surrounding them that would provide foraging habitat for frogs using the ponds. There are a few patches of grasses and exotic shrubs growing within 50 m, but there is no continuous vegetation cover, with the majority of the area being sealed with concrete and buildings. Hence and frogs present would not only have to travel at least 50 m to reach any area of substantial vegetation, the routes typically require taking detours around buildings and over hard surfaces which is not suitable habitat for foraging and leaves GGBF exposed to predators.

The two large ponds associated with the pumping station provide an opposite situation. They have little emergent vegetation and are shaded around the periphery and so provide little in the way of basking opportunities and shelter over the water itself and the banks are similarly heavily vegetated. However, they are surrounded by low grassed areas that are easily traversed and considered preferred migratory and feeding habitat (Muir 2008). The fringing vegetation also provides shelter habitat and potential overwintering sites. So these ponds are poor habitat for the GGBF, but the immediate surrounds suitable for foraging. The presence of the Plague Minnow is only a minor issue for adult frogs and is not expected to cause frogs to avoid these ponds.

The tributary of Towradgi Creek is not favourable sheltering habitat and provides poor foraging habitat. The heavy shading prevents basking and there is little to no emergent vegetation for aquatic shelter. There is also minimal debris for shelter sites. Some areas have adjacent grass that provides foraging opportunities, but many sections are bordered by dense exotic vegetation for at least 10-20 m from the edge of the channel and this is not good foraging habitat (see Plates 7 and 8). This vegetation would need to be crossed to reach the better low grass areas and would not be easy for frogs to do so.

4.2.3 Dispersal habitat

As noted, the species will move some distance overland from shelter sites to reach breeding sites and back to preferred non-breeding pools, but the species is noted to avoid ponds that are separated by more than 500 m from another water body (Hamer et al. 2002). The species also prefers to disperse through areas with low or minimal ground cover that allows easier movements (Muir 2008). The ponds present are within close enough proximity to allow regular movements between these water bodies if the terrain between is suitable and also to migrate to the tributary of Towradgi Creek. But the intervening habitats (habitat matrix) is very mixed in its quality, including cleared and vegetation free areas in the Coke Works itself, dense vegetation lining the tributary and cleared grassy areas. The only areas of habitat the species would likely use for movements in

any regular way would be the grassy areas as they provide a relatively easy path for movements that is also safe enough to avoid predators and desiccation. So movements across the development are possible, but they may be very directed and the poor matrix of habitat provides likely barriers to rapid and effective movements and dispersal.

The main migratory route across the site would likely be the tributary of Towradgi Creek, even if this water course is far from ideal because of the heavy shading across much of its length. It does remain a single direct connection that allows for shelter and for the frogs to be close to water. It also links to Towradgi Creek itself and this flows down to Bellambi Lagoon, which remains the most likely place for the GGBF to remain in relatively close proximity (2 km) to the development site. However, the lands otherwise adjacent to the development site are heavily alienated through urban development including an extensive network of roads with significant traffic flows. So movements would be expected to be restricted to the creek lines themselves and so not easily achieved over 2 km when the creeks have shading and poor to no foraging and shelter habitat.

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5. Assessment of species presence

5.1 Features determining Green and Golden Bell Frog presence

The first consideration at this time for the presence of the GGBF in any location is whether the area is greater than 10 km from coast. Studies have demonstrated that water bodies this close to the coast can have saline influences that inhibit the growth of the chytrid fungus. Based on the few recent records of the GGBF further than 10 km from the coast, the GGBF is only likely to be present where a refuge is provided from the fungus. This can be because of human intervention to create ideal breeding conditions and temperatures that retard the effects of the fungus (e.g. habitats created at Riverstone by a backyard breeder) or where historic land use has provided an "anti-fungicidal" environment (i.e., have chemical properties that inhibit growth) that supresses the growth of the fungus, but is not too toxic for the frogs and tadpoles themselves. It is not feasible to map such locations based on historic use and it would be unlikely that documentation would be extensive and accurate enough to provide clear guidance as to whether an available aquatic environment provided conditions that were suitable to prevent strong growth but still allow the persistence of the GGBF. If such conditions do exist, it would seem very likely that the species would already have been recorded there and already identified the habitat as suitable. Hence the best understanding of the suitability of sites is based on recent records of the GGBF.

Secondarily, studies have demonstrated a relationship to exist between the probability of occupancy of a pond by GGBF and both the presence of other GGBF nearby and the connectivity of wetland sites within the landscape. The spatial arrangement of permanent wetlands must provide a short enough distance and suitable matrix of intervening habitat for frogs to move between ponds as well as a large enough number and types of wetlands within a 1 km radius to provide multiple interactive breeding sites (Hamer et al. 2002; Hamer & Mahony 2010; Valdez et al. 2015; Hamer 2018). The maintenance of a viable GGBF population at a local scale is based on the presence of a high density of well-connected water bodies with suitable intervening habitat.

In particular respect to connectivity, the matrix of roads present is likely to have a major influence on whether GGBF can inhabit an area. A high density of roads and the presence of larger roads with high volumes of traffic provide a negative environment for the GGBF. Their habit of migrating between water bodies to maintain a metapopulation requires free movement to allow populations to remain connected, allow new breeding sites to be colonised and allow local extinctions to be repopulated by dispersing individuals. Large roads represent barriers in both distances that frogs must cover in exposed conditions and the typically heavier volumes of traffic prohibit the successful crossing by frogs. Numerous smaller roads provide the same effect. Rural areas generally have a low density of roads and so provide a relatively suitable environment for the GGBF where there are water bodies present. Large roads or numerous smaller roads surrounding areas of otherwise suitable habitat makes that habitat unlikely to be used. The presence of roads reduces the potential use even where they do not completely isolate a site and so the greater the presence of roads, the less potential there is for the species to be present.

5.2 Suitability of habitat on the subject land

The information in Section 2 demonstrates the ability of the GGBF to use a broad range of habitats and only urbanised areas represent unsuitable habitat, mainly because of the absence of breeding ponds and the high density of roads and buildings that form barriers to movements. the development site itself represents

potential habitat for the species, albeit of a highly variable nature in regards to quality. There is suitable breeding habitat in the form of several ponds in proximity with open water and emergent vegetation and that do not contain fish. There are also ponds and the Tributary that provide additional water bodies in close enough proximity to allow for easy movement of frogs between sites as is considered necessary for this species to survive (Hamer et al. 2002).

There is also suitable foraging habitat in the form of low grassy areas and some debris and denser vegetation that a local population could use for foraging, movements and shelter. However, the positioning of these different elements in the landscape is not so favourable for the GGBF as the grassy areas are not typically immediately adjacent to the water bodies and the dense vegetation is potentially too dense and forms a barrier to movements between water bodies.

More importantly is the consideration of the 200 m area around the development site, which is largely highly urbanised and is very poor habitat for the GGBF and would likely form a very large barrier to connections being maintained to other populations of frogs. Such maintenance of connectivity is essential for the GGBF.

5.3 Importance of the subject land to the Green and Golden Bell Frog

The development site is within 10 km of the coast, but it has not been recorded within the development area, nor within 2 km of the site for almost 20 years. The species appears to be absent from the site and is not expected to frequent the site in any way for the foreseeable future.

The vegetation present is suitable for the species in providing some shelter and food resources. There are suitable permanent water bodies for breeding within the development site, but not any obvious ephemeral breeding sites. The tributary is shaded and contains the Plague Minnow and so forms poor breeding habitat and limited connectivity. The breeding sites generally do not have direct connection to the areas of preferred foraging/shelter habitat and must cross either dense vegetation or areas of poor cover to move back and forwards between breeding sites and breeding and non-breeding habitat. This reduces the value of the development site as habitat as it makes it more difficult for the GGBF to establish longer-term populations on the development site.

The lands immediately surrounding the development site are all heavily impacted by urbanisation and extensive fragmentation by roads and rail lines. This disturbance provides a severe barrier to GGBF individuals dispersing into the development site under any circumstances. Given that GGBF typically moves only 200-300 m to reach a breeding site and rarely move over 500 m to do so it appears highly unlikely that individual GGBF would be migrating to or even through the subject land as part of regular and deliberate movements to and from breeding and /or non-breeding habitats. The distance between water bodies on the development site and even historic populations at Bellambi is over 1200 m away which is well beyond the 500 m limit to expect “connection” between parts of a broader population.

All of this information indicates that the development site is not likely to have been used by the GGBF in recent times and is unlikely to do so for the foreseeable future. And any use of the site is likely to be minimal with the habitat in its current form and it will not provide habitat for important and/or essential life processes.

Based on the BAM guidelines (DPIE 2020) the following applies when assigning any species polygon for the GGBF:

The species polygon boundary should align with aquatic habitats linked directly to the record and a buffer,

incorporating the PCTs with which the species is associated, of 200 m radius from the top of bank. The polygon should include minimum 50 m wide corridors of native and non-native vegetated areas linking the available water bodies, where relevant.

As there are no records for the site and I consider that there are no frogs currently using the development site and it is not realistic to expect this to happen for the foreseeable future, there is no reason to produce a polygon to protect PCTs within a 200 m radius of the available ponds.

The only potential corridor that could be applied to maintain connectivity is the Tributary of Towradgi Creek and this corridor is unfavourable for use due to the heavy shading and lack of connectivity that typically occurs to adjacent breeding habitat. The distance frogs would need to cover from the nearest possible breeding site at Bellambi Lagoon is well beyond the distance of 500 m that is required to allow frogs to move consistently between sites. Therefore no connective corridors need to be maintained in this instance.



Figure 5: Waterbodies and watercourses present in and around the development site

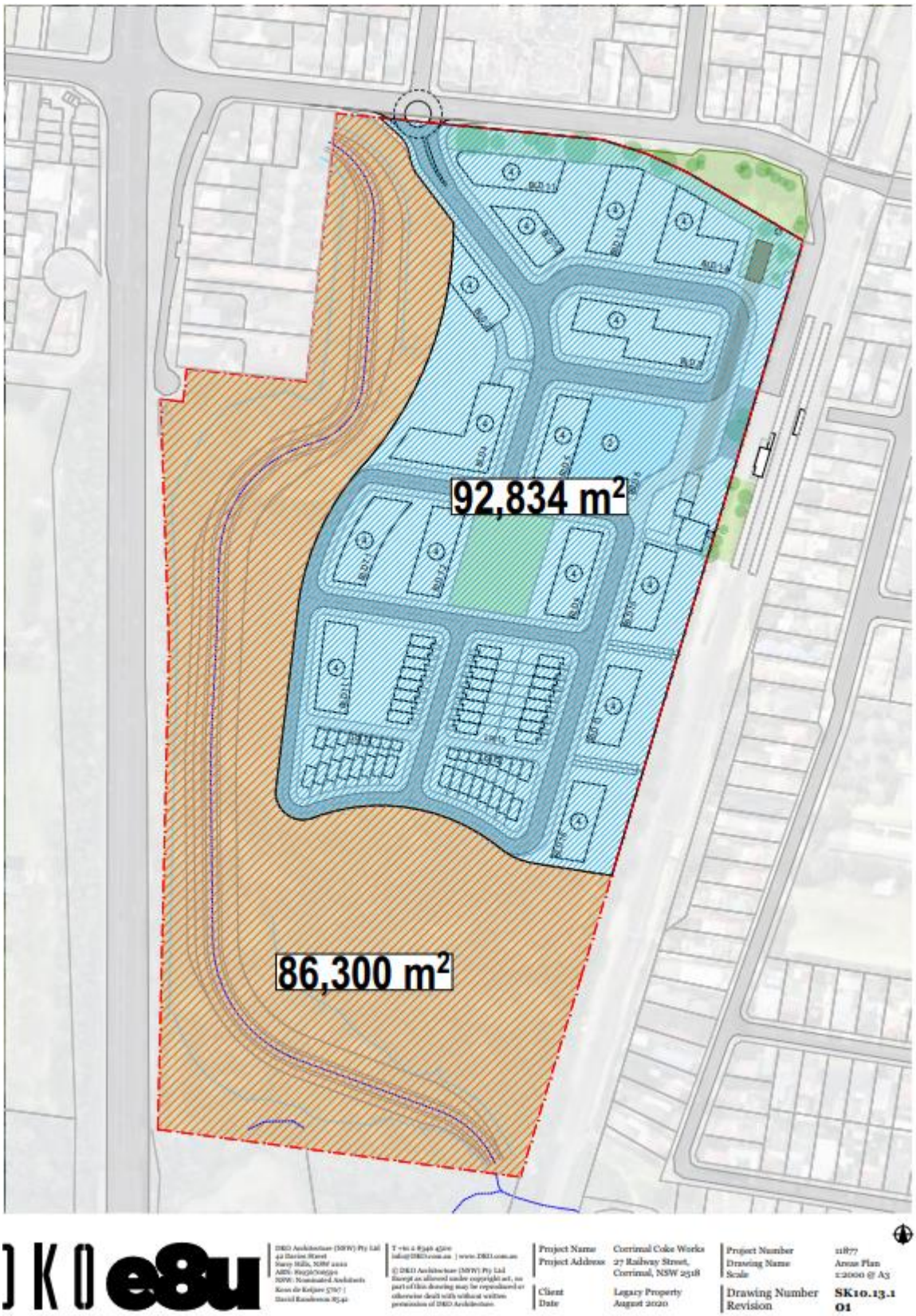


Figure 6: Proposed stream re-alignment

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7. Appendix A Dr Frank Lemckert CV



Frank Lemckert **PRINCIPAL SCIENTIFIC ECOLOGIST**

Frank has been a professional scientist since 1992, specialising in understanding and managing the ecology and management of threatened species. Frank has conducted ecological work throughout eastern Australia (NSW, Victoria, Queensland), establishing long-term research and monitoring programs into the management of fauna and developing strategies to mitigate the impacts of human disturbances. He has worked extensively with the NSW state and federal Governments on varying issues of fauna and flora management including the preparation of a draft NSW/National recovery plan for the Giant Burrowing Frog (*Heleioporus australiacus*) and recent expert review roles on fauna management plans and monitoring strategies for the NSW Natural Resources Commission. Frank is an accredited expert under the NSW Biodiversity Assessment Method (BAM) for a range of threatened frogs and wrote the BAM survey guidelines for NSW's threatened frogs. Frank has prepared reports on endemism and representation in reserves of flora and fauna for the Commonwealth, represented the NSW Forestry Commission in license negotiations for the Comprehensive Regional Assessment process (2000), been a member of a state regulators advisory group for the management of Cane Toads across Australia and the Taren Point Cane Toad Advisory Group, and provided expert ecological advice on illegal land clearing for the NSW and Commonwealth Governments. He has authored over 90 peer-reviewed publications. Frank is a research associate with the Australian Museum and University of Newcastle and convenor of the NSW Declining Frog Working Group. He is a recognised expert in frog ecology and management, but has completed management related projects and works on a range of terrestrial vertebrate fauna.

Frank's primary role as a consultant has been to use his expertise and experience in technical writing and threatened species legislation to develop and maintain quality assurance in project reporting including:

- Species Impact Statements.
- >100 flora and fauna reports and assessments of significance using the EP&A Act and EPBC Act.
- Biodiversity Assessment Reports for Warragamba Dam Raising, Nowra Bridge, Golden Highway and Eurobodalla Dam.
- Manager for the Oxley Highway to Kempsey and Frederickton to Eungai ecological monitoring program.
- Lead fauna survey design for the HumeLink transmission line project for Snowy Hydro 2.0.
- Complete targeted survey and monitoring works for threatened frog species including Giant Barred Frogs, Wallum Froglets, Green-thighed Frog and Green and Golden Bell Frogs.
- Construction and Environmental Management Plans, Monitoring Plans and Vegetation Management Plans for roads at Port Macquarie, Berry to Bomaderry and South Nowra.
- Nest Box, microbat and Green and Golden Bell Frog management plans for the Berry to Bomaderry and Oxley Highway to Kempsey Highway Upgrades.
- Review of monitoring strategies for the Woolgoolga to Ballina and Warrell Creek to Nambucca Heads programs for the Pacific Highway Upgrade.
- Review of two proposed Coal Seam Gas Impact Assessment methods for Matters of National Environmental Significance (contracted by the Commonwealth Government).
- Provision of species credit species expert reports for the Warragamba Dam raising project and Western Sydney Growth Centres Biocertification.

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- Roadside mapping, survey and management strategies for the Wallum Froglet and Mahony's Toadlet.
- Develop frog and reptile survey guidelines and impact offset guidelines for the Biodiversity Assessment Method.

QUALIFICATIONS

- Bachelor of Science, University of Sydney, 1984 (Terrestrial Ecology and Marine Management)
- Master of Science, University of Sydney, 1991 (Population biology of the Common Froglet)
- PhD, University of Newcastle, 2009 (Management of forest frogs in timber production forests of NSW).

PROJECT EXPERIENCE

ECOLOGICAL IMPACT ASSESSMENT

- MONITORING OF BAT POPULATIONS AND ASSESSMENT OF POTENTIAL IMPACTS OF THE PROPOSED JEREMIAH WINDFARM AT ADJUNGBILLY, NSW (2019-PRESENT).
- MANAGEMENT OF IMPACTS ON GREEN AND GOLDEN BELL FROGS FOR THE KIWEF PROJECT AT KOORAGANG ISLAND, NSW FOR DARACON (2019-PRESENT).
- IMPACT ASSESSMENTS FOR HOUSING DEVELOPMENTS ON KOALAS IN THE CAMPBELLTOWN AREA (PRIVATE DEVELOPMENT AND CAMPBELLTOWN COUNCIL (2019)
- EXPERT REPORT ON THE GREEN AND GOLDEN BELL FROG FOR TWO WESTERN SYDNEY GROWTH AREAS BIOCERTIFICATION PROJECT (2018-2020)
- WARRAGAMBA DAM RAISING PROJECT TARGET SURVEYS, IMPACT ASSESSMENTS, EXPERT REPORTING (SIX SPECIES) AND Q/A FOR WATER NSW (2018-19)
- GRANITE HILLS WINDFARM BIRD AND BAT STRIKE MODELLING AND ECOLOGICAL IMPACT ASSESSMENT, NIMMITABEL, AKUO ENERGY (2018) AND ELYSIAN WINDFARM, NIMMITABEL, AKUO ENERGY (2018)
- VEGETATION REMOVAL AND THREATENED FROG MANAGEMENT STRATEGIES, NEW INTERCITY FLEET MANAGEMENT FACILITY, JOHN HOLLAND GROUP (2018-PRESENT)
- NOWRA BRIDGE EIS ECOLOGICAL ASSESSMENTS, NSW RMS (2018)
- HEATHCOTE ROAD UPGRADE IMPACT ASSESSMENT AND REVIEW OF MITIGATION MEASURES, NSW RMS (2018-2019)
- EUROBODALLA DAM BIODIVERSITY ASSESSMENT REPORT, EUROBODALLA SHIRE COUNCIL (2017-18).

GOVERNMENT REVIEWS/REPORTS

- BIODIVERSITY ASSESSMENT METHOD FROG SURVEY GUIDELINES FOR SPECIES CREDIT SPECIES (2020)
- EXPERT WORKSHOP TO DEVELOP A NSW-WIDE NIL-TENURE FAUNA MONITORING PROGRAM, NSW NATURAL RESOURCES COMMISSION (2020)
- REVIEW OF SPECIES MANAGEMENT PLANS FOR THE YELLOW-BELLIED GLIDER, GIANT BURROWING FROG, EASTERN BRISTLEBIRD AND SOUTHERN BROWN BANDICOOT PREPARED UNDER THE NSW THREATENED SPECIES LICENSE FOR FORESTRY OPERATIONS, NSW NATURAL RESOURCES COMMISSION (2019)
- PROVISION OF INFORMATION AS THE BASIS FOR THE DEVELOPMENT OF SIX THREATENED FLORA SPECIES MANAGEMENT PLANS TO BE PREPARED UNDER THE NSW THREATENED SPECIES LICENSE FOR FORESTRY OPERATIONS, NSW NATURAL RESOURCES COMMISSION (2019)
- EXPERT REVIEW OF BIODIVERSITY IMPACT ASSESSMENT REPORT FOR THE HORNSBY QUARRY REHABILITATION PROJECT (2019)
- HORNSBY COUNCIL EXPERT WITNESS FOR DEVELOPMENT IMPACTS AT DURAL, HORNSBY SHIRE COUNCIL (2016)

- EXPERT ADVICE ON IMPACTS OF ILLEGAL LAND CLEARING AT EVANS HEAD, NSW STATE GOVERNMENT (2016)
- EXPERT ADVICE ON IMPACTS OF ILLEGAL LAND CLEARING AT SOMERSBY, COMMONWEALTH GOVERNMENT (2015)
- REVIEW OF MONITORING STRATEGIES FOR THE WOOLGOOLGA TO BALLINA AND WARRELL CREEK TO NAMBUCCA HEADS PROGRAMS FOR THE PACIFIC HIGHWAY UPGRADE, NSW RMS (2014)
- REVIEW OF IMPACT ASSESSMENT PATHWAYS FOR TWO LPNG PROJECTS, COMMONWEALTH GOVERNMENT (2013)
- REVIEW OF THREATENED SPECIES MODELLING IN FORESTRY AREAS, VIC FORESTS (2012)
- FLORA AND FAUNA REPRESENTATION IN THE AUSTRALIAN RESERVE SYSTEM, COMMONWEALTH GOVERNMENT (2010)
- FLORA AND FAUNA ENDEMISM PATTERNS ACROSS AUSTRALIA, COMMONWEALTH GOVERNMENT (2009)
- REVIEW IMPACTS TO THREATENED REPTILES AND AMPHIBIANS IN THE SOUTHERN BRIGALOW BELT, FOR WPS (2008)
- EXPERT REPRESENTING FORESTS NSW IN THE COMPREHENSIVE REGINAL ASSESSMENT PROGRAM FOR THE REGIONAL FOREST AGREEMENT PROGRAM (1999-2001)
- EXPERT REVIEW OF FAUNA AND FLORA IMPACTS FOR 13 NSW FORESTRY COMMISSION EIS REPORTS (1992-94).

EPBC REFERRALS

- AUSTEN QUARRY (*EUCALYPTUS PULVERULENTA*), HARTLEY, HY-TEC INDUSTRIES (2014-15)
- MARYS MOUNT KOALA (*PHASCOLARCTOS CINEREUS*) REFERRAL, GUNNEDAH QUARRY PRODUCTS (2015)
- GREEN AND GOLDEN BELL FROG (*LITORIA AUREA*) REFERRALS FOR THE PRINCES HIGHWAY UPGRADE AT SOUTH NOWRA, NSW RMS (2011-2012).

MONITORING PROGRAMS

- NIL-TENURE FERAL MANAGEMENT AND MONITORING STRATEGY FOR THE NARRABRI COAL SEAM GAS PROJECT, SANTOS (2019).
- THREATENED FAUNA MONITORING HUME HIGHWAY, KAPOOKA, NSW RMS (2018)
- GREEN AND GOLDEN BELL FROG BASELINE MONITORING PROGRAM AT MEROO LAKES, NSW OEH (2016-17)
- OXLEY HIGHWAY TO KEMPSEY THREATENED BIODIVERSITY MONITORING, NSW RMS (2013-2017)
- FCNSW STATE-WIDE ECOLOGICAL MONITORING PROGRAM, FORESTRY CORPORATION OF NSW (2009-10)

PLANS OF MANAGEMENT / STRATEGIES

- GREEN AND GOLDEN BELL FROG PRE-CLEARING WORKS KOORAGANG ISLAND (DARACON 2016 & CURRENT)
- REVIEW OF SPECIES MANAGEMENT PLANS FOR THE YELLOW-BELLIED GLIDER, GIANT BURROWING FROG, EASTERN BRISTLEBIRD AND SOUTHERN BROWN BANDICOOT PREPARED UNDER THE NSW THREATENED SPECIES LICENSE FOR FORESTRY OPERATIONS, NSW NATURAL RESOURCES COMMISSION (2019)
- PROVISION OF INFORMATION AS THE BASIS FOR THE DEVELOPMENT OF SIX THREATENED FLORA SPECIES MANAGEMENT PLANS TO BE PREPARED UNDER THE NSW THREATENED SPECIES LICENSE FOR FORESTRY OPERATIONS, NSW NATURAL RESOURCES COMMISSION (2019)
- NESTBOX, MICROBAT AND GREEN AND GOLDEN BELL FROG MANAGEMENT PLANS, BERRY TO BOMADERRY UPGRADE OF THE PRINCES HIGHWAY, NSW RMS (2017)
- GREEN AND GOLDEN BELL FROG SURVEYS AND MONITORING, PRINCES HIGHWAY UPGRADES AT SOUTH NOWRA AND BERRY TO BOMADERRY, NSW RMS (2012-2017)
- THREATENED FROG MODELLED HABITAT REQUIREMENTS, HORNSBY SHIRE COUNCIL (2016)
- MICROBAT MANAGEMENT PLAN FOR CLARENCETOWN BRIDGE, NSW RMS (2016)

- EASTERN BENTWING-BAT MANAGEMENT PLAN, GERRINGONG, NSW RMS (2014)
- GREEN AND GOLDEN BELL FROG MANAGEMENT STRATEGY, PRINCES HIGHWAY UPGRADE, NSW RMS (2012-2014)
- EXPERT REVIEW OF THREATENED FROG MANAGEMENT PLAN - WOOLGOOLGA TO BALLINA UPGRADE, NSW RMS (2014)
- THREATENED MICROBAT MANAGEMENT PLAN FOR WARRINGAH MALL, NORTHERN BEACHES COUNCIL (2014)
- COMMONWEALTH/NSW GIANT BURROWING FROG RECOVERY PLAN, DEWHA/DECC (2012)
- NSW DPI REPRESENTATIVE FOR THE NATIONAL ADVISORY GROUP ON CANE TOAD MANAGEMENT (2009-2011)
- TAREN POINT CANE TOAD MANAGEMENT ADVISORY GROUP (2007-2008).

TRAINING

- LEAD INSTRUCTOR > 50 WILDLIFE TRAINING SCHOOLS RUN IN NSW, ACT AND VICTORIA PROVIDING PRESENTATIONS ON THE SURVEY, IDENTIFICATION AND MANAGEMENT OF ALL FLORA AND FAUNA. THIS INCLUDED DETAILED INSTRUCTION ON THE MANAGEMENT OF THREATENED WADING AND AQUATIC BIRDS AND OTHER AQUATIC SPECIES PRESENTED TO QUEENSLAND, VICTORIAN, NSW AND COMMONWEALTH GOVERNMENT STAFF (1993-2017)
- PRIVATE FORESTRY SURVEY REQUIREMENTS, VICTORIAN TIMBER (2016).

PUBLICATIONS

Book Chapters

Hecnar S. J., & Lemckert, F.L. 2012. Habitat Protection: Refuges and Reserves. Pp 3636-3675 In Biology of the Amphibia Volume 10 - Conservation and Decline of Amphibians: Ecology, Effects of Humans, and Management. H. Heatwole (Ed.). Surrey-Beattey and Sons, Sydney.

Lemckert, F.L., & Mahony, M.J. 2018. The status of Decline and Conservation of Frogs in Temperate Coastal South-eastern Australia. Pp 59-72 In Amphibian Biology Volume 11 - Conservation and Decline of Amphibians: Eastern Hemisphere (Australia, New Zealand and Pacific Islands). H. Heatwole and J. Rowley (Eds.). CSIRO Publishing, Melbourne.

Lemckert, F.L., Hecnar S.J., & Pilliod, D.S. 2012. Habitat Destruction and Modification. Pp 3291-3342 In Biology of the Amphibia Volume 10 - Conservation and Decline of Amphibians: Ecology, Effects of Humans, and Management. H. Heatwole (Ed.). Surrey-Beattey and Sons, Sydney.

Lemckert, F.L. & Penman, T. 2012. Climate Change and Australia's frogs: how much do we need to worry? Pp 92-98 In: Wildlife and Climate Change: towards robust conservation strategies for Australian fauna. D. Lunney & P. Hutchings (Eds.). Royal Zoological Society of NSW, Mosman, NSW, Australia.

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Lemckert, F.L. & Slatyer, C. 2004. Herps in forests: schools to educate land managers in their conservation. Pp 1055-1058 In Conservation of Australia's Forest Fauna, Second Edition. D Lunney (Ed.). Royal Zoological Society of NSW, Sydney.

Lemckert, F. & Morse, R. 1999. Frogs in the timber production forests of the Dorrigo escarpment in northern NSW: an inventory of species present and the conservation of threatened species. Pp 72-80 In Declines and Disappearances of Australian Frogs. A. Campbell (Ed.). Environment Australia, Canberra.

Scientific Papers

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Gillespie, G.R., Roberts, J.D., Hunter, D., Hoskin, C.J., Alford, R.A., Heard, G.W., Hines, H. Lemckert, F., Newell, D. & Scheele, B.C. 2020. Status and Priority Conservation Actions for Australian Frog Species. Biological Conservation 247, 108543. https://doi.org/10.1016/j.biocon.2020.108543.

Mahony, M., Moses, B., Mahony, S.V., Lemckert, F.L. & S Donnellan. 2020. A new species of frog in the *Litoria ewingii* species group (Anura: Pelodryadidae) from south-eastern Australia. Zootaxa 4858: 201-230.

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Waters, C.M., Penman, T.D., Hacker, R.B., Law, B., Kavanagh, R.P., Lemckert, F. & Alemseged Y. 2013. Balancing trade-offs between biodiversity and production in the re-design of rangeland landscapes. The Rangeland Journal 35:143-154.

Daly, G. and Lemckert, F.L. 2011. Survey of the reptiles and amphibians of the montane forests near Tenterfield on the north coast of New South Wales. Australian Zoologist 35:957-972.

Lemckert, F.L. 2011. Managing pond breeding anurans in the selectively harvested forests of coastal New South Wales, Australia. Forest Ecology and Management 262:1199–1204.

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Penman, T. D. & Lemckert F. L. 2008. Monitoring the green and golden bell frog: current problems and an alternative approach. Australian Zoologist 34:373-378.

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Lemckert, F., Brassil, T., Kavanagh, R. & Law, B. 2006. Trapping small mammals for research and management: how many die and why? Australian Mammalogy 28:201-208.

Penman, T.D., Lemckert, F.L. & Mahony, M.J. 2006. Meteorological effects on the activity of the giant burrowing frog, *Heleioporus australiacus*, in south-eastern Australia. Wildlife Research 33:35-40.

Penman, T., Lemckert, F. & Mahony, M. (2006). A preliminary investigation into the potential impacts of fire on a forest dependent burrowing frog species. Pacific Conservation Biology 12:78-83.

Penman, T., Lemckert, F., Slade, C. & Mahony, M. 2006. Non-breeding habitat requirements of the giant burrowing frog (*Heleioporus australiacus*) in south-eastern Australia. Australian Zoologist 33:251-257.

Fitzgerald, F., Shine, R., Lemckert, F. & Towerton, A. 2005. Habitat requirements of the threatened snake species *Hoplocephalus stephensii* (Elapidae) in eastern Australia. Austral Ecology 30:465-474.

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Lemckert, F.L. 2004. Variations in anuran movements and habitat use: implications for conservation. Applied Herpetology 1:165-181.

Lemckert, F.L. & Brassil, T. 2004. Movements and habitat use by the giant burrowing frog, *Heleioporus australiacus*. Amphibia-Reptilia 24:207-211.

Lemckert, F.L., Brassil, T. & Haywood, A. 2004. Effects of low intensity fire on pond-breeding anurans in mid-northern New South Wales, Australia. Applied Herpetology 1:183-195.

Penman, T., Lemckert, F. & Mahony, M. 2004. Two hundred and ten years of looking for giant burrowing frog. Australian Zoologist 32:597-604.

Fitzgerald, M., Shine, R. & Lemckert, F. 2003. A reluctant heliotherm: thermal ecology of the arboreal snake *Hoplocephalus stephensii* (Elapidae) in dense forest. Journal of Thermal Biology 28:515-524.

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Lemckert, F.L. 2000. Observations on the effects of fire on the Hip-pocket Frog, *Assa darlingtoni*. Herpetofauna 30:51-52.

Lemckert, F.L., Brassil, T. & McCray, K. 1998. Recent records of the giant burrowing frog (*Heleioporus australiacus*) from the far south coast of NSW. Herpetofauna 28:32-39.

Lemckert, F., Potter, M., Smith, B. & Bruest, T. (1997). Recent records of the southern barred frog (*Mixophyes balbus*) from the south coast of NSW. Herpetofauna 27:60-62.

Unpublished reports

Lemckert, F. and Brassil, T. 2009. Focusing on the Landscape Biodiversity in Australia's National Reserve System Part A: Fauna. A Report for Caring for Our Country through the Australian Biological Resources Study. Available at http://www.bushblitz.org.au/reports.php.

Lemckert, F. and Brassil, T. 2009. Focusing on the Landscape Biodiversity in Australia's National Reserve System Part B: Flora. A Report for Caring for Our Country through the Australian Biological Resources Study. Available at http://www.bushblitz.org.au/reports.php.

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Lemckert, F.L. 1994. Report on the Wallum Froglet (*Crinia tinnula*) in the Bulahdelah Management Area. Report for Bulahdelah District, State Forests of NSW.

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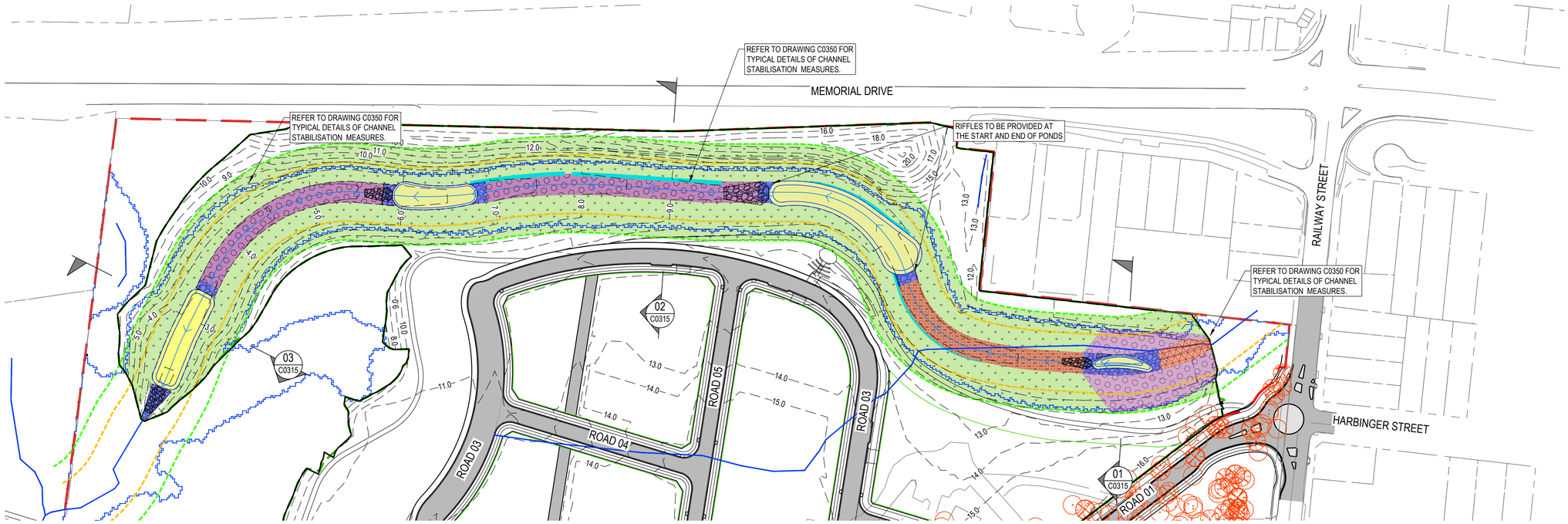
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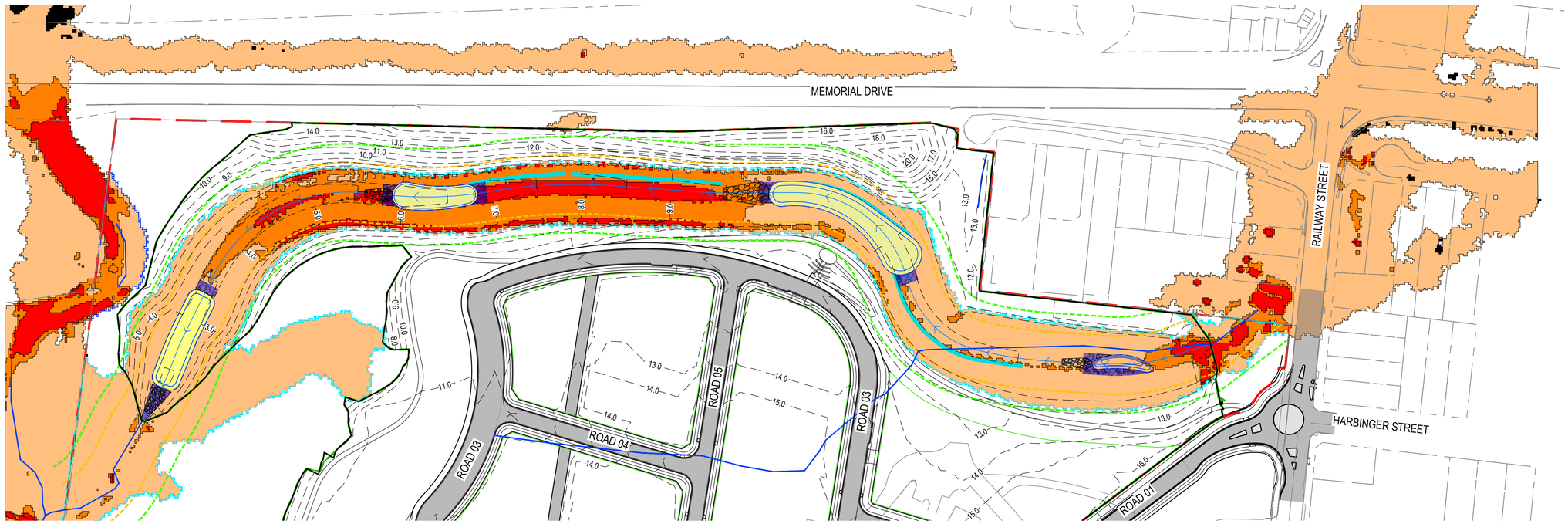
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Appendix L Communications outlining controls for the creek realignment to mimic natural conditions, promote habitat and reduce erosion



CREEK ALIGNMENT - CHANNEL TREATMENTS

SCALE 1:1250



CREEK ALIGNMENT - SHEAR STRESS

SCALE 1:1250

PROPOSED

LEGEND

- SITE BOUNDARY
- EXTENT OF WORKS
- CREEK REALIGNMENT
- PONDS
- VEG COIR LOGS
- ROCK TOE REVETMENT
- RIFFLE
- ROCK LINED CASCADES
- STABILISED CHANNEL
- REVEGETATION & JUTE MESH
- SHEAR STRESS (< 100 N/m^2)
- SHEAR STRESS (100 - 200 N/m^2)
- SHEAR STRESS (> 200 N/m^2)
- 7.0 CONTOURS (1.0m)
- 1% AEP FLOOD EXTENTS

EXISTING

- LOT BOUNDARY
- RIPARIAN ZONE INNER BOUNDARY (RZI)
- RIPARIAN ZONE OUTER BOUNDARY (RZO)

NOTES:

1. SHEAR STRESS BANK TREATMENT AS FOLLOWS:
   - 1.1. HIGH (>200 N/m^2) - ROCK ARMOURING INCLUDING CASCADES & REVETMENT
   - 1.2. MEDIUM (100 - 200 N/m^2) - STABILISATION OF CHANNEL WITH VEGETATION & JUTE MESHING
   - 1.3. LOW (< 100 N/m^2) - STABILISATION OF CHANNEL WITH VEGETATION & JUST MESHING

REV	DATE	DESCRIPTION	AMD BY	APP BY
1	24.09.24	ISSUED FOR APPROVAL	SCM	SS

0 12.5 25 37.5 50 62.5m
SCALE 1:1250 AT ORIGINAL SIZE

LEGACYPROPERTY

MAKER ENG SURVEY DESIGN DELIVER

DRAWN: S.McINNES	DESIGNED: C.WIEWIORA
DRAFT CHECK: C.WIEWIORA	DESIGN CHECK: S.SAIYANMONTAKUL
APPROVED: S.SAIYANMONTAKUL	
NOT FOR CONSTRUCTION	

CORRIMAL COKE WORKS
DEVELOPMENT
CREEK CIVIL WORKS
LAYOUT PLAN

DRAWING NUMBER	SHEET No.	ORIG. SIZE	REVISION
MKR00452-16-C0105		A1	1

Stephen McInnes, 9/24/2024 11:44 AM

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From: Suppachock Saiyanmontakul
To: Ferdinand Haefele; Gleeson, Joseph; Lemckert, Frank; Henderson, Meredith; Adrian Ma
Cc: leedouglass@reditus.com.au; Angus Dyson; Adrian Kilburn; Thomas Kent
Subject: RE: [#MKR00452] Stage 2-4 amended documents
Date: Tuesday, 17 September 2024 8:56:53 AM
Attachments: image004.png
image005.png
image007.png
image008.jpg
image012.jpg
image013.jpg
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image010.jpg
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image024.jpg
MKR00452 Stage 2-4 Creek Treatment.dwg
MKR00452-00-SK105-SK105.pdf

CAUTION: This email originated from an external sender. Verify the source before opening links or attachments.

Good morning all,

Please see attached the proposed treatment of the creek realignment in accordance with the shear stress.

The following hierarchy of controls have been considered in accordance with the Geomorphology Report:

1. High Shear Stress (>200N/m2) – installation of material able to weather the high shear stress to prevent vegetation loss and erosion. In addition, a shallow 'cascade' was included at the upstream channel transition as per the report. Furthermore, rock revetment has been included on the side slopes of the channel at locations of high shear stress up to the 100 year flood level which has been considered as the design storm. For certain areas of high shear stress, rock revetment is proposed to line the channel as well. The final form of the rock revetment is open to change as it can be either rocks embedded into the slope or perhaps gabion mattress, as long as it provides stability and protection.

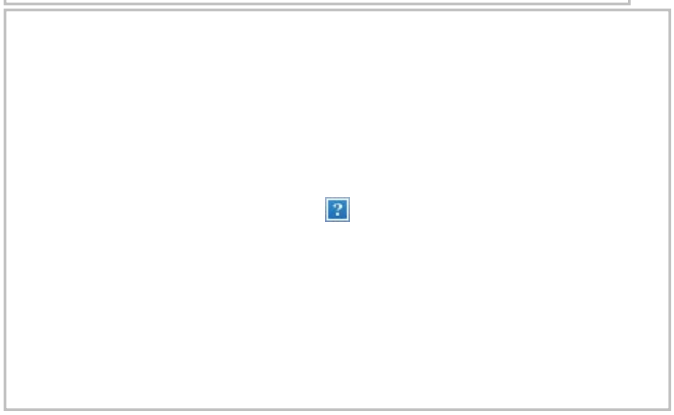
Cascade detail



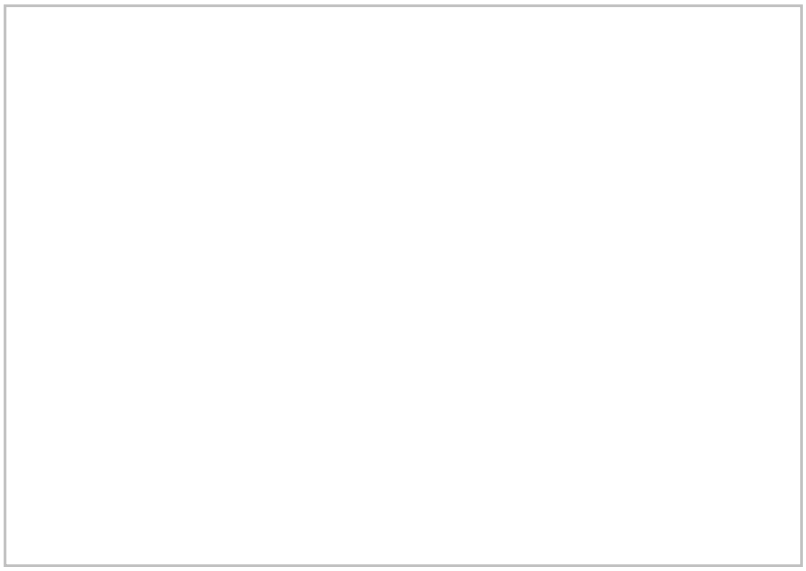



Rock Revetment

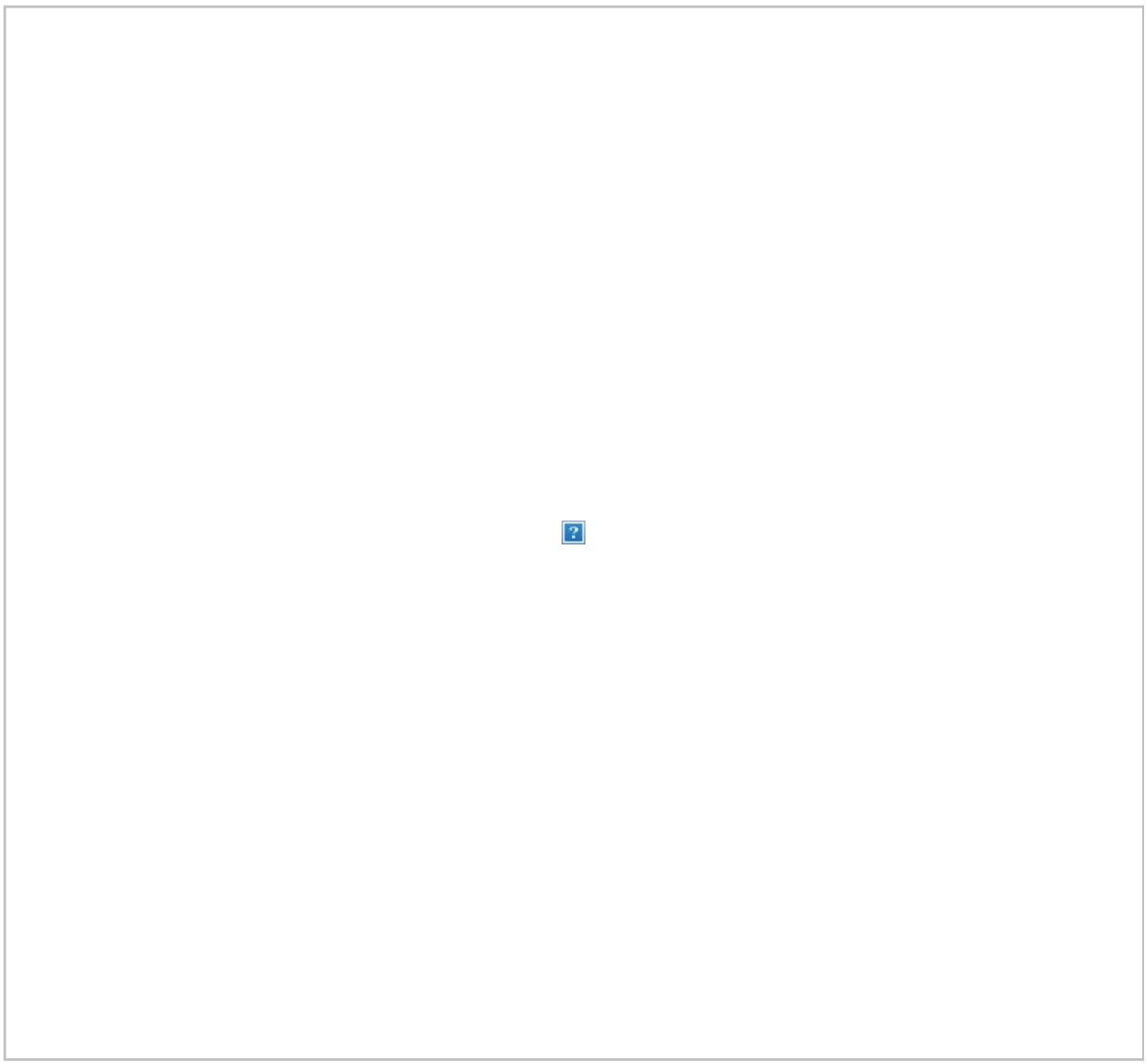




2. Medium to Low Shear Stress (>200 N/m2) – as per the geomorphological report, shear stress under 200N/m2 will cause a ‘possible’ risk of erosion but will only require a lesser form of stabilisation in the form of vegetation and jute meshing. This accounts for the majority of the area and is consistent with the landscaping.



Riffles will be provided at the start and end of each intermittent pond to replicate natural formations.



Additionally, we have proposed discrete engineered log jams on the banks of the creek as an additional measure of protection whilst promoting habitat diversity.

We will further confirm the proposed treatments with the Geomorphologist this Friday.

I have attached the CAD file for the hatched areas for your information.

We will continue with finalisation of the cross sections and details to be provided shortly with the intent of integrating into the Civil DA set.

If you have any questions or comments please let me know, happy to discuss.

Best regards,

Suppachock

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From: Ferdie Haefele <fh@clouston.com.au>
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Subject: RE: [#MKR00452] Stage 2-4 amended documents

Hi Suppachock,

As time is very limited for us and Ecological to update our reports and packages – when will you issue us the updated drawing? Can you please give us a timeline.

In regards to the below log jams – we do not have a problem with this proposal as it will indeed increase bio-diversity and give a more naturalistic feel. As long as the method how they are fixed and layout orientation does not have an effect on the low flow channel / creating additional flow force on embankments.

Kind Regards
Ferdinand Haefele, AILA RLA No. 15994

Principal Landscape Architect

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---

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Cc: Gleeson, Joseph <Joseph.Gleeson@ecoaus.com.au>; Henderson, Meredith <MeredithH@ecoaus.com.au>; Lemckert, Frank <Frank.Lemckert@ecoaus.com.au>; leedouglass@reditus.com.au; Angus Dyson <Angus.Dyson@makereng.com.au>; Adrian Ma

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A3 Grey-headed Flying-fox Management Plan (ELA 2024b)

Attached as a separate document.

Corrimal Residential Development Grey-headed Flying-fox Management Plan

Prepared for Legacy Property Pty Ltd.

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DOCUMENT TRACKING

Project Name	Corrimal Residential Development Grey-headed Flying-fox Management Plan
Project Number	22SYD 2750
Project Manager	Alex Gorey
Prepared by	Alex Gorey, Frank Lemckert and Joseph Gleeson
Reviewed by	**Frank Lemckert**
Approved by	**Frank Lemckert**
Status	**Final**
Version Number	**7**
Last saved on	**24 September 2024**

This report should be cited as 'Eco Logical Australia 2024. *Corrimal Residential Development Grey-headed Flying-fox Management Plan*. Prepared for Legacy Property Pty Ltd.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd.

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Template 2.8.1

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1. Overview

1.1. Objectives

The objectives of this Camp Management Plan (the Plan) are to:

- minimise impacts to the proposed residential community, while conserving flying-foxes and their habitat
- provide a reasonable level of amenity for the surrounding community
- manage public health and safety risks
- clearly define roles and responsibilities
- enable land managers and other stakeholders to use a range of suitable management responses to sustainably manage flying-foxes
- effectively communicate with stakeholders during planning and implementation of management activities
- enable long-term conservation of flying-foxes in appropriate locations. This Management Plan is for the construction and establishment phase of the development site and is valid for 10 years or for the duration of the site redevelopment.
- ensure management is sympathetic to flying-fox behaviours and requirements
- improve community understanding and appreciation of flying-foxes, including their critical ecological role
- ensure flying-fox welfare is a priority during all works
- ensure camp management is consistent with broader conservation management strategies that may be developed to protect threatened species/communities
- ensure camp management does not contribute to loss of biodiversity or increase threats to threatened species/communities
- clearly outline the camp management actions that will be utilised at the camp
- ensure management activities are consistent with the NSW Flying-fox Camp Management Policy (OEH 2018)
- facilitate license approval and follow issued Threatened Species Licence conditions to mitigate actions that may impact the camp
- implement an adaptive management approach to camp management based on evidence collected.

This PoM has also been updated following initial submission to address comments made from Council in a request for Information (RFI) issued 4 April 2024.

The PoM was amended in response to Council comment number B1.7 (H). .

1.2. Terminology

The terminology used in this plan relates to specific stages of the proposed development.

- **Bulk earthworks phase** – relates to site preparation which facilitates the construction of dwelling and ancillary infrastructure. This phase includes actions required to cut and fill, vegetation removal, spoil stockpiling and use of earth moving equipment, chainsaws, chippers and other machinery.
- **Embellishment and soft works** – relates to revegetation and landscaping and replanting of the future riparian corridor
- **Operational phase** – relates to the period following completion of bulk earthworks, construction and initial embellishment and soft works phase. This phase relates to the ongoing operation and management of the completed subdivision, and does not cover construction or bulk earthworks.
- **Threatened Species License** – Three Threatened Species Licenses have been issued by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW, each of which provides specific requirements for the management of the Grey-headed Flying-fox in relation to the proposed development. NSW DCCEEW have issued the following licences:
    - Licence DOC24/644921-3 for Stage 1 Bulk Earthworks DA, DA-2023/166 (Appendix A).
    - Licence DOC24/536883-5 for Demolition DA, DA22/1249 (Appendix B).
    - Licence DOC24/537230-3 for Sewer Lead-in works (Approved activity under Part 5 of the Environmental Planning and Assessment Act 1979) (Appendix C).
    - A licence will be sought following approval of Stage 2-4 Bulk Earthworks DA.

- **Unsuitable habitat** – street trees, exotic vegetation that can present a choking hazard to the environment (e.g. Cocos Palms) and the 100 m buffer.
- **Loss of condition** – evidenced by trees stripped of fruits and leaves in the camp or in foraging habitat surrounding the camp.
- **Suitably qualified ecologist** – an ecologist (or other acceptable person) with at least 5 years' experience who can confidently identify a Grey-headed Flying-fox and basic camp dynamics, including whether there are adults and pups and whether there is a creche present. They must have undertaken an induction into the site and the presence of the colony.
- **Flying-fox expert –** a person with at demonstrated experience in the survey and monitoring of Grey-headed Flying-foxes who can distinguish Grey-headed Flying-foxes from other flying-foxes and who can adequately assess the signs of stress in the species and who has vaccinations against the bat Lyssavirus. Such a person should be submitted for approval to DCCEEW for approval.

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2. Context

2.1. Camp area

The study area is located on Railway Street, Corrimal and consists of four lots (Lot 11 DP749492, Lot 5 DP749492, Lot 126 DP598190 and Lot 1 DP 795791) with a combined area of 18.16 ha. The study area is within the Wollongong Local Government Area (LGA) and is located approximately 5 km north of the Wollongong city centre (Figure 1). The approved rezoning covers land zoned as R3 Medium Density Residential and RE1 – Public Recreation.

The study area is bounded by Memorial Drive on the western side, Railway Street and residential housing to the north, the railway line and residential housing to the east, and the vegetated riparian area of Towradgi Creek to the south. The study area is generally flat with a gentle slope towards Towradgi Creek in the south east. A large portion of the study area represents cleared and landscaped land as part of the previous use of the study area by Illawarra Coke Company as a cokeworks facility.

The camp is located at the southern extent of the study area, between the old settling pond and Towradgi Creek. The flying-fox numbers at the camp typically fluctuates from between <50 and 600 individuals, but with occasional influx periods of where 2,000-6,000 individuals can be present. Typical "core" camp extents of 200-600 (as at December 2019 and October 2022) and influx camp extents are shown in Figure 2 and Figure 5. The typical camp extent of 200-600 flying-foxes covers around 0.16 ha with approximately 0.28 ha of additional suitable contiguous potential and previously used camp habitat remaining adjacent to and connected with the core camp.

2.2. History of the camp

The camp was first recorded in 2017 and is seasonally occupied during late spring and summer by *Pteropus poliocephalus* (Grey-headed Flying-fox). Monthly camp monitoring has occurred since July 2019 and is ongoing. Monitoring has observed that the camp empties generally empties during Winter, although low numbers remained present through the Winter of 2021. Flying-foxes generally starting to return in mid Spring, and occupying the camp through late spring and Summer. The core camp extent is consistently located near the dam wall, where water spills into Towradgi Creek, with larger camp extents previously recorded further south of the dam (Figure 5). Figure 4 provides an illustration of the changes in camp extent from April-June 2024, when flying-foxes leave the area, compared to the typical core camp extent. All available monitoring data can be found in Appendix D.

Mating and courtship behaviour has been observed within the flying fox camp, most recently in April – May 2024. Pups have also been observed once at the camp in November 2019, following a significant period of absence of bats. flying foxes. The flyout watch conducted on 19 February 2020 also recorded flying-foxes using the dam for belly dipping immediately prior to flying out for their nightly forage. Based off the results of monitoring of the camp in 2024, with 200-600 bats present, the resident flying-foxes prefer to roost in *Acacia maidenii* (Maiden's wattle), *Cinnamomum camphora* (Camphor laurel) and *Ligustrum lucidum* (Privet).

The maximum total number of flying-foxes ever recorded at the camp was between 4,000 – 6,000 individuals in January 2020. This count occurred after the 2019 / 2020 bushfires where camps and potential foraging habitat within the south coast region was significantly affected. Numbers prior to and after the 2019 / 2020 bushfire season stabilised and have consistently remained around 200 – 500 flying-foxes during Spring and Summer. Therefore, it is anticipated that the sharp and temporary increase in numbers was likely a result of a severe food and refuge habitat throughout the broader South Coast region and such rapid increases would not occur again without another set of unusual circumstances. No other species of flying-fox has been identified in the camp.

2.3. Land tenure

The land is in private tenure and is currently owned by Illawarra Coal Company. The camp occurs on land zoned RE1 – Public Recreation and is adjacent to land zoned R3 – Medium Density Residential. The land surrounding the camp will be used as public recreation, with any community use limited to the outer edges of the zoning. Where native vegetation exists immediately adjacent to the camp, this will be retained in situ. The native vegetation to the west will be cleared to allow for the construction of a 40 m wide riparian corridor that will be revegetated.

2.4. Reported issues related to the camp

There have been no issues of flying-fox management previously reported in relation to the camp, which has remained relatively isolated from human activities by the closed Corrimal Cokeworks grounds. This plan has been developed to minimise potential conflict between future residents and the camp and to follow Threatened Species Licenses issued for all phases of the work.

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Figure 1: Location of the study area

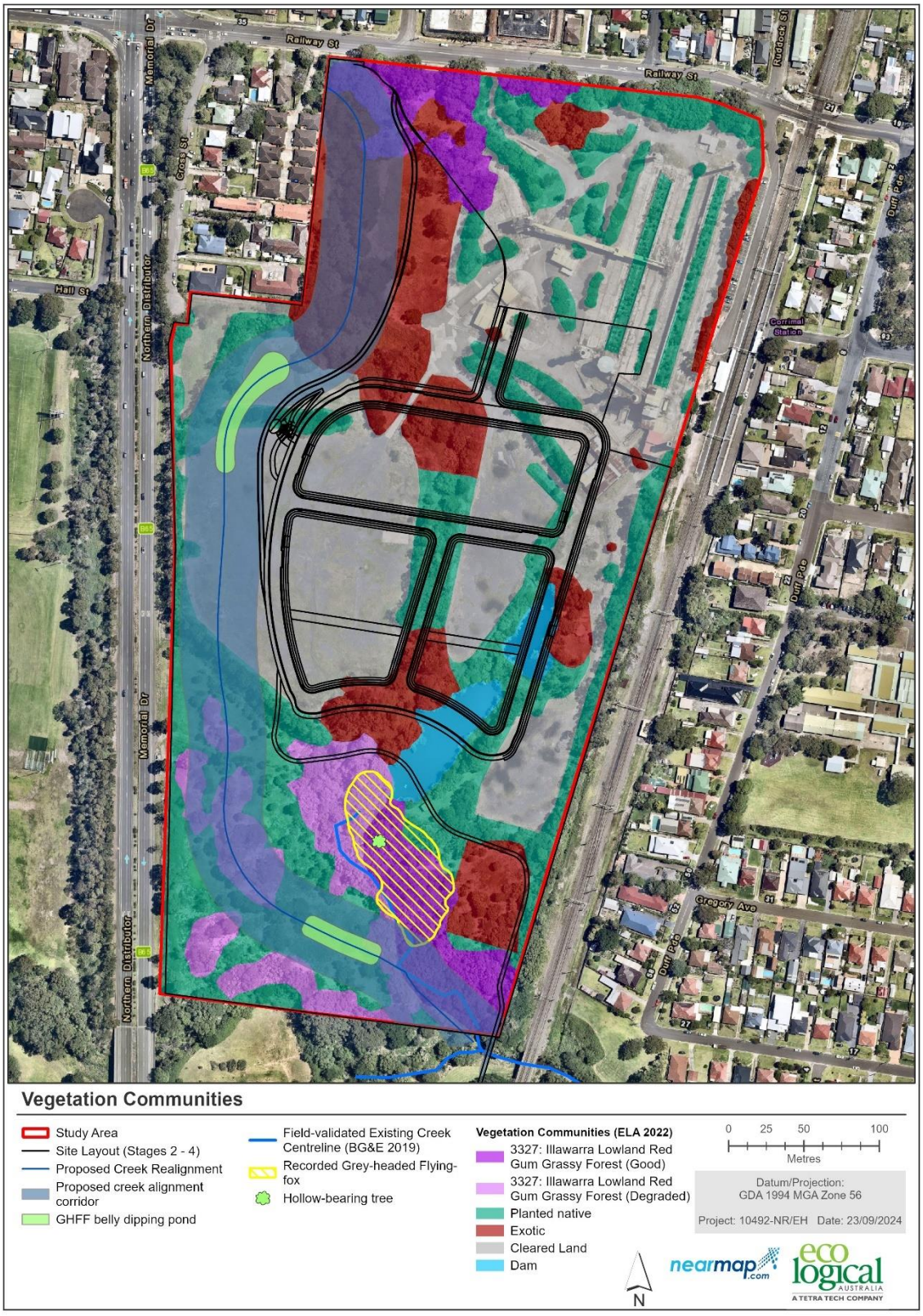


Figure 2: Development footprint, ecological values, potential belly dipping pond and core camp extent in the study area



Figure 3: Grey-headed Flying-foxes in the study area



Figure 4: Mapped changes in the flying camp extent

3. Legislation and policy

3.1. State

3.1.1. Flying-fox Camp Management Policy

The Flying-fox Camp Management Policy 2015 (the Policy) has been developed to empower land managers, principally local councils, to work with their communities to manage flying-fox camps effectively. It provides the framework within which the Department will make regulatory decisions. In particular, the Policy strongly encourages local councils and other land managers to prepare Camp Management Plans for sites where the local community is affected.

3.1.2. Biodiversity Conservation Act 2016

The purpose of the *Biodiversity Conservation Act 2016* (BC Act) includes to conserve biodiversity at the bioregional and state scales. Under this Act, a person who harms or attempts to harm an animal of a threatened species, an animal that is part of a threatened ecological community, or a protected animal, is guilty of an offence.

The Grey-headed Flying-fox is listed as threatened under the BC Act. This plan has considered whether a biodiversity conservation licence under Part 2 of the BC Act may be required. A licence is required if the proposed action is likely to result in one or more of the following:

a. harm to an animal that is a threatened species, or part of a threatened population.

The implementation of the proposed works may potentially harm the Grey-headed Flying-fox and therefore, a licence under the BC Act is required. The Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) has advised that Threatened Species Licence applications will only be assessed on development applications (DAs) that have been approved. The Corrimal Cokeworks DAs have been submitted in separate stages. Therefore, Legacy Property have sought separate licences for impacts to the flying fox camp following approved development consent of each stage of development. Legacy Property hold the following licences for approved development stages:

- Licence DOC24/644921-3 for Stage 1 Bulk Earthworks DA, DA-2023/166 (Appendix A).
- Licence DOC24/536883-5 for Demolition DA, DA22/1249 (Appendix B).
- Licence DOC24/537230-3 for Sewer Lead-in works (Approved activity under Part 5 of the Environmental Planning and Assessment Act 1979) (Appendix C).

Licence conditions must be adhered to for each stage of works. If any changes to the plan are proposed or there is an incidental occurrence of harm, amendments to the licence will be required. A Threatened Species License to allow completion of the Sewer Lead-in Works was issued in July 2024 (Appendix A) and all conditions of that license must be adhered to for that component of the works.

A fourth licence will be required for the Stage 2-4 Bulk Earthworks DA. A licence application will be submitted following approval of the DA.

3.1.3. Prevention of Cruelty to Animals Act 1979

It may be an offence under this Act if there is evidence of unreasonable/unnecessary torment associated with management activities. Adhering to welfare and conservation measures provided in Section 10.3 will ensure compliance with this Act.

3.1.4. Environmental Planning and Assessment Act 1979

The objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act) are to encourage the proper management, development and conservation of resources, for the purpose of the social and economic welfare of the community and a better environment. It also aims to share responsibility for environmental planning between different levels of government and promote public participation in environmental planning and assessment.

The EP&A Act is administered by the Department of Planning and Environment. Consistent with the Act, development under Part 4 of the Act does not require licensing under the BC Act. The proponent is proposing to submit a development application to Wollongong Shire Council for assessment and approval under Part 4 of the EP&A Act. As the consent authority, Wollongong Council will be responsible for reviewing and approving this plan.

3.2. Commonwealth

3.2.1. Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection for the environment, specifically matters of national environmental significance (MNES). A referral to the Commonwealth Department of Climate Change, Energy the Environment and Water (DCCEEW) is required under the EPBC Act for any action that is likely to significantly impact on an MNES. MNES under the EPBC Act that relate to flying-foxes include:

- world heritage sites (where those sites contain flying-fox camps or foraging habitat)
- wetlands of international importance (where those wetlands contain flying-fox camps or foraging habitat)
- nationally threatened species and ecological communities.

The subject land does not contain a world heritage site or a wetland of international importance that contains a Grey-headed Flying-fox Camp. The subject land does contain a known camp which contains, on average 300 individuals. The proposed action was also considered against the referral guidelines for Grey-headed Flying-fox which specifically relate to impacts on a nationally important camp. A national important camp is a camp that has either:

- contained ≥10,000 GHFF in more than one year in the last 10 years
- been occupied by more than 2500 GHFF permanently or seasonally every year for the last 10 years.

Since camp monitoring commenced, the camp has not held >10,000 flying-foxes for more than 1 year or been occupied by >2,500 flying-foxes permanently or seasonally for the last 10 years. Therefore, the

camp does not meet the definition of a nationally important camp. In addition, the camp management actions are being conducted to minimise any potential for a significant impact to the camp and a referral has not been recommended. A referral may be required if the camp is consistently disturbed, or this plan is not adhered to.

4. Flying-fox ecology and behaviour

The information in this chapter has been developed with the use of the Flying-fox Camp Management Plan Template (DPIE 2019).

4.1. Ecological role

Flying-foxes make a substantial contribution to ecosystem health through their ability to move seeds and pollen over long distances (Southerton et al. 2004). This directly assists gene movement in native plants, improving the reproduction, regeneration and viability of forest ecosystems (DEE 2019b). Some plants, particularly *Corymbia* spp., have adaptations suggesting they rely more heavily on nocturnal visitors such as flying-foxes for pollination than daytime pollinators (Southerton et al. 2004).

Grey-headed flying-foxes may travel 100 km in a single night with a foraging radius of up to 50 km from their camp (McConkey et al. 2012) and have been recorded travelling over 500 km in two days between camps (Roberts et al. 2012). The average nightly foraging distance has been estimated at 20 km (DAWE 2021).

Long-distance seed dispersal and pollination make flying-foxes critical to the long-term persistence of many plant communities (Westcott et al. 2008; McConkey et al. 2012), including eucalypt forests, rainforests, woodlands and wetlands (Roberts et al. 2006). Seeds that can germinate away from their parent plant have a greater chance of growing into a mature plant (DES 2018). Long-distance dispersal also allows genetic material to be spread between forest patches that would normally be geographically isolated (Parry-Jones & Augee 1992; Eby 1991; Roberts 2006). This genetic diversity allows species to adapt to environmental change and respond to disease pathogens. Transfer of genetic material between forest patches is particularly important in the context of contemporary fragmented landscapes.

Flying-foxes are considered 'keystone' species given their contribution to the health, longevity and diversity among and between vegetation communities. These ecological services ultimately protect the long-term health and biodiversity of Australia's bushland and wetlands. In turn, native forests act as carbon sinks (Roxburgh et al. 2006), provide habitat for other animals and plants, stabilise river systems and catchments, add value to production of hardwood timber, honey and fruit (e.g. bananas and mangoes; Fujita 1991), and provide recreational and tourism opportunities worth millions of dollars each year (DES 2018).

4.2. Flying-foxes in urban areas

Flying-foxes appear to be roosting and foraging in urban areas more frequently. There are many possible drivers for this, as summarised by Tait et al. (2014):

- loss of native habitat and urban expansion
- opportunities presented by year-round food availability from native and exotic species found in expanding urban areas

- disturbance events such as drought, fires, cyclones
- human disturbance at non-urban roosts or culling at orchards
- urban effects on local climate
- refuge from predation
- movement advantages, e.g. ease of manoeuvring in flight due to the open nature of the habitat or ease of navigation due to landmarks and lighting.

4.3. Under threat

Flying-foxes roosting and foraging in urban areas more frequently can give the impression that their populations are increasing; however, the Grey-headed Flying-fox is in decline across its range and in 2001 was listed as vulnerable by the NSW Government through the *Threatened Species Conservation Act 1995* (now BC Act).

At the time of listing, the species was considered eligible for listing as vulnerable, as counts of flying-foxes over the previous decade suggested the national population had declined by up to 30%. It was also estimated the population would continue to decrease by at least 20% in the next three generations given the continuation of the current rate of habitat loss, culling and other threats.

The main threat to grey-headed flying-foxes in New South Wales is clearing or modification of native vegetation. This removes appropriate roosting and breeding sites and limits the availability of natural food resources, particularly winter–spring feeding habitat in north-eastern NSW. The urbanisation of the coastal plains of south-eastern Queensland and northern NSW has seen the removal of annually-reliable winter feeding sites, which is continuing.

There are a wide range of ongoing threats to the survival of the Grey-headed Flying-fox, including:

- habitat loss and degradation
- conflict with humans (including culling at orchards)
- infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.)
- exposure to extreme natural events such as cyclones, drought and heatwaves.

Flying-foxes have limited capacity to respond to these threats and recover from large population losses due to their slow sexual maturation, low reproductive output, long gestation and extended maternal dependence (McIlwee & Martin 2002).

4.4. Typical camp characteristics

All flying-foxes are nocturnal, typically roosting during the day in communal camps. These camps may range in number from a few to hundreds of thousands, with individual animals frequently moving between camps within their range. Typically, the abundance of resources within a 20 to 50-km radius of a camp site will be a key determinant of the size of a camp (SEQ Catchments 2012). Many flying-fox camps are temporary and seasonal, tightly tied to the flowering of their preferred food trees; however, understanding the availability of feeding resources is difficult because flowering and fruiting are not

reliable every year, and can vary between localities (SEQ Catchments 2012). These are important aspects of camp preference and movement between camps and have implications for long-term management strategies.

Little is known about flying-fox camp preferences; however, research indicates that apart from being in proximity to food sources, flying-foxes choose to roost in vegetation with at least some of the following general characteristics (SEQ Catchments 2012; Eco Logical Australia 2018):

- closed canopy >5 metres high
- dense vegetation with complex structure (upper, mid- and understorey layers)
- within 500 metres of permanent water source
- within 50 kilometres of the coastline or at an elevation <65 metres above sea level
- level topography (<5° incline)
- greater than 1 ha to accommodate and sustain large numbers of flying-foxes.

Optimal vegetation available for flying-foxes must allow movement between preferred areas of the camp. Specifically, it is recommended that the size of a patch be approximately three times the area occupied by flying-foxes at any one time (SEQ Catchments 2012).

4.5. Grey-headed flying-fox (*Pteropus poliocephalus*) species profile

The Grey-headed Flying-fox is found throughout eastern Australia, generally within 200 km of the coast, from Finch Hatton in Queensland to Melbourne, Victoria (DPIE 2019c). This species now ranges into South Australia and individual flying-foxes have been reported on the Bass Islands and mainland Tasmania (Driessen et al. 2011). It requires foraging resources and camp sites within rainforests, open forests, closed and open woodlands (including melaleuca swamps and banksia woodlands). This species is also found throughout urban and agricultural areas where food trees exist and will feed in orchards at times, especially when other food is scarce (DPIE 2019a).

GHFF generally show a high level of fidelity to camp sites, returning year after year to the same site, and have been recorded returning to the same branch of a particular tree (SEQ Catchments 2012). This may be one of the reasons flying-foxes continue to return to small urban bushland blocks that may be remnants of historically used larger tracts of vegetation.

The GHFF population has a generally annual southerly movement in spring and summer, with their return to the coastal forests of north-east NSW and south-east Queensland in winter (Ratcliffe 1932; Eby 1991; Parry-Jones & Augee 1992; Roberts et al. 2012). This results in large fluctuations in the number of GHFF in New South Wales, ranging from as few as 20% of the total population in winter up to around 75% of the total population in summer (Eby 2000). They are widespread throughout their range during summer, but in Spring and Winter are uncommon in the south. In Autumn they occupy primarily coastal lowland camps and are uncommon inland and on the south coast of New South Wales (DECCW 2009).

There is evidence the GHFF population declined by up to 30% between 1989 and 2000 (Birt 2000; Richards 2000 cited in DPIE 2019a). There are a wide range of ongoing threats to the survival of the

GHFF, including habitat loss and degradation, culling in orchards, conflict with humans, infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, and power line electrocution) and competition and hybridisation with the Black Flying Fox (*Pteropus alecto* – BFF) (DECCW 2009).

5. Management measures for on-ground works – Bulk earthworks phase

The following management measures have been designed for implementation during the construction phase of the works. The management measures have been designated to the relevant construction phase of bulk earthworks and split into measures relative to proximity to the camp. This protocol will be incorporated in safe work method statements and induction materials for staff and contractors working near the camp.

In additional to the measures outlined below, works are to adhere to the following Threatened Species Licences that are relevant for each stage of works:

- Licence DOC24/644921-3 for Stage 1 Bulk Earthworks DA, DA-2023/166 (Appendix A).
- Licence DOC24/536883-5 for Demolition DA, DA22/1249 (Appendix B).
- Licence DOC24/537230-3 for Sewer Lead-in works (Approved activity under Part 5 of the Environmental Planning and Assessment Act 1979) (Appendix C).
- A licence will be sought following approval of Stage 2-4 Bulk Earthworks DA.

The mitigation measures in the following sections are consistent with the licence conditions, which are very similar across all three licences except for the Sewer-lead in works Licence that includes an additional condition, Condition 10, which provides measures around the removal of habitat trees within the potential flying fox area. Condition 7 of the Stage 1 Bulk Earthworks Licence also includes an additional provision for continuous supervision for stockpiling materials within 75-200 m of the camp. The conditions outlined in Chapter 5 include all conditions across all licences.

5.1. Pre-construction

The Threatened Species Licences allows works to be undertaken within 75m of the flying fox camp while the flying foxes are present. However, as far as possible, works within 75 m of the flying fox camp should be scheduled/planned to be done while the flying foxes are absent from the site. The flying foxes are generally absent or in low numbers in winter. If the flying foxes do not vacate the site, or return much earlier than expected, works within 75m of the camp are to be done in accordance with the licence.

5.1.1. Pre-construction conditions across all licences

Condition 3: At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).

Condition 4: If the camp is deemed empty of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert

Condition 5: When the grey-headed flying-fox camp is occupied and on-site actions are planned:

a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for

- Grey-headed flying-fox numbers
- The camp footprint
- The distance of on-site actions to the camp
- General health of flying-foxes (including signs of malnourishment)
- Signs of breeding including
- The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant
- Birthing or lactating females
- Females carrying young
- Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
- Courtship and/or mating behaviours

Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps

b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site works have commenced

    i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request.

A preliminary survey to confirm if flying-foxes are present must be conducted by a qualified flying-fox ecologist in the week prior to works commencing and must be repeated if works cease for a period of longer than three weeks. Otherwise inspections will be required daily by a suitably qualified and skilled person to determine if the camp has flying-foxes in it. If so, then monitoring will be required as detailed in the following sections.

5.1.2. Inductions

All staff and contractors are to undertake environmental inductions regarding management of the camp and identification of the Grey-headed Flying-fox, disease risks associated with flying-foxes and the stop work triggers (Table 7; Appendix B). A designated experienced flying-fox ecologist should be available to contact at any time if there are concerns for the welfare of GHFF at the camp. Any stop work decision would be made by the relevant land manager.

Once the development is in the operational phase, the public and land users need to know who to contact (e.g. WIRES or Sydney Wildlife) if dead or injured flying foxes are found. A range of communication and messaging methods will be employed to facilitate this, but must be initiated by the developer prior to the operational phase. It is the responsibility of the land manager and contractors to conduct a risk assessment and determine workplace health and safety requirements; however minimum requirements are provided below.

5.1.3. Preparation of replacement habitat plan

Prior to the commencement of bulk earthworks, a plan to de-water the dam closest to the camp and the creation of a replacement water body must be prepared and will be appended to this Management Plan. The replacement water body is required to be in a position where it can be used by the Flying-foxes for belly dipping and where it can provide relief from heat stress. The belly dipping pond must be free of debris and have a clear flypath for the flying foxes to perform belly dipping safely. The plan should outline protocols to de-water the dam whilst the camp is empty and create the replacement dam before the flying foxes return to the camp. If the dam cannot be dewatered when the camp is empty, strict mitigation and monitoring measures are required to be developed to ensure no indirect harm or increased risk of heat stress would occur and the new water body must be in place prior to dam de-watering occurring of the original dam. The current proposed alternative water body is Towradgi Creek, which is to be re-aligned and rehabilitated from its current highly disturbed state and will include a section that will form a permanent pool at point adjacent to the GHFF roost. Alternative locations for the dam could include existing water bodies outside the boundary of the subject land, provided they meet the requirements of the replacement habitat. This must be detailed in the plan and these measures approved by the project ecologist and Council before work can proceed. The proposed location for the new belly dipping pond is shown on Figure 2.

5.2. During construction

5.2.1. Creation of supplementary aquatic habitat

Prior to the commencement of bulk earthworks across the subject land, the supplementary aquatic habitat must be created. The supplementary habitat should be prepared consistent with the plan submitted at the relevant DA stage.

5.2.2. Supervision works in accordance with the current active Threatened Species Licences.

The holder of the certificate must ensure that:

Condition 1: Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated.

Condition 2: Any incident/s of harmed/dead grey-headed flying-foxes

a. Must be reported immediately to a local wildlife carer group for welfare response and collection
b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes.

Condition 6: Signs of stress in the grey-headed flying-foxes are defined as any of the following

- More than 30% of the camp takes flight and remains in flight for more than 20 minutes
- Saliva spreading (i.e. licking themselves other than for grooming)

- Grey-headed flying-foxes located on or within two metres of the ground
- Aborting young
- Dependant young abandoned for greater than 20 minutes during the day
- An increase in the number of flying-foxes being taken into local care
- Harmed/dead flying-fox/es found under or adjacent to the camp
- New grey-headed flying-fox camps forming within 5 km of the on-site actions.

Condition 7: If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken.** Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery. This also includes the stockpiling of materials within the future Stage 2 area of the site (refer to Condition 8 for works 75-200 m from the edge of the camp).

Condition 8: If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp,**

a. In addition to on-site personnel continuous monitoring requirements (Condition 7), a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au.
b. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

    i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)
    ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be onsite to monitor for signs of stress and advise site-managers on response.

c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

    i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress
    ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert
    iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence
    iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW.

Condition 9: If the grey-headed flying-fox camp is occupied, for any works within **75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au
b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted
c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

    i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress
    ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence
    iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day
    iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works causing the signs of stress are appropriate to continue or should be deferred to a later date.
    v. All signs of stress incidents and responses for works within 75 m of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au.

d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 m of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.
e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately.

Condition 10: In the area denoted as the potential extent (typical camp extent) of the flying-fox camp as shown in Figure 5

a. Vegetation/trees providing habitat for the flying-fox camp must not be felled, lopped or have large branches removed if it has not been identified in the Sewer lead-in Works, Stage 1 and 2-4 Bulk Earthworks and Demolition works for alteration (as per Figure 5 and Figure 6).

b. Vegetation/trees that are within the area identified in the Sewer lead-in Works, Stage 1 and 2-4 Bulk Earthworks and demolition works (within the development footprint and Construction Buffer area identified in Figure 5 and Figure 6) must not be felled, lopped or have large branches removed when flying foxes are in them or within 30 m of the vegetation/tree being felled, lopped or modified, or when flying-foxes are within a distance where they are likely to be harmed by the vegetation/tree that is being felled, lopped or modified (which may include a distance >30 m).

Condition 11: When temperatures are predicted to be above 35°C

a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including

   - Panting
   - Saliva spreading (i.e. licking themselves other than for grooming)
   - Grey-headed flying-foxes located on or within 2 m of the ground
   - Grey-headed flying-foxes clumping around tree trunks
   - Grey-headed flying-foxes on the ground
   - Grey-headed flying-foxes dying.

b. b. Should any signs of heat-stress be noted,

   i. On-site actions that cause any disturbance to the camp must cease immediately
   ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately.

Condition 12: When temperatures are predicted to be above 38°C

a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 m of the camp must cease
b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress
c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately.

Condition 13: A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage

a. a. Minimise disturbance within 200 m of the grey-headed flying-fox camp
b. b. Monitor for signs of stress
c. c. Cease actions should the grey-headed flying-foxes show signs of stress.

Condition 14. New grey-headed flying-fox camps that establish within 5 km of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these

camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.

Condition 15. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including

- Information about camp occupation dates
- Grey-headed flying-fox numbers
- The camp footprint (providing maps to show any temporal and spatial changes)
- The distance from on-site actions to the camp
- Signs of breeding (providing details on what signs were observed)
- General health of flying-foxes (including signs of malnourishment)
- Any stress incidents and responses
- Feedback on flying-fox responses to any works undertaken within 75 metres of
- the edge of the camp (including details on what the works were, and what the
- immediate and short-term responses were)
- Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management.

Documentation by the suitably qualified ecologist should be prepared to demonstrate that the protocols have been followed in all situations. This will take the form of weekly emails and monthly reports to be provided to Council and DCCEEW.

Works must be staged to preference works within 75 m of the flying fox camp to be conducted when the flying foxes are absent from the site.

Table 1 below shows a summary of the triggers and associated actions.

Table 1: Triggers and actions to mitigate impacts

Welfare trigger	Signs	Actions
Signs of stress	• more than 30% of the camp takes flight and individuals are in flight for more than 20 minutes • saliva spreading • located on or within 2 m of the ground • aborting young (if young present).	Temporarily cease works until the flying foxes settle. If flying foxes settle works can recommence. Contact an ecologist to monitor stress levels if the activity needs to be done the following day/s.
Evidence of maternity roost is identified (pups present)	• Camp generally empty during winter and early Spring. The camp is not known to be a maternity roost, however it possibly may be used for such, most likely during late Spring and summer during the typical maternity season. ELA notes that the maternity season for the GHFF in NSW is no longer clearly defined by DCCEEW.	Works to proceed if camp is empty. If camp is not empty and pups are identified: ○ Noise-generating activities (e.g. building demolition, tree removal, woodchipping) within 75 m of the camp to be avoided ○ Continuous monitoring of flying foxes to determine if they become stressed as per above

Welfare trigger	Signs	Actions
		○ Works to follow protocols in this plan.
Gale force wind	• inability to forage • located on or within 2 m of the ground.	Minimise disturbance within 200 m of the camp and monitor animal welfare.
Heat stress	• panting • saliva spreading • located on or within 2 m of the ground.	Monitor weather conditions and prepare teams to respond to heat stress - refer to Section 4.6 for details. Works within 200 m of the camp must cease when temperatures exceed 38°C.
Food shortage	• loss of condition evident.	Minimise disturbance within 200 m of the camp and monitor animal welfare.
Injury/death	• a flying-fox appears to have been injured/killed due to non-natural causes.	Contact an ecologist or wildlife carer. Investigate possible cause and cease action that was a factor, if relevant, and revise management strategy as needed. Obtain approval to proceed under the revised management plan.

5.2.3. Personal health measures when in contact with flying foxes

- All personnel working within 200 m of the camp will wear protective clothing including long sleeves and pants. Additional items such as eye protection and a hat are also recommended. Appropriate hygiene practices will be adopted such as washing hands with soap and water before eating/smoking.
- A wash station will be available along with an anti-viral antiseptic (e.g. Betadine) should someone be bitten or scratched. If a person is bitten or scratched by a FF they should:
    - wash the wound with soap and water for at least five minutes (do not scrub)
    - contact their doctor immediately to arrange for post-exposure vaccinations.
    - If flying-fox saliva contacts the eyes, nose, mouth or an open wound, flush thoroughly with water and seek immediate medical advice.
    - Details of the nearest hospital or doctor who can provide post-exposure prophylaxis will be kept on site.
- Only trained and vaccinated personnel are allowed to handle injured or dead flying-foxes.

If at any time it is identified that ongoing disruption or harm occurs to any Grey-headed Flying-foxes, then works must cease and consideration give as to whether a referral to the Commonwealth DCCEEW is recommended.

5.2.4. General measures

The following protocols must be followed where machinery is used in the subject land:

- Ensure all plant and equipment is maintained to Australian Standards to minimise noise generation. This includes:
  - no more than eight hours of exposure to noise measured at 85 decibels
  - no noise which exceeds 140 decibels, unless the camp is empty
  - if noise exceeds 85 decibels, than the exposure time must decrease, consistent with the Australian Standards.
- Position plant and equipment as far from the camp as possible.
- Shield noise at its source, where possible.
- Modify equipment to produce less noise or use alternative construction techniques to minimise noise.
- Avoid construction or noise activities during hours when the GHFF are most settled in the camp.
- Avoid shining lights toward the GHFF camp.
- Stop works procedure if flying-fox disturbance occurs in absence of ecologist.
- Monthly monitoring to continue.
- Do not stockpile materials within 75 m of the camp when the camp is occupied.
- Works are not undertaken during times of extreme heat evens (> 38°C).

If actions cannot comply with these mitigation measures, a referral to the NSW Department of Climate Change, Energy, Environment and Water (DCCEEW) is required.

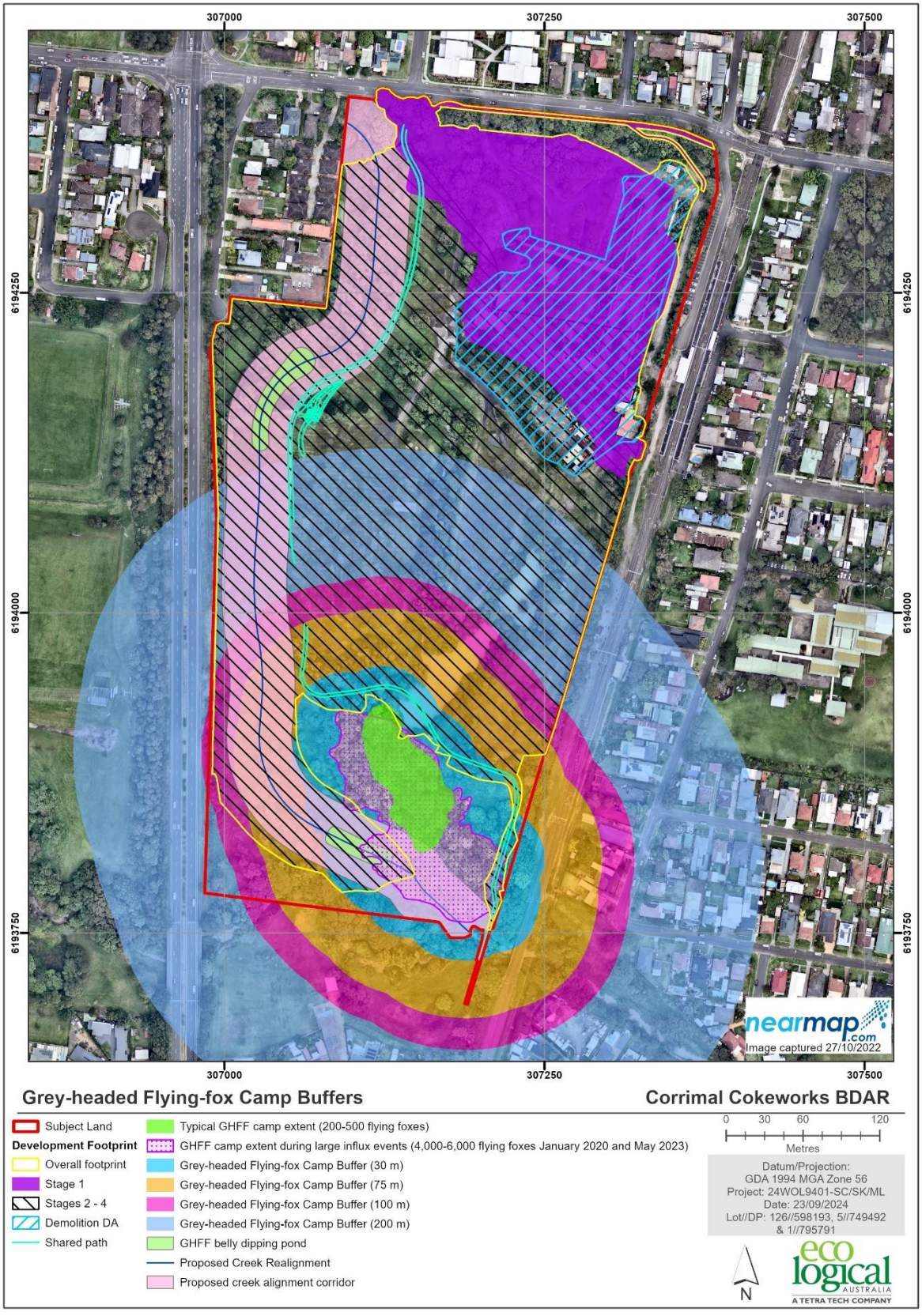


Figure 5: Construction buffers relative to the Grey-headed Flying-fox camp.

**Please note, this figure shows a 100 m buffer off the Stage 1 Bulk Earthworks development footprint. This buffer was used in the Biodiversity Development Assessment Report (ELA 2022) to assess potential impacts to the GHFF Camp. It has been used in this report for context, and information only. It does not relate to any prescribed management actions or mitigation measures described in this plan.

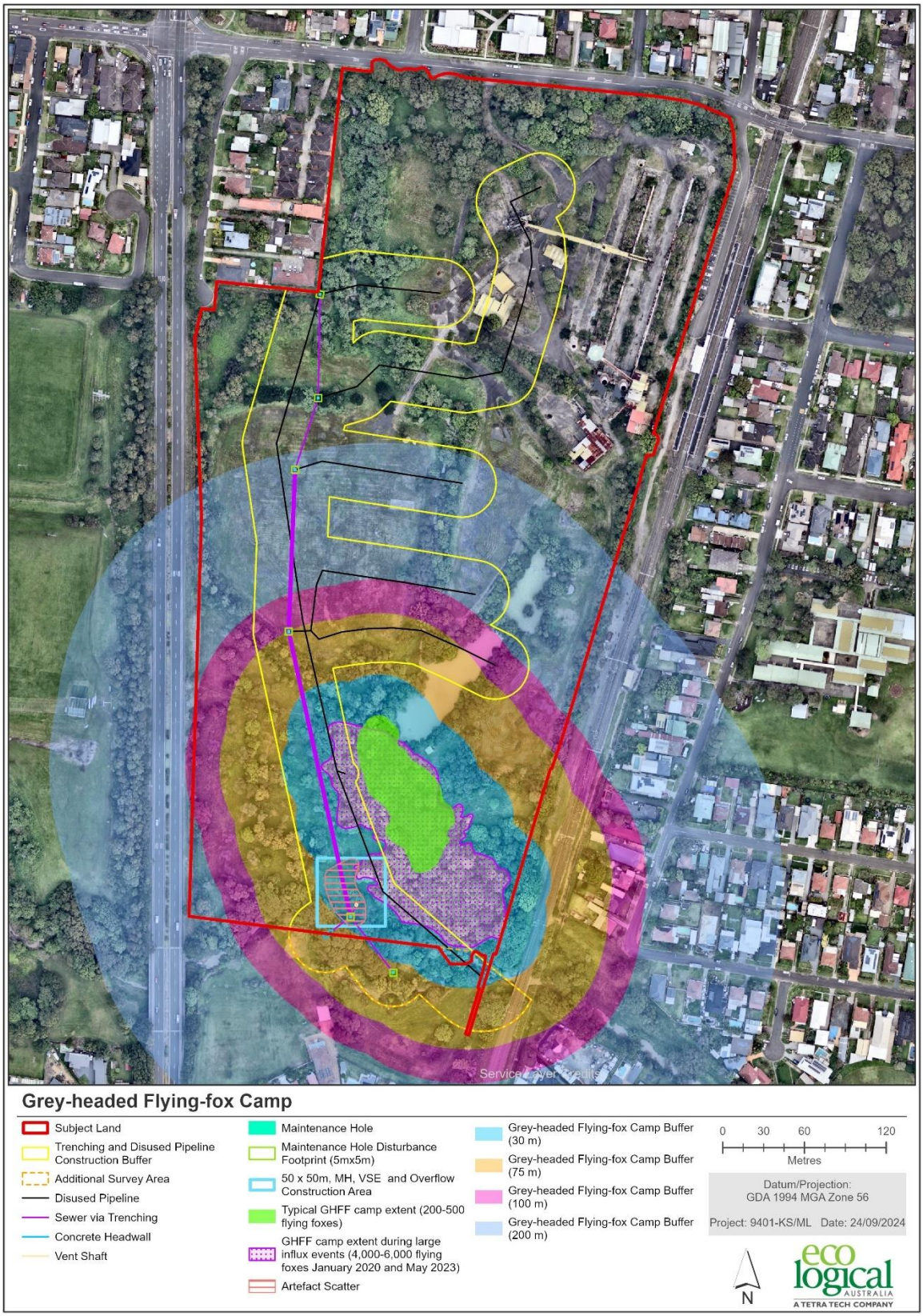


Figure 6: Sewer-lead in works impact areas

6. Management measures for on-ground works – embellishment and soft works

6.1. Revegetation and land management to create alternative habitat

As part of the proposed development, the future riparian corridor will be constructed and revegetated with native vegetation that will form part of Plant Community Type (PCT) 838 – Forest Red Gum Thin-leaved Stringybark Grassy Woodlands. This PCT is consistent with the vegetation that the camp is currently occupying in the subject land. The vegetation densities will decrease along the outer edges of the riparian corridor, to decrease potential conflicts with humans and land use.

NSW Department of Environment and Climate Change conducted a study ranking the importance of different species of trees in providing a feeding resource for Grey-headed Flying Foxes for Conservation Management (DCCEW 2008). The study found the following list to trees to be considered significant food plants for flying foxes:

Table 4.1. Species in the blossom diet of Grey-headed flying foxes and their flower scores. Where more than one score was assigned to the species, the range is given. No scores are given for species that were not identified in descriptions of vegetation types. Species with high (≥0.65) wt p*r scores are indicated by shading. These are considered significant food plants for the animals.

Family	Species	Common name	Prod	Relia	Wt p*r
Fabaceae	*Castanospermum australe*	Black bean	0.77	1	0.83
Proteaceae	*Banksia integrifolia v. int*	Coast Banksia	0.77	1	0.83
	B. serrata	Old Man Banksia	0.54	0.30	0.45
	Grevillea robusta	Silky Oak	1	1	1
Myrtaceae	*Angophora costata*	Smooth-barked Apple	0.37	0.30	0.35
	A. floribunda	Rough-barked Apple	0.54	0.30	0.45
	A. leiocarpa		0.37	0.30	0.35
	Corymbia citriodora citriodora	Lemon-scented Gum	0.91	0.30	0.65
	C. eximia	Yellow Bloodwood	0.70	0.30	0.54
	C. gummifera	Red Bloodwood	0.91	0.30	0.65
	C. henryi	Large-lved Spotted Gum	0.70	0.30	0.54
	C. intermedia	Pink Bloodwood	1	0.60	0.86
	C. maculata	Spotted Gum	0.91	0.30	0.65
	C. tessellaris	Carbeen	0.61	0.15	0.40
	C. trachyphloia	Brown Bloodwood	0.54	0.30	0.45
	C. variegata	Northern Spotted Gum	0.91	0.30	0.65
	Eucalyptus acmenoides	White Mahogany	0.37	0.60	0.43
	E. albens	White Box	0.70	0.30	0.54
	E. amplifolia	Cabbage Gum	0.70	0.15	0.44
	E. andrewsii	New England Blackbutt	0.59	0.80	0.65
	E. bancrofti	Orange Gum	0.70	0.30	0.54
	E. botryoides	Southern Mahogany	0.54	0.45	0.51
	E. camaldulensis	River Red Gum	0.70	0.60	0.67
	E. campanulata	New England Blackbutt	0.37-0.54	0.30-0.45	0.39-0.45
	E. cloeziana	Gympie Messmate	0.47	0.15	0.34
	E. deanei	Mtn Blue Gum	0.70	0.80	0.73
	E. fibrosa	Broad-leaved Ironbark	0.70	0.30	0.54
	E. grandis	Flooded Gum	0.54	0.60	0.56
	E. longirostrata	Grey Gum	0.54	0.15	0.37
	E. maidenii	Maiden's Gum	0.54	0.30	0.45
	E. major	Grey Gum	0.54	0.15	0.37
	E. melanophloia	Silver-leaved Ironbark	0.54-0.70	0.30	0.45-0.54
	E. melliodora	Yellow Box	0.32	0.60	0.39
	E. moluccana	Grey Box	0.37-0.59	0.30-0.80	0.35-0.65
	E. muelleriana	Yellow Stringybark	0.47	0.30	0.41
	E. paniculata	Grey Ironbark	0.61	0.30	0.49
	E. parramattensis	Parramatta Red Gum	0.54	0.30	0.45
	E. pilularis	Blackbutt	0.54-0.80	0.45	0.51-0.67
	E. piperita	Sydney Peppermint	0.59	0.45	0.55
	E. planchoniana	Needlebark	0.70	0.30	0.54
	E. propinqua	Small-fruited Grey Gum	0.47	0.15	0.34
	E. punctata	Large-fruited Grey Gum	0.54	0.60	0.56
	E. pyrocarpa	Large-fruited Blackbutt	0.70	0.30	0.54
	E. resinifera	Red Mahogany	0.54	0.15	0.37
	E. robusta	Swamp Mahogany	1	1	1
	E. rummeryi	Steel Box	0.70	0.30	0.54
	E. saligna	Sydney Blue Gum	0.70	0.80	0.73
	E. seeana	Narrow-leaved Red Gum	0.77	0.80	0.78
	E. siderophloia	Grey Ironbark	0.91	0.60	0.81
	E. sideroxylon	Mugga Ironbark	0.70	0.30	0.54
	E. tereticornis	Forest Red Gum	0.54-0.91	0.15-0.60	0.37-0.88
	E. tricarpa	Red Ironbark	0.47	0.15	0.34
	Lophostemon confertus	Brush box	0.41	0.63-0.80	0.46
	M. quinquenervia	Five-veined Paperbark	0.91	0.80	0.88
	Syncarpia glomulifera	Turpentine	0.54-0.59	0.60-0.80	0.56-0.65

Figure 7: Significant blossom food plants for flying foxes. Source - DCCEW 2008 Ranking the feeding habitats for Grey-headed Flying Foxes (DCCEW 2008).

Table 4.3. Species in the fruit diet of Grey-headed flying foxes and an estimate of the southern limit to their range (decimal degrees). Species on this list have been confirmed by observations of feeding animals or by identification of faecal or spat material.

Family	Species	Common name	Latitude of southern limit
GYMNOSPERMAE			
Podocarpaceae	*Podocarpus elatus*	Plum Pine	35.7
ANGIOSPERMAE			
Anonaceae	*Rauwenhoffia leichardtii*	Zig Zag Vine	30.3
Apocynaceae	*Melodinus australis*	Southern Melodinus	34.5
Arecaceae	*Livistona australis*	Cabbage Palm	37.8
	Archontophoenix cunninghamiana	Bangalow Palm	35.7
Avicenniaceae	*Avicennia marina*	Grey Mangrove	39
Caprifoliaceae	*Sambucus australasica*	Yellow Elderberry	37.8
Chenopodiaceae	*Rhagodia candolleana*	Seaberry Saltbush	Tasmania
Cunoniaceae	*Schizomeria ovata*	Crabapple	36.2
Davidsoniaceae	*Davidsonia* spp.	Davidson's Plum	28.8
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony	35.5
Ehretiaceae	*Ehretia acuminata*	Koda	36.7
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong	33.3
	E. reticulatus	Blueberry Ash	Tasmania
	E. grandis	Blue Fig	30.7
Escalloniacae	*Polyosma cunninghamii*	Featherwood	35.5
Euphorbiaceae	*Mallotus discolor*	White Kamala	29.7
Icacinaceae	*Pennantia cunninghamii*	Brown Beech	35.7
Meliaceae	*Melia azedarach*	White Cedar	34.9
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry	Tasmania
Moraceae	*Ficus coronata*	Creek Sandpaper Fig	37.8
	F. fraseri	Sandpaper Fig	33.3
	F. macrophylla	Moreton Bay Fig	34.9
	F. obliqua	Small-leaved Fig	36.2
	F. rubiginosa	Rusty Fig	37
	F. superba	Deciduous Fig	35.3
	F. virens	White Fig	29.7
	F. watkinsiana	Strangler Fig	32.4
	Maclura cochinchinensis	Cockspur Thorn	35.3
Myrtaceae	*Acmena hemilampra*	Broad-leaved Lilly Pilly	29.4
	A. ingens	Red Apple	28.9
	A. smithii	Lilly Pilly	39
	Rhodamnia argentea	Malletwood	31.4
	Syzygium australe	Brush Cherry	35.7
	S. corynanthum	Sour Cherry	31.6
	S. crebrinerve	Purple Cherry	31.6
	S. luehmanii	Riberry	31

Family	Species	Common name	Latitude of southern limit
	S. oleosum	Blue Lilly Pilly	34.4
Passifloraceae	*Passiflora herbertiana*	Native Passionfruit sp.	36.2
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	38.3
Rhamnaceae	*Alphitonia excelsa*	Red Ash	36.2
Rosaceae	*Rubus rosifolius*	Native Raspberry	38.1
Rubiaceae	*Morinda jasminoides*	Morinda	38.3
Sapindaceae	*Diploglottis australis*	Native Tamarind	34.6
Sapotaceae	*Planchonella australis*	Black Apple	34.4
Solanaceae	*Solanum aviculare*	Kangaroo Apple	Tasmania
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree	36.7
	D. photinophylla	Shining-leaved Stinging Tree	33.5
Viscaceae	*Notothixos cornifolius*	Kurrajong Mistletoe	33.5
Vitidaceae	*Cissus hypoglauca*	Five-leaf Water Vine	38.2

Figure 8: Observed fruit bearing trees used as feeding trees for flying foxes. Source: Ranking the feeding habitats of Grey-headed flying foxes for conservation management (DCCEW 2008).

ELA have recommended that the above listed trees and shrubs are not to be used as in the landscaping in and immediately around the proposed built areas in an effort to discourage the flying foxes from foraging in close proximity to the future urban areas. This is in response to the SOFAC comment B1.7 (vi) from Wollongong City Council.

Of the above listed preferred flying fox feed trees, the following species are characteristic of the remnant vegetation community recorded within the development site.

- *Angophora floribunda*
- *Corymbia maculata*
- *Eucalyptus amplifolia*
- *Eucalyptus botryoides <–> saligna*
- *Eucalyptus paniculata*
- *Eucalyptus pilularis*
- *Eucalyptus tereticornis*
- *Alphitonia excelsa*
- *Diospyros pentamera*
- *Ficus macrophylla subsp. macrophylla*
- *Ficus obliqua*
- *Melia azedarach*
- *Pittosporum undulatum*
- *Syzygium australe*
- *Livistona australis*

- *Maclura cochinchinensis*
- *Melodinus australis*
- *Passiflora herbertiana subsp. herbertiana*

The Vegetation Management Plan (VMP) (ELA 2024) for the development site will prioritise these preferred flying fox feed species for revegetation works where this does not encourage direct interactions of flying-foxes with the residents. Exotic trees such as Privet and Camphor laurel may present roosting habitat for GHFF and as such established exotic trees over 8 m high should be staged in their removal or potentially retained if that retention does not impede implementation of the VMP programme. Staging of removal may require some proportion of revegetation be moved into the maintenance period.

Similarly, the species listed in Figures 6 and 7 have been sent to the project landscaping consultants with the instruction to avoid planting these species in development areas outside of the VMP area. This precaution would be implemented to discourage flying foxes using vegetation in proposed built up areas to reduce human/flying fox interaction and prevent harm to the flying foxes.

The proposed revegetation occurs along the western extent of the proposed subdivision and ties into the existing creekline near Towradgi Creek. The camp is currently positioned downstream of a human-made dam that was used a settling pond during the operation of the cokeworks facility. As part of the construction process, the dam will be dewatered. The current proposed alternative water body is Towradgi Creek, which is to be re-aligned and rehabilitated from its current highly disturbed state and will include a section that will form a permanent pool at point adjacent to the GHFF roost (Figure 2). The realigned water body must be in place prior to dam de-watering occurring of the original dam.

6.2. Additional vegetation management measures

- All vegetation management works are to be conducted in line with current and future flying fox Threatened Species Licences.
- **Condition 10** of the Sewer Lead in works licence states: In the area denoted as the typical camp extent of the flying-fox camp as shown in Figure 5

    i. Vegetation/trees providing habitat for the flying-fox camp must not be felled, lopped or have large branches removed if it has not been identified in the Sewer lead-in Works, Stage 1 and 2-4 Bulk Earthworks and Demolition works for alteration (as per Figure 5 and Figure 6).

    ii. Vegetation/trees that are within the area identified in the Sewer lead-in Works, Stage 1 and 2-4 Bulk Earthworks and demolition works (within the development footprint and Construction Buffer area identified in Figure 5 and Figure 6) must not be felled, lopped or have large branches removed when flying foxes are in them or within 30 m of the vegetation/tree being felled, lopped or modified, or when flying-foxes are within a distance where they are likely to be harmed by the vegetation/tree that is being felled, lopped or modified (which may include a distance >30 m).

- Vegetation management in the core camp habitat will be carried out by suitably qualified and experienced bush regenerators, with at least one supervisor knowledgeable about flying-fox habitat requirements and experienced in working under a camp.
- Vegetation modification, including weed removal, will not alter the conditions of the site such that it becomes unsuitable flying-fox habitat for Level 1.
- Weed removal should follow a mosaic pattern, maintaining refuges in the mid- and lower storeys at all times.
- Weed control in the core habitat area will be undertaken using methods to minimise time in the core habitat for most effective outcomes. This may include the use of machinery in accordance with conditions of the Threatened Species licence. .
- Species selected for revegetation within the VMP area will be consistent with the Illawarra Lowlands Grassy Woodland habitat on site.
- Landscape maintenance outside the core habitat must be conducted in accordance with the Threatened Species Licences.

7. Camp management actions – operational phase

7.1. Education and awareness programs

A comprehensive and targeted flying-fox education and awareness program would be developed to provide accurate information to the local community about flying-foxes. The program will include:

- Grey-headed Flying-fox ecology and behaviour.
- Camp dynamics and numbers.
- Ways to manage risk to human health.
- Alleviate concerns regarding health and safety issues.
- Program of works proposed for the camp .
- Procedure for community feedback.

The aim of establishing an education program is to improve community understanding of flying-fox issues and alleviate community concerns about the presence of the camp. The education and awareness program would be developed and appended to this plan for implementation once the subject land is in its operational phase.

7.2. Access and signage

Access to the camp from the residential development should be restricted to prevent residents entering the camp area and encountering flying foxes. Signage should be installed at various points around the Grey-headed Flying-fox camp to promote public awareness about the camp.

7.3. Vegetation management

7.3.1. Mowing and other machinery use

Mowing and using brush-cutters within core habitat will be managed under strict protocols to promote vegetation regrowth and prevent disturbance to the camp. Regrowth should be monitored and managed by bush regeneration practices (see below) to promote native species, rather than weeds, as part of the Vegetation Management Plan. Chainsaws may only be used when the cause is to reduce a health and safety risk situation (e.g., unstable tree). Chippers must not be used within 75 m of the camp. Mowing, brush cutting or use of other powered machinery (chainsaws, chippers) will be permitted in adjacent areas (within the 100 m buffer off the development and retained lands) to maintain grass with scattered trees under strict protocols. All other adjacent landscape works must operate mindful of impacts to the camp and refer to stop work triggers for operation.

7.4. Incident management protocols

This management option involves implementing protocols for managing incidents or situations specific to particular camps. Such protocols may include 'flying-fox watch' patrols at sites that host vulnerable people, management of pets at sites popular for walking dogs, or preparation for heat stress incidents (when the camp is subjected to extremely high temperatures leading to flying-foxes changing their behaviour and/or dying).

7.5. Participation in research

Legacy Property have engaged Eco Logical Australia to monitor the camp on a monthly basis. Monthly monitoring commenced in 2019 and is anticipated to continue. Camp monitoring includes population estimates by conducting fly-out counts at dusk when the flying-foxes are exiting the camp for their nightly foraging activities and mapping of camp extent to document any changes to the area of occupation.

7.6. Buffers

During the rezoning process, a 100 m buffer from the core extent of the Grey-headed Flying-fox was established. The intention of the buffer is to provide an area that does not contain foraging resources for the Grey-headed Flying-fox, or human infrastructure, that together will minimise potential interactions between the flying-foxes and humans. The DCP includes provisions for the inner 50% of the buffer (closest to the camp) to be void of any structures that would encourage human use. The buffer may involve planting low-growing or spiky plants between the residential subdivision and the camp. The plantings could create a visual buffer between the camp and residences and make access to the camp difficult.

The DCP includes provisions for the outer 50 m of the buffer to include recreational structures such as play equipment.

To facilitate the establishment of the buffer, it is recommended that the current vegetation and dam are removed using a staged approach and when the camp is not occupied (i.e. winter and early spring).

A clearing program must be established and appended to this plan to ensure that any clearing is conducted to minimise direct and indirect harm to any resident Grey-headed Flying-fox.

7.7. Performance criteria

This Plan will be successful if the following measures are satisfied, as determined by annual reporting to DPIE as per licensing requirements:

- no harm to the flying-foxes other than through natural processes
- low levels of conflict with current or future users, as measured by complaints
- camp sustained in situ (as determined by monitoring – see Section 7.2)
- no roosting in unsuitable habitat
- improved amenity (less rubbish and weeds than currently present).

One complaint a month or less when the camp is occupied is considered to reflect low levels of conflict. If complaints escalate, the plan may require review.

7.8. Monitoring and reporting

Monthly camp counts are currently being conducted by ELA. It is recommended that monthly camp counts continue during the construction phase and for one year following the completion of construction activities. Monitoring could be completed quarterly following the one year anniversary of completion of works. All information will be provided to NSW DCCEEW to assist in their management of GHFF issues in the region.

7.9. Plan review triggers

If monitoring indicates that these performance criteria are not being satisfied, this will trigger a review of the Plan. Other factors that would trigger a review include changes to relevant policy/legislation

- new management techniques becoming available
- outcomes of research that may influence the Plan
- incidents associated with the camp.

Results of each review will be included in reports for submission to Council. If the Plan is to remain current, a full review will be completed after five years following the completion of construction. The revision is necessary to determine ongoing long-term management requirements that will be effective for the camp as conditions and information change.

If the number of individuals occupying the camp increases by 200 % from the core numbers (estimated at 350 individuals) this plan must be reviewed immediately and updated to determine the best response. The purpose of reviewing the plan when an influx occurs is to ensure that the response is appropriate to the size, extent and use of the camp.

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7.10. Completion of new MP for operational phase

A new GHFF MP will be prepared for the operational phase of the development. This revised MP will include all of the above listed measures and be adapted to include any additional lessons learnt through the construction phase or changes that may have occurred with GHFF populations more broadly over time.

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APPENDIX A – THREATENED SPECIES LICENSE DOC24/644921-3 FOR STAGE 1 BULK EARTHWORKS DA (DA-2023/166)

Department of Climate Change, Energy, the Environment and Water

Adrian Kilburn
Project Director
LEGACY PROPERTY
LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
45/25 Martin Place
Sydney NSW 2000

Date: 9 August 2024
Our ref: DOC24/644921-3
Licence number: DOC24/644921-3
Contact: Lorraine Oliver 02 6229 7120

Dear Mr Kilburn,

Subject: **Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development – Stage 1 Bulk Earthworks DA2023/166.**

I refer to your application to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) dated 16 July 2024 (emailed 17 July 2024) for a Threatened Species Licence (TS Licence), a class of Biodiversity Conservation Licence under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act), for potential impacts to the on-site grey-headed flying-fox camp relating to the proposed Corrimal Cokeworks residential and commercial development (GDA94 Latitude: -34.378589, Longitude: 150.90239). Specifically, the TS Licence application was for a licence to manage impacts from the following stages of development:

- Stage 1 Bulk Earthworks – DA-2023/166.

DCCEEW understands the aim of the actions referred to in the TS Licence application is to prepare the Corrimal Cokeworks site for the establishment of a future residential and commercial development. DCCEEW understands this TS Licence application is only for site preparation actions and not for construction of the proposed residential and commercial development.

This TS Licence is separate to any development approvals, and any conditions associated with such approvals, relating to the Corrimal Cokeworks residential and commercial development.

This TS Licence and conditions are for the Stage 1 Bulk Earthworks – DA-2023/166. As discussed, where applicable the TS Licence conditions will remain consistent across the breadth of TS Licences issued for this development and will only change when an aspect of the staged development impacts differently on the on-site grey-headed flying-fox camp.

The TS Licence conditions account for the following possible scenarios regarding the grey-headed flying-fox:

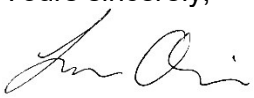
1. Camp occupation
2. Signs of breeding in an occupied camp
3. Proximity of works to the camp
    a. Any on-site works
    b. Any works 75-200 metres from the edge of the occupied camp
    c. Any works within 75 metres of the edge of the occupied camp, and including the occupied camp footprint and the previously-mapped core camp extent (as per Figure 1 in the TS Licence application)

Based on the information provided to DCCEEW by Legacy Property, I have assessed your TS Licence application for the proposed Stage 1 Bulk Earthworks – DA-2023/166in accordance with the provisions of the BC Act and the *Biodiversity Conservation Regulation 2017* and determined that the proposed action is not likely to significantly affect threatened species or their habitats if conducted in accordance with the conditions attached to this TS Licence.

A copy of your new biodiversity conservation TS Licence is enclosed. Please note that your TS Licence is subject to conditions. These conditions are outlined in the TS Licence. It is an offence under s2.14(4) of the BC Act to breach a condition of a TS Licence.

A public register of all biodiversity conservation licences and all decisions made to vary, suspend or cancel those licences can be viewed at https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/threatened-species-licences

If you have any further questions regarding this matter, please contact me on 02 6229 7120 or at Lorraine.oliver@environment.nsw.gov.au.
Yours sincerely,



LORRAINE OLIVER
Senior Team Leader, Ecosystems and Threatened Species
South East Branch, DCCEEW Biodiversity and Conservation

Threatened Species Licence

Biodiversity Conservation Act 2016

Threatened species licence, a class of biodiversity conservation licence under Part 2 of the *Biodiversity Conservation Act 2016*, to:

- harm or pick a threatened species, threatened ecological community or protected plant or animal
- and/or damage habitat of a threatened species or threatened ecological community

Licence number: **DOC24/644921-3**
Date granted: **9th August 2024**
Date of expiry: **9th August 2029**

Granted To:

LEGPRO 70 Pty. Ltd. ATF LEGPR 70 Unit Trust
ABN: 62 744 723 737
45/25 Martin Place
Sydney NSW 2000

DESCRIPTION OF PROPOSED ACTION
The proposed action:
Legacy Property are proposing a residential and commercial development within the subject land (GDA94 Latitude: -34.378589 Longitude: 150.90239 Wollongong LGA). Stage 1 of the proposed development is 3.63 ha in size and is positioned in the northeast of the subject land. The proposed development includes:

- Bulk earthworks using heavy machinery
- Tree and vegetation removal
- Ancillary works including compounds, access, parking, fencing and sediment management.

DCCEEW understands these works have been approved as per the Land and Environment Court Notice of Orders Made, granting consent subject to the conditions specified in Annexure A as determined 30 July 2024 (Case number 2023/00447943, dated 30 July 2024). Legacy Property have advised Stage 1 Bulk Earthworks – DA-2023/166 “will involve the following activities:

- Site establishment including but not limited to site compounds and on-site parking areas;
- Establishment of sediment and erosion control measures in accordance with the requirements of managing Urban Stormwater handbook (commonly referred to as the ‘Blue Book’ prepared by Landcom (2004);
- Protection and removal of existing trees within the site;
- Bulk earthworks operations to achieve design levels including preliminary box out roads and construction of protective pavement for construction access; and

- Material stockpile within the future Stage 2 area of the site."

DCCEEW notes conditions within the Land and Environment Court's Grant of Consent relevant to the grey-headed flying-foxes and their habitat include, but are not necessarily limited to, Conditions 3, 4, 21, 50 and 68.

This TS Licence applies only to the Stage 1 Bulk Earthworks – DA-2023/166 and not to the construction of the proposed residential and commercial development. This licence only applies to grey-headed flying-foxes and grey-headed flying-fox habitat.

RELEVANT CONDITIONS

The holder of the certificate must ensure that

1. Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated
2. Any incident/s of harmed/dead grey-headed flying-foxes
    a. Must be reported immediately to a local wildlife carer group for welfare response and collection
    b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
    c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes
3. At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).
4. If the camp is **deemed empty** of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert
5. When the grey-headed flying-fox camp is occupied and on-site actions are planned:
    a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for
        - Grey-headed flying-fox numbers
        - The camp footprint
        - The distance from on-site actions to the camp
        - General health of flying-foxes (including signs of malnourishment)
        - Signs of breeding including
            - The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant.
            - Birthing or lactating females
            - Females carrying young
            - Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
            - Courtship and/or mating behaviours

- Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps

b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site actions have commenced

   i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request

6. Signs of stress in the grey-headed flying-foxes are defined as any of the following

   - More than 30% of the camp takes flight and remains in flight for more than 20 minutes
   - Saliva spreading (i.e. licking themselves other than for grooming)
   - Grey-headed flying-foxes located on or within 2 metres of the ground
   - Aborting young
   - Dependant young abandoned for greater than 20 minutes during the day
   - An increase in the number of flying-foxes being taken into local care
   - Harmed/dead flying-fox/es found under or adjacent to the camp
   - New grey-headed flying-fox camps forming within 5 kilometres of the on-site actions

7. If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken**. Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery. This also includes the stockpiling of materials within the future Stage 2 area of the site (refer to Condition 8 for works 75-200 metres from the edge of the camp).

8. If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp**,
   a. In addition to on-site personnel continuous monitoring requirements (Condition 7) a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

   b. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

      i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)

      ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to monitor for signs of stress and advise site-managers on response

c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

    i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

    ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

    iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

    iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

    v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW

9. If the grey-headed flying-fox camp is occupied, for any works **within 75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

    a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

    b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted

    c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

        i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress

        ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

        iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day

        iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works

causing the signs of stress are appropriate to continue or should be deferred to a later date.

v. All signs of stress incidents and responses for works within 75 metres of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au

d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 metres of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.

e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately

10. When temperatures are predicted to be above 35°C

    a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including
        - Panting
        - Saliva spreading (i.e. licking themselves other than for grooming)
        - Grey-headed flying-foxes located on or within 2 metres of the ground
        - Grey-headed flying-foxes clumping around tree trunks
        - Grey-headed flying-foxes on the ground
        - Grey-headed flying-foxes dying

    b. Should any signs of heat-stress be noted,

        i. On-site actions that cause any disturbance to the camp must cease immediately

        ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

11. When temperatures are predicted to be above 38°C

    a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease

    b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress

    c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

12. A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage

    a. Minimise disturbance within 200 metres of the grey-headed flying-fox camp

    b. Monitor for signs of stress

c. Cease actions should the grey-headed flying-foxes show signs of stress

13. New grey-headed flying-fox camps that establish within 5 kilometres of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.
14. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including
    - Information about camp occupation dates
    - Grey-headed flying-fox numbers
    - The camp footprint (providing maps to show any temporal and spatial changes)
    - The distance from on-site actions to the camp
    - Signs of breeding (providing details on what signs were observed)
    - General health of flying-foxes (including signs of malnourishment)
    - Any stress incidents and responses
    - Feedback on flying-fox responses to any works undertaken within 75 metres of the edge of the camp (including details on what the works were, and what the immediate and short-term responses were)
    - Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management

Note it is an offence under s2.14(4) of the *Biodiversity Conservation Act 2016* to breach a condition of a licence.

LORRAINE OLIVER

Senior Team Leader, Ecosystems and Threatened Species

South East Branch, DCCEEW Biodiversity and Conservation Illawarra

(by Delegation)
9 August 2024

APPENDIX B – THREATENED SPECIES LICENSE DOC24/536883-5 FOR DEMOLITION DA (DA22/1249)

Department of Climate Change, Energy, the Environment and Water

Adrian Kilburn
Project Director
LEGACY PROPERTY
LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
45/25 Martin Place

Sydney NSW 2000

Date: 9 July 2024
Our ref: DOC24/536883-5
Licence number: DOC24/536883-5
Contact: Lorraine Oliver 02 6229 7120

Dear Mr Kilburn,

Subject: **Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development – Demolition Development Application (DA) – DA-2022/1249.**

I refer to your application to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) dated 22 May 2024 (with emailed amendment documentation 22 May 2024) for a Threatened Species Licence (TS Licence), a class of Biodiversity Conservation Licence under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act), for potential impacts to the on-site grey-headed flying-fox camp relating to the proposed Corrimal Cokeworks residential and commercial development (GDA94 Latitude: -34.378589, Longitude: 150.90239). Specifically, the TS Licence application was for a TS Licence to manage impacts from the following stages of development:

- Demolition Development Application (DA) – DA-2022/1249
- Sewer lead-in works

DCCEEW understands the aim of the actions referred to in the TS Licence application is to prepare the Corrimal Cokeworks site for the establishment of a future residential and commercial development. DCCEEW understands this TS Licence application is only for site preparation actions and not for construction of the proposed residential and commercial development.

This TS Licence is separate to any development approvals, and any conditions associated with such approvals, relating to the Corrimal Cokeworks residential and commercial development.

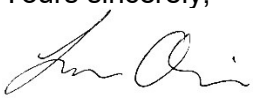
To provide clear guidance and conditions for each stage of the development we have treated the TS Licence applications for Demolition Development Application (DA) – DA-2022/1249 and the Sewer lead-in works separately. This TS Licence and conditions are for Demolition Development Application (DA) – DA-2022/1249. As discussed, where applicable the TS Licence conditions will remain consistent across the breadth of TS Licences issued for this development and will only change when an aspect of the staged development impacts differently on the on-site grey-headed flying-fox camp.

I have assessed your TS Licence application for the proposed Demolition Development Application (DA) – DA-2022/1249 in accordance with the provisions of the BC Act and the *Biodiversity Conservation Regulation 2017* and, based on the information provided to DCCEEW by Legacy property in the application, have determined that the proposed action is not likely to significantly affect threatened species or their habitats if conducted in accordance with the conditions attached to this TS Licence.

A copy of your new biodiversity conservation TS Licence is enclosed. Please note that your TS Licence is subject to conditions. These conditions are outlined in the TS Licence. It is an offence under s2.14(4) of the BC Act to breach a condition of a TS Licence.

A public register of all biodiversity conservation TS Licences and all decisions made to vary, suspend or cancel those TS Licences can be viewed at www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/threatened-species-licences

If you have any further questions regarding this matter, please contact me on 02 6229 7120 or at Lorraine.oliver@environment.nsw.gov.au.
Yours sincerely,



LORRAINE OLIVER
Senior Team Leader, Ecosystems and Threatened Species
South East Branch, DCCEEW Biodiversity and Conservation

Threatened Species Licence

Biodiversity Conservation Act 2016

Threatened species licence, a class of biodiversity conservation licence under Part 2 of the *Biodiversity Conservation Act 2016*, to:

- harm or pick a threatened species, threatened ecological community or protected plant or animal
- and/or damage habitat of a threatened species or threatened ecological community

Licence number: **DOC24/536883-5**
Date granted: **9th July 2024**
Date of expiry: **9th July 2029**

Granted To:

LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
ABN: 62 744 723 737
45/25 Martin Place
Sydney NSW 2000

DESCRIPTION OF PROPOSED ACTION

The proposed action:

Legacy Property are proposing a residential and commercial development within the subject land (GDA94 Latitude: -34.378589 Longitude: 150.90239 Wollongong LGA). Prior to development the site requires demolition works. Large existing remnant structures of the former Corrimal Cokeworks present on the site require demolition, with some structures proposed to be retained. The site consists of batteries, conveyors, storage tanks, stacks, offices, quench towers and warehouses. Generally, these structures will be demolished using 25t - 48t excavators, systematically shearing the infrastructure to the ground in a safe and controlled manner. The structures will be processed into smaller, more manageable sizes before transport to a laydown and processing area on site, all of which will occur > 200 m from the resident grey-headed flying-fox colony.

This licence applies only to the preparatory demolition works as described in Demolition Development Application (DA) – DA-2022/1249 and not to the construction of the proposed residential and commercial development. This licence only applies to grey-headed flying-foxes and grey-headed flying-fox habitat.

RELEVANT CONDITIONS

The holder of the certificate must ensure that

1. Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated
2. Any incident/s of harmed/dead grey-headed flying-foxes
    a. Must be reported immediately to a local wildlife carer group for welfare response and collection
    b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
    c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes
3. At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).
4. If the camp is **deemed empty** of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert
5. When the grey-headed flying-fox camp is occupied and on-site actions are planned:
    a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for
        - Grey-headed flying-fox numbers
        - The camp footprint
        - The distance from on-site actions to the camp
        - General health of flying-foxes (including signs of malnourishment)
        - Signs of breeding including
            - The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant.
            - Birthing or lactating females
            - Females carrying young
            - Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
            - Courtship and/or mating behaviours
            - Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps
    b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site actions have commenced

i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request

6. Signs of stress in the grey-headed flying-foxes are defined as any of the following

   - More than 30% of the camp takes flight and remains in flight for more than 20 minutes
   - Saliva spreading (i.e. licking themselves other than for grooming)
   - Grey-headed flying-foxes located on or within 2 metres of the ground
   - Aborting young
   - Dependant young abandoned for greater than 20 minutes during the day
   - An increase in the number of flying-foxes being taken into local care
   - Harmed/dead flying-fox/es found under or adjacent to the camp
   - New grey-headed flying-fox camps forming within 5 kilometres of the on-site actions

7. If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken**. Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery.

8. If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp**,
   a. In addition to on-site personnel continuous monitoring requirements (Condition 7) a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

   b. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

      i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)

      ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to monitor for signs of stress and advise site-managers on response

   c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

      i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

      ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

      iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW

9. If the grey-headed flying-fox camp is occupied, for any works **within 75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

    a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

    b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted

    c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

        i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress

        ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

        iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day

        iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works causing the signs of stress are appropriate to continue or should be deferred to a later date.

        v. All signs of stress incidents and responses for works within 75 metres of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au

    d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 metres of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.

e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately

10. When temperatures are predicted to be above 35°C
    a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including
        - Panting
        - Saliva spreading (i.e. licking themselves other than for grooming)
        - Grey-headed flying-foxes located on or within 2 metres of the ground
        - Grey-headed flying-foxes clumping around tree trunks
        - Grey-headed flying-foxes on the ground
        - Grey-headed flying-foxes dying
    b. Should any signs of heat-stress be noted,
        i. On-site actions that cause any disturbance to the camp must cease immediately
        ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately
11. When temperatures are predicted to be above 38°C
    a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease
    b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress
    c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately
12. A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage
    a. Minimise disturbance within 200 metres of the grey-headed flying-fox camp
    b. Monitor for signs of stress
    c. Cease actions should the grey-headed flying-foxes show signs of stress
13. New grey-headed flying-fox camps that establish within 5 kilometres of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.
14. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including
    - Information about camp occupation dates
    - Grey-headed flying-fox numbers

- The camp footprint (providing maps to show any temporal and spatial changes)
- The distance from on-site actions to the camp
- Signs of breeding (providing details on what signs were observed)
- General health of flying-foxes (including signs of malnourishment)
- Any stress incidents and responses
- Feedback on flying-fox responses to any works undertaken within 75 metres of the edge of the camp (including details on what the works were, and what the immediate and short-term responses were)
- Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management

Note it is an offence under s2.14(4) of the *Biodiversity Conservation Act 2016* to breach a condition of a licence.



LORRAINE OLIVER

Senior Team Leader, Ecosystems and Threatened Species

South East Branch, DCCEEW Biodiversity and Conservation Illawarra

(by Delegation)
9 July 2024

APPENDIX C – THREATENED SPECIES LICENSE DOC24/537230-3 FOR SEWER LEAD-IN WORKS

Department of Climate Change, Energy, the Environment and Water

Adrian Kilburn
Project Director
LEGACY PROPERTY
LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
45/25 Martin Place

Sydney NSW 2000

Date: 9 July 2024
Our ref: DOC24/537230-3
Licence number: DOC24/537230-3
Contact: Lorraine Oliver 02 6229 7120

Dear Mr Kilburn,

Subject: **Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development – Sewer lead-in Works.**

I refer to your application to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) dated 22 May 2024 (with emailed amendment documentation 22 May 2024) for a Threatened Species Licence (TS Licence), a class of Biodiversity Conservation Licence under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act), for potential impacts to the on-site grey-headed flying-fox camp relating to the proposed Corrimal Cokeworks residential and commercial development (GDA94 Latitude: -34.378589, Longitude: 150.90239). Specifically, the TS Licence application was for a licence to manage impacts from the following stages of development:

- Demolition Development Application (DA) – DA-2022/1249
- Sewer lead-in works

DCCEEW understands the aim of the actions referred to in the TS Licence application is to prepare the Corrimal Cokeworks site for the establishment of a future residential and commercial development. DCCEEW understands this TS Licence application is only for site preparation actions and not for construction of the proposed residential and commercial development.

This TS Licence is separate to any development approvals, and any conditions associated with such approvals, relating to the Corrimal Cokeworks residential and commercial development.

To provide clear guidance and conditions for each stage of the development we have treated the TS Licence applications for Demolition Development Application (DA) – DA-2022/1249 and the Sewer lead-in works separately. This TS Licence and conditions are for the Sewer lead-in works. As discussed, where applicable the TS Licence conditions will remain consistent across the breadth of TS Licences issued for this development and will only change when an aspect of the staged development impacts differently on the on-site grey-headed flying-fox camp.

The TS Licence conditions account for the following possible scenarios regarding the grey-headed flying-fox:

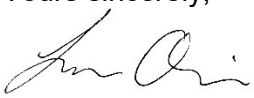
1. Camp occupation
2. Signs of breeding in an occupied camp
3. Proximity of works to the camp
    a. Any on-site works
    b. Any works 75-200 metres from the edge of the occupied camp
    c. Any works within 75 metres of the edge of the occupied camp, and including the occupied camp footprint and the previously-mapped core camp extent (as per Figures 1 and 2 in the TS Licence application)

Based on the information provided to DCCEEW by Legacy Property, I have assessed your TS Licence application for the proposed Sewer lead-in Works in accordance with the provisions of the BC Act and the *Biodiversity Conservation Regulation 2017* and determined that the proposed action is not likely to significantly affect threatened species or their habitats if conducted in accordance with the conditions attached to this TS Licence.

A copy of your new biodiversity conservation TS Licence is enclosed. Please note that your TS Licence is subject to conditions. These conditions are outlined in the TS Licence. It is an offence under s2.14(4) of the BC Act to breach a condition of a TS Licence.

A public register of all biodiversity conservation licences and all decisions made to vary, suspend or cancel those licences can be viewed at www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/threatened-species-licences

If you have any further questions regarding this matter, please contact me on 02 6229 7120 or at Lorraine.oliver@environment.nsw.gov.au.
Yours sincerely,



LORRAINE OLIVER
Senior Team Leader, Ecosystems and Threatened Species
South East Branch, DCCEEW Biodiversity and Conservation

Threatened Species Licence

Biodiversity Conservation Act 2016

Threatened species licence, a class of biodiversity conservation licence under Part 2 of the *Biodiversity Conservation Act 2016*, to:

- harm or pick a threatened species, threatened ecological community or protected plant or animal
- and/or damage habitat of a threatened species or threatened ecological community

Licence number: **DOC24/537230-3**
Date granted: **9th July 2024**
Date of expiry: **9th July 2029**

Granted To:

LEGPRO 70 Pty. Ltd. ATF LEGPR 70 Unit Trust
ABN: 62 744 723 737
45/25 Martin Place
Sydney NSW 2000

DESCRIPTION OF PROPOSED ACTION
The proposed action:
Legacy Property are proposing a residential and commercial development within the subject land (GDA94 Latitude: -34.378589 Longitude: 150.90239 Wollongong LGA). Prior to development the site requires sewer lead-in works, including the removal of the existing disused pipeline and installation of the new sewer pipeline to be trenched. DCCEEW understands these works have been approved by Sydney Water as the proponent and determining authority (Sydney Water Approval Case No. 178698 dated 28/3/23). Legacy Property have advised “these works are relatively small scale, however they include construction and earthworks in close proximity to the flying fox camp”.

The detailed scope of works includes:
- Installation of a new sewer pipeline to be trenched. A 10m construction corridor has been assumed for the portions of the pipeline requiring trenching
- Installation of maintenance holes 5 x 5m
- Open trenching (50m development corridor) to facilitate the removal of the disused pipeline (4.3ha of impact)
- Storage of topsoil, spoil and quarry materials immediately adjacent to the excavated area.
- 50m x 50m launch and retrieval pad, including overflow and evacuation footprint.

The proposed heavy machinery to be used to support underboring and trenching will include:
- Excavators
- Bobcat
- Bogie
- Flatbed truck

Additional machinery may be used that will ensure that only similar low impacts occur to the soil. Other ancillary tools and machinery may be required to undertake the works including pumps, generators, utility vehicles, jack hammers/rock hammering equipment, hand tools etc.

This TS Licence applies only to the sewer lead-in works and not to the construction of the proposed residential and commercial development. This licence only applies to grey-headed flying-foxes and grey-headed flying-fox habitat.

RELEVANT CONDITIONS

The holder of the certificate must ensure that

1. Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated
2. Any incident/s of harmed/dead grey-headed flying-foxes
    a. Must be reported immediately to a local wildlife carer group for welfare response and collection
    b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
    c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes
3. At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).
4. If the camp is **deemed empty** of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert
5. When the grey-headed flying-fox camp is occupied and on-site actions are planned:
    a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for
        - Grey-headed flying-fox numbers
        - The camp footprint
        - The distance from on-site actions to the camp
        - General health of flying-foxes (including signs of malnourishment)
        - Signs of breeding including
            - The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant.
            - Birthing or lactating females
            - Females carrying young
            - Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
            - Courtship and/or mating behaviours

- Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps

b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site works have commenced

   i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request

6. Signs of stress in the grey-headed flying-foxes are defined as any of the following

   - More than 30% of the camp takes flight and remains in flight for more than 20 minutes
   - Saliva spreading (i.e. licking themselves other than for grooming)
   - Grey-headed flying-foxes located on or within 2 metres of the ground
   - Aborting young
   - Dependant young abandoned for greater than 20 minutes during the day
   - An increase in the number of flying-foxes being taken into local care
   - Harmed/dead flying-fox/es found under or adjacent to the camp
   - New grey-headed flying-fox camps forming within 5 kilometres of the on-site actions

7. If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken**. Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery.

8. If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp**,
   a. In addition to on-site personnel continuous monitoring requirements (Condition 7) a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

   b. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

      i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)

      ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to monitor for signs of stress and advise site-managers on response

c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

    i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

    ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

    iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

    iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

    v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW

9. If the grey-headed flying-fox camp is occupied, for any works **within 75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

    a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

    b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted

    c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

        i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress

        ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

        iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day

        iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works

causing the signs of stress are appropriate to continue or should be deferred to a later date.

v. All signs of stress incidents and responses for works within 75 metres of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au

d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 metres of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.

e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately

10. In the area denoted as the potential extent of the flying-fox camp as shown in Figure 1 (as provided in the TS Licence application)

    a. Vegetation/trees providing habitat for the flying-fox camp must not be felled, lopped or have large branches removed if it has not been identified in the **Sewer lead-in Works** for alteration (as per Figure 2 provided in the TS Licence application).

    b. Vegetation/trees that are within the area identified in the **Sewer lead-in Works** (within the Trenching and Disused Pipeline Construction Buffer area identified in Figure 2) must not be felled, lopped or have large branches removed when flying-foxes are in them or within 30 metres of the vegetation/tree being felled, lopped or modified, or when flying-foxes are within a distance where they are likely to be harmed by the vegetation/tree that is being felled, lopped or modified (which may include a distance >30 metres).

11. When temperatures are predicted to be above 35°C

    a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including
        - Panting
        - Saliva spreading (i.e. licking themselves other than for grooming)
        - Grey-headed flying-foxes located on or within 2 metres of the ground
        - Grey-headed flying-foxes clumping around tree trunks
        - Grey-headed flying-foxes on the ground
        - Grey-headed flying-foxes dying

    b. Should any signs of heat-stress be noted,

        i. On-site actions that cause any disturbance to the camp must cease immediately

        ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

12. When temperatures are predicted to be above 38°C
    a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease
    b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress
    c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately
13. A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage
    a. Minimise disturbance within 200 metres of the grey-headed flying-fox camp
    b. Monitor for signs of stress
    c. Cease actions should the grey-headed flying-foxes show signs of stress
14. New grey-headed flying-fox camps that establish within 5 kilometres of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.
15. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including
    - Information about camp occupation dates
    - Grey-headed flying-fox numbers
    - The camp footprint (providing maps to show any temporal and spatial changes)
    - The distance from on-site actions to the camp
    - Signs of breeding (providing details on what signs were observed)
    - General health of flying-foxes (including signs of malnourishment)
    - Any stress incidents and responses
    - Feedback on flying-fox responses to any works undertaken within 75 metres of the edge of the camp (including details on what the works were, and what the immediate and short-term responses were)
    - Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management

Note it is an offence under s2.14(4) of the *Biodiversity Conservation Act 2016* to breach a condition of a licence.



LORRAINE OLIVER

Senior Team Leader, Ecosystems and Threatened Species

South East Branch, DCCEEW Biodiversity and Conservation Illawarra

(by Delegation)
9 July 2024

APPENDIX D – GREY-HEADED FLYING-FOX MONITORING DATA

Date	Survey effort	Observations
18 July 2019	Not documented	No individuals or signs of Grey-headed Flying-fox
26 July 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
8 August 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
23 August 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
6 September 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
20 September 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
4 October 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
25 October 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
15 November 2019	1 person hour, count	No individuals or signs of Grey-headed Flying-fox
22 November 2019	3 person hours, count	100 – 200 individuals observed
5 December 2019	1 person hour, count	200 – 350 individuals observed
12 December 2019	1 person hour, count	250 – 450 individuals observed
10 January 2020	2 person hours, count	Influx recorded, numbers estimated to have significantly increased
22 January 2020	6 person hours, static count and fly out watch	4,000 – 5,000 flying-foxes recorded (flyout) and estimated 5,208 flying-foxes during static count
29 January 2020	4 person hours, fly out watch, camp extent mapping	3,321 -5,831 flying-foxes recorded, camp extent mapped
19 February 2020	4 person hours, fly out watch	940 – 5,241 flying-foxes recorded (flyout).
24 March 2020	Fly out	Approx. 500
23 April 2020	Fly out	Approx 600
13 May 2020	Fly out	2
23 July 2020	Fly out	None observed
2 September 2020	Fly out	None observed
October 2020	Passive observation	Flying-foxes present in low numbers (>5)
3 November 2020	Passive observation	Approx. 50, camp size reduced
11 November 2020	Passive observation	Approx. 50, camp size reduced
6 December 2020	Fly out	Approx. 300
21 January 2021	Fly out	Approx. 200
2 February 2021	Fly out	Approx. 450 – 650
30 March 2021	Fly out	Approx. 450 – 500
13 April 2021	Fly out	Approx. 130
10 May 2021	Fly out	Approx 200

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Date	Survey effort	Observations
2 June 2021	Fly out	Approx 30 – 50
29 June 2021	Fly-out	One (1)
10 August 2021	Fly-out	Approx 11
28 September 2021	Fly-out	Three (3) noting that the team observed these could have been from another adjacent camp
26 October 2021	Fly-out	Approx 9
3 November 2021	Fly-out	Approx 150
12 December 2021	Fly-out	Approx 150 (noting weather could have compromised count)
January 2022	No count due to poor weather	No count
25 February 2022	Fly-out	Approx 50
30 March 2022	Fly-out	Approx 12
26 April 2022	Fly out	Approx 3
31 May 2022	Fly -out	No individuals identified, noting the weather was suboptimal for surveys
14 June 2022	Fly-out	Approx 48
14 July 2022	Fly out	None observed
15 August 2022	Fly out	None observed
27 September 2022	Fly out	Approx. 30
27 October 2022	Fly out	Approx. 155-165
29 November 2022	Fly out	Approx. 190
20 December 2022	Fly out	Approx. 35
23 January 2023	Fly out	Approx. 80
15 February 2023	Fly out	Approx.280
22 February 2023	Fly out	Approx. 260
1 March 2023	Fly out	Approx. 560
8 March 2023	Fly out	Approx. 290
15 March 2023	Fly out	Approx. 525
11 April 2023	Fly-out	Approx. 1200
21 April 2023	Day time count in tree canopies	Approx. 550
27 April 2023	Fly out	Approx. 2000
02 May 2023	Fly-out	Approx. 3500
09 May 2023	Fly-out	Approx. 4500
16 May 2023	Fly-out	Approx. 2600
26 May 2023	Fly-out	None observed

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Date	Survey effort	Observations
31 May 2023	Fly-out	None observed
06 June 2023	Fly-out	None observed
14 June 2023	Fly-out	None observed
20 June 2023	Fly-out	None observed
27 June 2023	Fly-out	None observed
6 July 2023	Fly-out	None observed
20 July 2023	Fly-out	None observed
26 July 2023	Fly-out	None observed
03 August 2023	Fly-out	None-observed
09 August 2023	Fly-out	None observed
17 August 2023	Fly-out	None observed
24 August 2023	Fly-out	None-observed
31 August 2023	Fly-out	None-observed
06 September 2023	Fly-out	None-observed
14 September 2023	Fly-out	Approx. 14
21 September 2023	Fly-out	Approx. 25
28 September 2023	Fly-out	Approx. 21
6 October 2023	Fly out	Approx. 20
13 October 2023	Fly out	None observed, noting survey was ceased early due to strong wind and heavy rain
19 October 2023	Fly out	Approx. 228. Camp present behind the dam
25 October 2023	Fly-out	Approximately 620
7 November	Fly-out	439
18 April 2024	Daytime roost survey	250-300.
25 April 2024	Daytime roost survey	250-300.
3 May 2024	Daytime roost survey	Approx. 500
10 May 2024	Daytime roost survey	450-500
17 May 2024	Daytime roost survey	450-500
22 May 2024	Daytime roost survey	450-500
30 May 2024	Daytime roost survey	450-550
05 June 2024	Daytime roost survey	150
14 June 2024	Daytime roost survey	100-120
21 June 2024	Daytime roost survey	0
28 June 2024	Daytime roost survey	0
5 July 2024	Daytime roost survey	0

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Date	Survey effort	Observations
12 July 2024	Daytime roost survey	0
16 July 2024	Daytime roost survey	None-observed
24 July 2024	Daytime roost survey	None-observed
1 August 2024	Daytime roost survey	None-observed
9 August 2024	Daytime roost survey	None-observed
5 September 2024	Daytime roost survey	None-observed
12 September 2024	Daytime roost survey	None-observed
16 September 2024	Daytime roost survey	None-observed
24 September 2024	Daytime roost survey	None-observed

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APPENDIX E – GREY-HEADED FLYING-FOX COMBINED MONTHLY MONITORING REPORT

Corrimal Cokeworks Grey-headed Flying Fox Monitoring Report			
TO	NSW Department of Climate Change, Energy, the Environment and Water		
FROM	Eco Logical Australia Pty Ltd.		
DATE	11 July 2024	PURPOSE	Monthly monitoring report
SUBJECT	Corrimal Cokeworks Grey-headed Flying Fox Monthly Monitoring Report		

This monitoring report is prepared to satisfy the *NSW Biodiversity Conservation Act 2016* (BC Act) Threatened Species Licence DOC24/536883-5 (issued on 9 July 2024) that Legacy Property Development Pty Ltd hold for the implementation of the demolition works at the Corrimal Cokeworks development Site. Previously, demolition works were undertaken under licence DOC23/597669-1, however this licence was cancelled on 20 May 2024. The demolition works have been approved under DA-2022/1249 and the conditions of the DA require that the works are to be undertaken in accordance with the Threatened Species Licence.

One of the requirements of the licence is that weekly monitoring of the camp is to occur when the GHFF camp is present and works are being undertaken on the site. Clause 5 of the licence states licence:

When the Grey-headed Flying-fox camp is occupied. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for:

- Grey-headed flying-fox numbers
- The camp footprint
- The distance from on-site actions to the camp
- General health of flying-foxes (signs of malnourishment)
- Signs of breeding including:
    - The presence of female flying-foxes in late-stage pregnancy
    - Birthing or lactating females
    - Females carrying young
    - Dependant young
    - Courtship or mating behaviour
    - Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps.

A monthly report to DPE is also required under the licence as per condition 13 (DOC23/597669-1) and condition 14 (DOC24/536883-5):

A suitably qualified ecologist/flying-fox expert will provide monthly reports to DPE on commencement of the action including Information about camp occupation dates;

- Grey-headed flying-fox numbers
- The camp footprint

- The distance from on-site actions to the camp
- Signs of breeding
- General health of flying-foxes (signs of malnourishment)
- Any stress incidents and responses
- Report successes and failures in managing signs-of-stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management.

Demolition works commenced in November 2023. Legacy have advised that demolition works are currently complete as of 11 July 2024. Demolition supervision to monitor the flying foxes for signs of stress by ELA ecologists was undertaken on 20 and 26 February 2024 during demolition of structures within 76-200m of the flying fox camp and the Chimney stack. This supervision report is provided in Attachment A. Weekly monitoring of the camp commenced 18 April 2024. The results of the weekly monitoring are provided in Table 1. The approximate recorded extent of the flying fox camp is show in Figure 1.

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Figure 1: Flying fox camp extent as at 5 June 2024

Table 1: Monitoring results

Date	Number of flying foxes (approximate)	Distance from on-site actions to the camp	Dependent young	Signs of breeding	Signs of malnourishment	Any stress incidents, responses.
18 April 2024	250	>200m.	Absent	No	No	Flying foxes became slightly disturbed by presence of ecologists. They were vocal and were observed briefly flying to different trees an a few occasions – approximately 10 flying foxes at a time. However, were able to settle quickly. No prolonged circling in flight occurred.
24 April 2024	350	>200m	Absent	Yes, one pair appeared to be mating during inspection	No	None
03 May 2024	500+	>200m	Absent	Yes, one pair appeared to be mating during inspection	No	Minor disturbance as ecologists walked underneath roosting trees.
10 May 2024	450-500	>200m	Absent	Yes, four pairs appeared to be mating during inspection	No	No
17 May 2024	450-500	>200m	Absent	Yes, at least ten pairs appeared to be mating during inspection	No	No
22 May 2024	450-500	>200m	Absent	Yes, three pairs appeared to be mating during inspection	No	No
30 May 2024	450-550	>200m	Absent	Yes, at least two pairs appeared to be mating during inspection	No	No
5 June 2024	150	>200m	Absent	None	No	No
14 June 2024	100-120	>200m	Absent	None	No	Flying foxes were largely condensed to three trees on the site. The few that were in neighbouring trees were active, crawling and swinging, however did not take flight. Movement likely attributed to morning, post foraging restlessness prior to sleep.

Date	Number of flying foxes (approximate)	Distance from on-site actions to the camp	Dependent young	Signs of breeding	Signs of malnourishment	Any stress incidents, responses.
21 June 2024	0	>200m	-	-	-	-
28 June 2024	0	>200m	-	-	-	-
5 July 2024	0	>200m	-	-	-	-

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ATTACHMENT A – ECO LOGICAL AUSTRALIA – CORRIMAL COKEWORKS CLEARANCE REPORT

8/14 Stennett Road
Ingleburn
NSW 2565
t: (02) 8579 5185

29 April 2024

Our ref: 23GWS 6652

Legacy Property
Level 45, 25 Martin Place
Sydney, NSW 2000

Attention: Thomas Kent

Dear Thomas,

Clearance supervision report – Threatened species supervision

Eco Logical Australia (ELA) was engaged by Legacy Property to conduct threatened species supervision during building demolition for the proposed development of the Corrimal Cokeworks site. This task was completed to satisfy the conditions of consent (DA-2022/1249) granted by Wollongong City Council as well as actions outlined in the Corrimal Cokeworks Microbat Management Plan (MMP) and Grey-headed Flying-fox Management Plan (GHFFMP), both prepared for Legacy Property by ELA in 2022.

Summary of results

Prior to clearance of buildings previously identified on site to contain Large Bent-winged Bat (*Miniopterus orianae oceanensis*) daily pre-clearance inspections for signs of microbat species were conducted to ensure no microbats were present prior to building demolition.

Buildings that were removed within the 76-200 metre buffer zone indicated in the GHFFMP (ELA 2022b) were completed under the supervision of ELA Ecologists to ensure minimal disturbance occurred to the Grey-headed Flying-fox colony. A brief pre-clearance survey was undertaken prior to building removal and then on-going monitoring of the Flying foxes for the remainder of the building demolition.

Results are provided in Appendix A and Appendix B provides maps and photos. If you have any questions about this report, please do not hesitate to contact me on jake.webb@ecoaus.com.au or 0482 860 875.

Regards,

Jake Webb
Project Manager

REFERENCES:

Eco Logical Australia 2022a. *Corrimal Cokeworks Microbat Management Plan.* Prepared for Legacy Property, dated 19 April 2023.

Eco Logical Australia 2022b. *Corrimal Residential Development Grey-headed Flying-fox Management Plan.* Prepared for Legacy Property, Dated 29 June 2023.

Department of Planning and Environment 2023*. Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development,* dated 29 June 2023.

Eco Logical Australia 2024. *Corrimal Cokeworks Pre-clearance Microbat Activity.* Addressed to Thomas Kent, dated 5 February 2024*.*

Appendix A: Requirements Addressed and Results

REQUIREMENTS ADDRESSED

Requirements to be addressed are derived from the conditions of consent within DA-2022/1249

Condition	Task
2. Project Ecologist	*A project ecologist shall be engaged for the duration of the works and oversee all demolition and associated works that may disturb or harm threatened species across the broader site, including Grey-headed Flying-foxes and Large Bent-winged Bats.*
3. Microbat Management Plan	*The Microbat Management Plan, prepared by Ecological Australia and dated 19 April 2023 is to be implemented in its entirety under the supervision of the appointed project ecologist.*

METHODOLOGY AND RESULTS

Microbat Supervision

Prior to the scheduling of works a pre-clearance microbat survey was completed by use of ultrasonic detectors, as outlined in the MMP (ELA 2022a). The summary letter of these works (ELA 2024) identified that there was no evidence of roosting colonies within the Cokeworks area at the time.

However, prior to the demolition of buildings that had been identified in the MMP (ELA 2022a) as containing Large Bent-wing bat, a brief pre-clearance inspection was completed on 14 February 2024 by ELA ecologist John Foster. This inspection was completed to identify any signs of roosting microbat species and to confirm that no roosting microbat species were present. During this survey, no signs indicating microbat presence were identified.

The demolition of the structure was completed in a staged approach under the guidance of the ecologist. The building was sectionally dismantled with periodic inspections of the building and surrounds to ensure no fauna was present. An excavator with a shear was used to remove portions of the roofing and beams before removing the remaining portion of the building. During these works, an underground tunnel was identified that continued to an adjacent building. A portion of the adjacent building was also removed, however the underground sections remained.

On 14 March 2024, ELA ecologist Jake Webb supervised the removal of the remaining underground structure of the adjacent building. A brief pre-clearance survey was completed, during to confirm that there were no microbats present. Removal of the remaining structure was completed by an excavator with grab attachments under the supervision of the ecologist and no microbats or signs of microbats were identified.

Grey-headed Flying-fox Supervision

No works were scheduled to occur within 75m from the GHFF camp and therefor the 76 – 200m buffer was applied as per the GHFFMP (ELA 2022b). This was done to ensure that demolition of the buildings result in minimal disturbance to the GHFF population. As per the GHFFMP (ELA 2022b), works conducted within 76 – 200m of the camp requires supervision by ecologists to ensure the welfare of the population. The demolition of two structures (one pump house and one concrete water tank), identified as D14 in

Figure 1, was completed within the 76 – 200m buffer zone on 20 February 2024 under the supervision of ELA ecologists Tim Finter and John Foster.

An initial survey of the GHFF camp was completed by ELA ecologist Tim Finter immediately prior to works. This was undertaken to determine the location of the population and assess their behaviour for signs of stress as derived from the Department of Planning and Environment Threatened species licence, dated 25 August 2023. This information collected prior to demolition starting was used as a base level to determine whether the flying foxes become stressed during the structure removal.

A brief pre-clearance survey of the two structures approved for removal as well as the surrounding areas was also completed by ELA ecologist John Foster immediately prior to works. No fauna as identified within the structures and demolition was cleared to commence.

Throughout the demolition process ELA ecologist remained in close proximity to the GHFF camp to monitor the behaviour of the flying-foxes. Another ELA ecologist, remained at the demolition site to supervise the removal of the structures. The ecologists remained in contact via 2-way UHF communication to inform of any changes to the camps behaviour.

The two structures were removed sectionally by an excavator with either a grab attachment or bucket. This allowed the slower and more controlled removal of the structures ensuring disturbance to the GHFF camp was minimised.

Throughout the removal of both structures the GHFF camp showed no signs of stress due to the removal of the two structures.

Once demolition was completed a final survey of the GHFF population, and immediate surrounds, was completed to ensure the welfare of the camp. No GHFF were identified to show any signs of stress during the demolition or after works were completed.

On 26 February 2024 ELA ecologist Kody Kemp, was on site to supervise the removal of a chimney stack, Identified in Figure 1 as D9. The removal of this stack was outside of the 200-metre buffer zone but was being felled towards the edge of the buffer zone boundary and had potential to cause a louder than normal noise for the area briefly. Due to these factors an ecologist was requested to be on site to monitor the GHFF population during this time. The GHFF camp was surveyed to assess for any signs of stress and create a base level for monitoring during the removal. The ecologist was in frequent communication via 2-way Radio with the contractors responsible for demolishing the structure. The stack was felled and the GHFF camp showed no signs of stress during works, leading up to and after the felling. Once the stack was felled another survey of the area was completed by the ecologist to ensure no GHFF were observed to show signs of stress or had become separated from the camp. No signs of stress or separation were identified.

PERMITS AND LICENSES

ELA is accredited as an 'Animal Research Establishment' under the NSW *Animal Research Act 1985*. In addition, ELA holds a Biodiversity Conservation Licence under Part 2, Division 3 of the *Biodiversity Conservation Act 2016*. Copies of the relevant permits and licenses can be provided if required.

Appendix B: Site map and Photos



Figure 1: Site map



Figure 2: Removal of structure previously identified as containing microbats



Figure 3: Removal of structure previously identified as containing microbats



Figure 4: Inspection of building previously identified as containing microbats



Figure 5: Demolition of building adjacent to microbat habitat building



Figure 6: Removal of structure within GHFF buffer zone



Figure 7: Removal of structure within GHFF buffer zone



Figure 8: Stack building preparing to be felled



Figure 9: Stack after being felled



Figure 10: Grey-headed Flying-fox camp in-situ



Figure 11: Grey-headed Flying-fox camp in-situ

APPENDIX F – GREY-HEADED FLYING-FOX INDUCTION MATERIAL

Grey-headed Flying Fox inspections

Frank Lemckert

17/7/2024



Inspection requirements

a) Map the location of the bats.

b) Number of bats present.

c) Tree occupancy.

d) Presence of juvenile bats.

e) Evidence of mating.

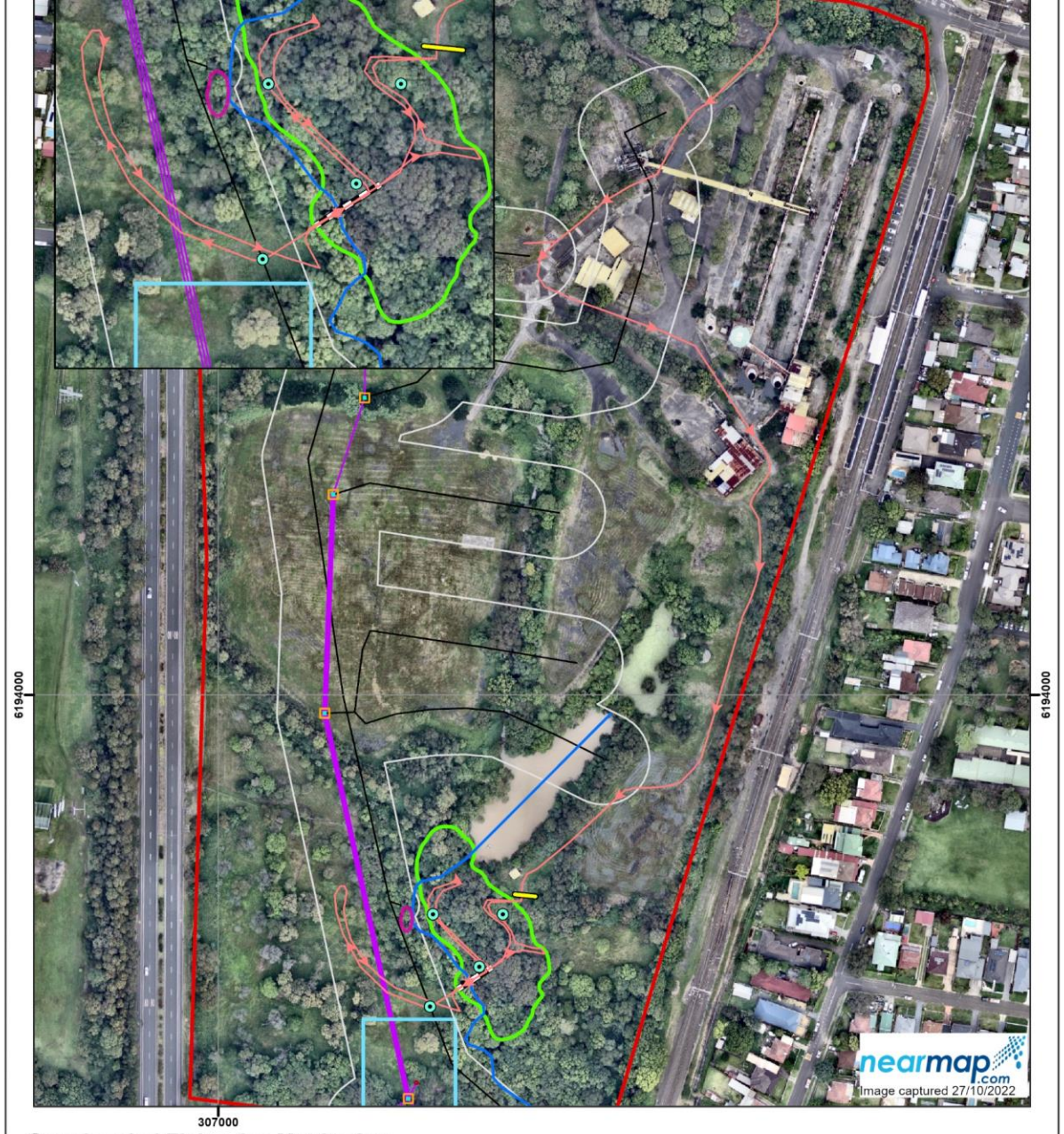
f) Signs of sick or dead bats.

g) Signs of bat disturbance.

A spreadsheet with the required fields for filling in will be made available.

This must be read in conjunction with the GHFF licence and Plan of Management for all details.





Presence and location of bats in the camp

Suitably qualified personnel inspect the camp site daily prior to work commencing and report signs of occupation (check license for details – required qualifications vary depending on works).

Walk the transect in the adjacent figure to determine and record the presence/ absence of bats and take photos at designated points to ensure consistent monitoring.

If bats are absent, note on the available spreadsheet, filling in all relevant fields (e.g. time, date, staff names).

If bat are present, undertake the camp assessment process as per the following slides and using the available spreadsheet.

Provide that information to the project ecologist.

The information is required to inform management decisions based on the License and Grey-headed Flying-fox Management Plan prepared for the site.

Record any other threatened fauna/flora that are seen incidentally during the inspection.

Number of bats present

Record number of bats present as accurately as you can – count individual bats if possible, but approximate numbers may be needed.

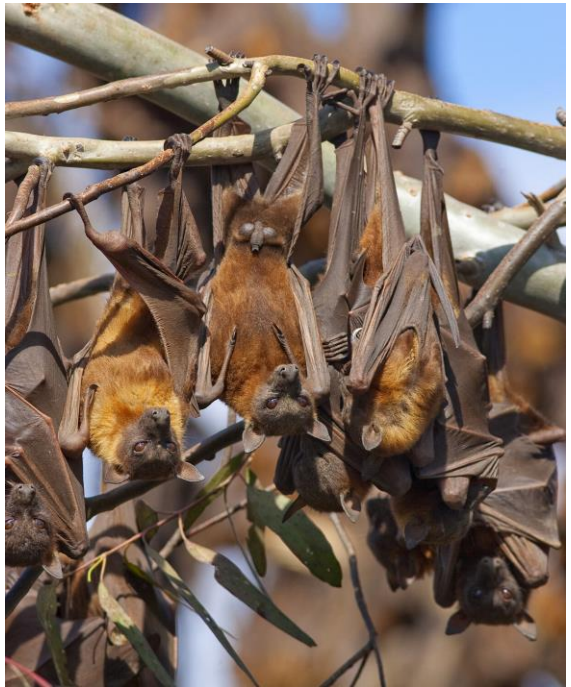
Record the location and extent of bats present and take a photograph.

If bats are in distinct groups, record the number of bats in each group, take a photograph and map the extent of each group.

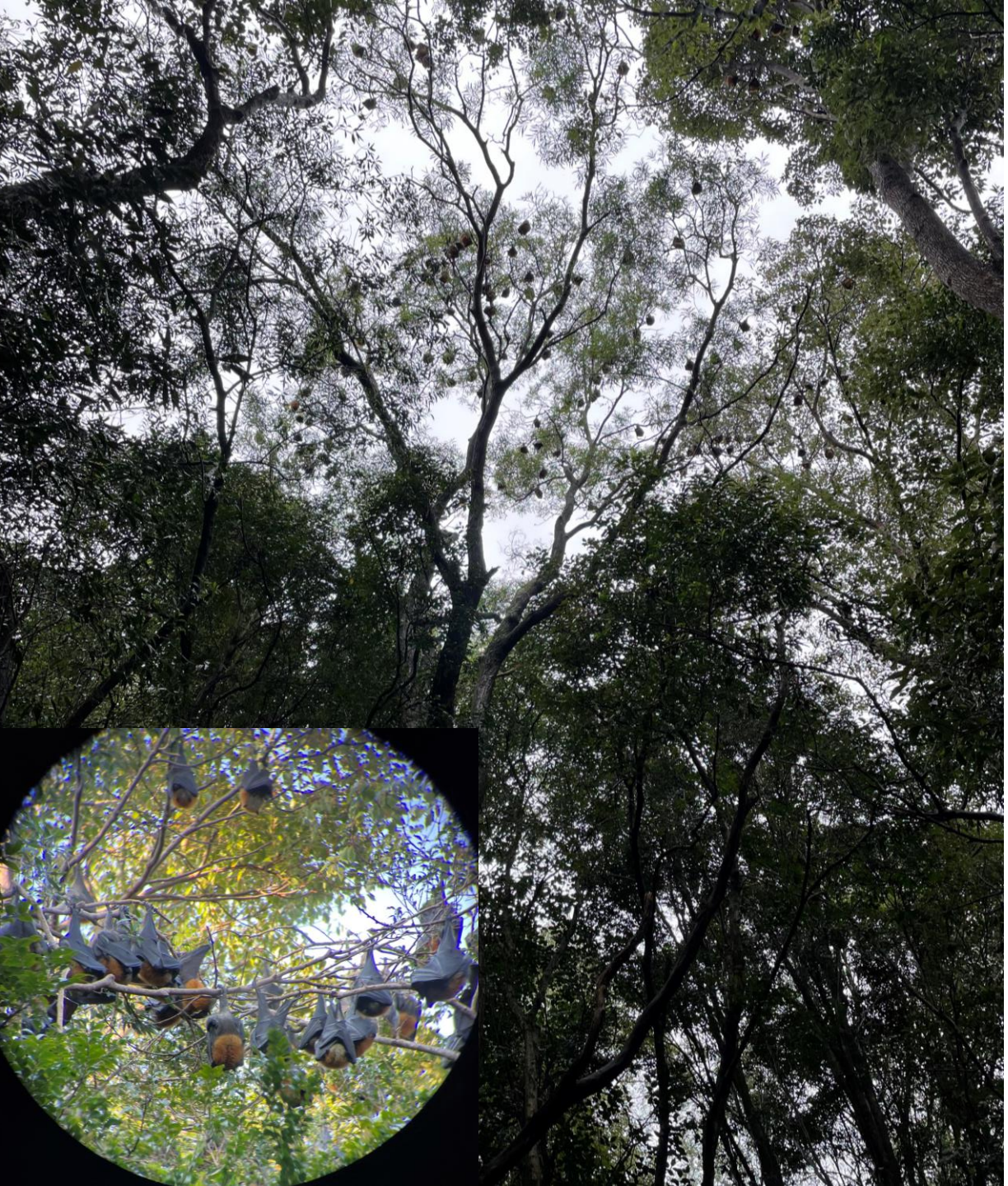
Confirm all bats are Grey-headed Flying-foxes (large with grey heads, reddish necks and black bodies) – Little Red Flying-foxes (smaller and uniform reddish colour; lower left) and Black Flying-foxes (same size as Grey-headed Flying-foxes, but all black; lower right) may use the camp. Record separately. Photos can help with confirming identification.

Field surveys will be assisted by having at least binoculars available and preferably a camera with a telephoto lens.









Tree occupancy

Record the species of trees being used by the bats at the time of the inspection.

Record the roosting height of the bats, which may change in different environmental conditions, particularly heat waves.

This information is important to understand if bats are using specific trees preferentially and if the use different types of trees at different time. This can help with decisions on bush regeneration approaches and core areas for the colony.

Presence of mating bats and juvenile bats

All parts of the colony should be observed for 5 minutes to record any mating, juvenile or likely pregnant female bats.

Mating behaviour is relatively obvious, with males testing the reproductive status of the females (top left) and then, if receptive, copulating (bottom left).

Heavily pregnant females should have distended bellies and perhaps identifiably enlarged nipples.

Juvenile bats may be present as individuals clinging to the mother's chest (images on right) or as smaller bats left in a creche.

Record the timing and location of any observed mating, juvenile bats or likely pregnant female bats – use the provided spreadsheet.

Take a photograph, if possible.





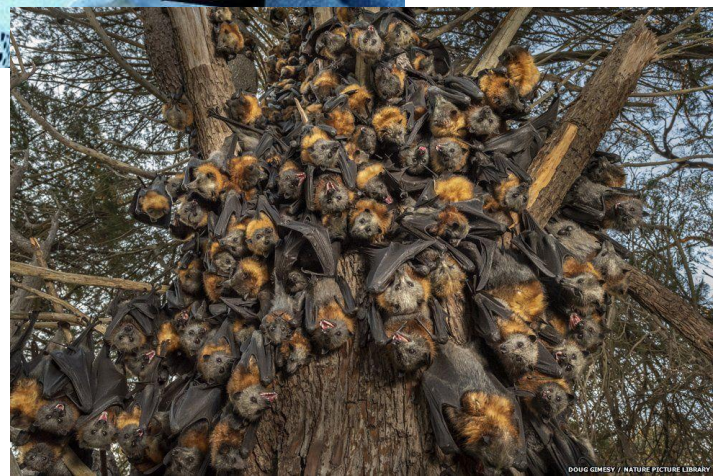












Check for malnourished, sick and dead bats

Check ground and trees for dead, injured, sick or malnourished bats (dead bats do not automatically fall to the ground).

Take a photo and record the location of dead bats and contact the approved bat expert for next steps – DO NO TOUCH THE BAT.

Sick/injured bats have poorly coordinated movements, blood on fur or injuries such as limp or badly torn wings.

Malnourished bats will be obviously skinny.

Heat stressed bats will cluster in lower, shaded places (bottom right). They may also pant and lick their wings to cool down.

For sick or injured bats, take photo and record location and observed illness/injury as per spreadsheet. Call WIRES or vet to attend the bat. Consult with approved bat expert. DO NOT TOUCH THE BAT.

The presence of sick or injured bats must be recorded and the approved bat expert notified immediately, who will notify DCCEEW.

Signs of stress and disturbance



- More than 30% of the camp takes flight and remains in flight for more than 20 minutes
- Saliva spreading (i.e. licking themselves other than for grooming) or fanning their wings continuously
- Grey-headed flying-foxes located on or within 2 m of ground
- Aborted young
- Dependant young abandoned for greater than 20 minutes during the day
- An increase in the number of flying-foxes being taken into local care (from local carers)
- Harmed/dead flying-fox/es found under or adjacent to the camp
- New grey-headed flying-fox camps forming within 5 km of the Cokeworks (from local information sources)

Signs of stress and disturbance



Record bat activity and any signs of stress. If no stress then proceed with works.

If stress is observed:

- Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

  ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

  iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

  iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

  v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW.



Signs of stress and disturbance

The colony should typically be noisy, but bats should be mostly (>90%) hanging in the trees relaxing.

Individual bats will constantly take flights around the camp, but that is normal if they are short flights.

Stress can occur because of noise, visual disturbance or heat. This is evident as bats flying more than usual (as above) or by excessive panting and flapping of wings to cool themselves (top right).

Record temperatures – if 35°C is expected or exceeded, work must follow the license protocol (following slide).

Again, if young are observed, works must not commence and a flying fox expert informed immediately. Works stop until a decision can be made by the expert on how to proceed.







Hot days procedure

When temperatures are predicted to be above 35°C

a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including:

– Panting

– Saliva spreading (i.e. licking themselves other than for grooming)

– Grey-headed flying-foxes located on or within 2 metres of the ground

– Grey-headed flying-foxes clumping around tree trunks

– Grey-headed flying-foxes on the ground

– Grey-headed flying-foxes dying

b. Should any signs of heat-stress be noted,

i. On-site actions that cause any disturbance to the camp must cease immediately

ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately.

When temperatures are predicted to be above 38°C

a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease

b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress

c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately





Which are Grey-headed Flying Foxes?

















ecological AUSTRALIA
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1300 646 131
www.ecoaus.com.au

A4 Vegetation Management Plan (ELA 2024c)

Attached as a separate document.

27 Railway Street, Corrimal Coke Works Vegetation Management Plan

Prepared for Legacy Property

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au

DOCUMENT TRACKING

Project Name	27 Railway Street, Corrimal Coke Works Vegetation Management Plan
Project Number	22SYD 2750
Project Manager	Alex Gorey
Prepared by	Paul Gibson-Roy, Taylor Benny
Reviewed by	Andrew Whitford
Approved by	Andrew Whitford
Status	**Final**
Version Number	**V7**
Last saved on	**25 September 2024**

This report should be cited as 'Eco Logical Australia 2024. *27 Railway Street, Corrimal Coke Works Vegetation Management Plan*. Prepared for Legacy Property and Illawarra Coke Company.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Legacy Property.

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Template 2.8.1

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Abbreviations

Abbreviation	Description
AABR	Australian Association of Bush Regenerators
BC Act	NSW *Biodiversity Conservation Act 2016*
DA	Development Application
ELA	Eco Logical Australia Pty Ltd
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
LP	Legacy Property
NVR	Native Vegetation Retention
PCT	Plant Community Type
RCZ	Riparian Conservation Zone
VMP	Vegetation Management Plan
WoNS	Weeds of National Significance
WCC	Wollongong City Council

1. Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Legacy Property for the proposed development of the former Corrimal Coke Works Site, located off Memorial Drive and Railway Street, Corrimal (**Figure 1**). This project aims to develop a disused industrial site into medium density residential housing (R3) and areas for public recreation (RE1).

Section 5.14.2 Clause 6 of the Wollongong DCP (2009) states that*:*

> *a VMP is to be submitted for Council approval at the time the initial Development Application is submitted proposing earthworks associated with the realignment of the riparian corridor, to achieve the ecological restoration of the entire length of the realigned corridor....*

This VMP has been prepared to meet the requirements of Section 5.14.2 of the DCP and to meet the Natural Resource Access Regulator's (NRAR) guidelines for controlled activity approvals.

1.1. Background

The former Corrimal Coke Works site is located at 27 Railway Street, Corrimal was rezoned and covers land zoned as R3 – Medium Residential and RE1 – Public Recreation across the following lots:

- Lot 1 DP 795791
- Lot 126 DP598190
- Lot 5 DP 749492
- Lot11 DP749492).

The study area covers an area of 18.16 ha (**Figure 1** and **Figure 2**).

1.2. Objectives of the Vegetation Management Plan

The Wollongong City Wide Development Control Plan 2009 – Former Corrimal Coke Works Site (Chapter D19) provides supplementary planning controls aiming to facilitate urban renewal of the former Corrimal Coke Works Site. Key objectives stated in this Chapter are to:

a. *Enable the development of the Site in a manner consistent with Wollongong Local Environmental Plan 2009 and the former Corrimal Coke Works Site Master Plan (outlined Section 4 Chapter D).*
b. *Supplement the planning controls of Wollongong DCP to create a liveable and sustainable residential precinct that provides high quality housing and high levels of amenity for future residents and the wider community.*
c. *Ensure that development of the Site results in an open and welcoming urban environment to facilitate integration and connection between future residents and the wider community.*
d. *Ensure that future development acknowledges, respects, and celebrates the Aboriginal and industrial heritage significance of the Site, and provides opportunities for public access to conserved, re-purposed and interpreted heritage elements and values.*

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e. *Provide for the conservation of significant heritage fabric relating to the history of the coke making operations on the Site, noting the site-specific exemptions attached to the State Heritage Register (SHR) listing.*
f. *Retain the existing tree lined character along Railway Street as a green buffer to the development and incorporate new tree plantings to support a future urban tree canopy.*
g. *Deliver a public transport-oriented development adjacent Corrimal Railway Station including a high-quality public domain, that promotes increased public transport use.*
h. *Provide for a neighbourhood scale retail precinct to meet the convenience retail needs of local residents and to activate Corrimal Railway Station and the Heritage Plaza, recognising the adopted Retail Hierarchy.*
i. *Enable the opportunity for flexible community and business space within the Heritage Plaza precinct, including the potential for tele-working and start-ups.*
j. *Create a high quality, safe and accessible public domain that provides a range of recreational and community benefits.*
k. *Develop a clear and safe hierarchy of roads, lanes, pedestrian, and cycle ways to integrate the Site with the wider Corrimal area, Corrimal Town Centre, and Corrimal Railway Station to encourage walking and cycling.*
l. *Realign and rehabilitate North Corrimal Creek to improve flood management, deliver a large PMF free developable area and enhance biodiversity values on the Site.*
m. *Protect the Grey-headed Flying-fox camp on the Site through the conservation of Endangered Ecological Communities and native vegetation, and maintenance of a buffer between the core mapped camp area and any future development.*
n. *Ensure that development of the Site maintains and establishes key view corridors including through the Site to the escarpment from the east and to the iconic C1 Brick Chimney Stack from within and outside the Site.*
o. *Ensure future residential development is located and designed to mitigate against noise and other impacts associated with the Grey-headed Flying-fox camp on the Site.*
p. *Provide a suitable buffer distance between development within the Site and the rail and state road corridors, and landscaping for noise attenuation.*

In keeping with the **objective k**, the overarching goals of this VMP are to:

- Guide the installation and management of native vegetation within the riparian corridor zone (RCZ)
- Ensure the long-term management of vegetation within the RCZ for ecological and biodiversity outcomes, and
- Provide details on how a Condition of Consent that requires a VMP will be achieved (including provision of indicative costs for management actions).

The strategy of this VMP is to guide the planning, installation, and maintenance of native species in the RCZ and additional retained lands adjacent to the RCZ. The VMP implementation period will run for a five-year implementation period. Following the five-year implementation period the RCZ will be managed (maintained) by the landowner in perpetuity. The objectives of the VMP are summarised in **Table 1**.

Table 1: VMP objectives

Objectives	Approach
Improve ecological health and integrity of native flora within the VMP area	• Revegetate with appropriate native species • Protect planted native vegetation from development pressures • Facilitate natural regenerative processes from planted species • Control priority and other weeds
Maintain ecological values within the VMP area	• Maintain native plantings and continue to assist regenerative processes • Maintain weed control • Prevent outbreaks of priority weeds • Protect or enhance habitat values for GHFF

1.3. Implementation of works

ELA understands that Legacy Property intends to involve local high school students in aspects of the revegetation works. These, and all other restoration works should be supervised or implemented by experienced regeneration contractors with team leaders / site supervisors having a minimum TAFE Certificate IV or Diploma level qualification in Conservation and Land Management and/or membership of the Association of Australian Bush Regenerators (or equivalent). Further, if restoration works are undertaken by community members or community associations, these must also be guided / supervised by qualified bush regenerators.

A supervising project ecologist with a relevant degree qualifications and industry membership is to be assigned to the project. This person should have a minimum of five years' experience managing restoration projects.

1.4. Key Terms

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

- Study area - the extent of Lot 1 DP 795791, Lot 5 DP 749492, Lot 126 DP 598190 and Lot 11 DP749492 at 27 Railway Street, Corrimal
- Development area - the proportion of the study area to be developed, specifically the proposed lots
- VMP area - the area within the proposed realigned riparian corridor and adjacent lands to be restored or revegetated and managed under this VMP.

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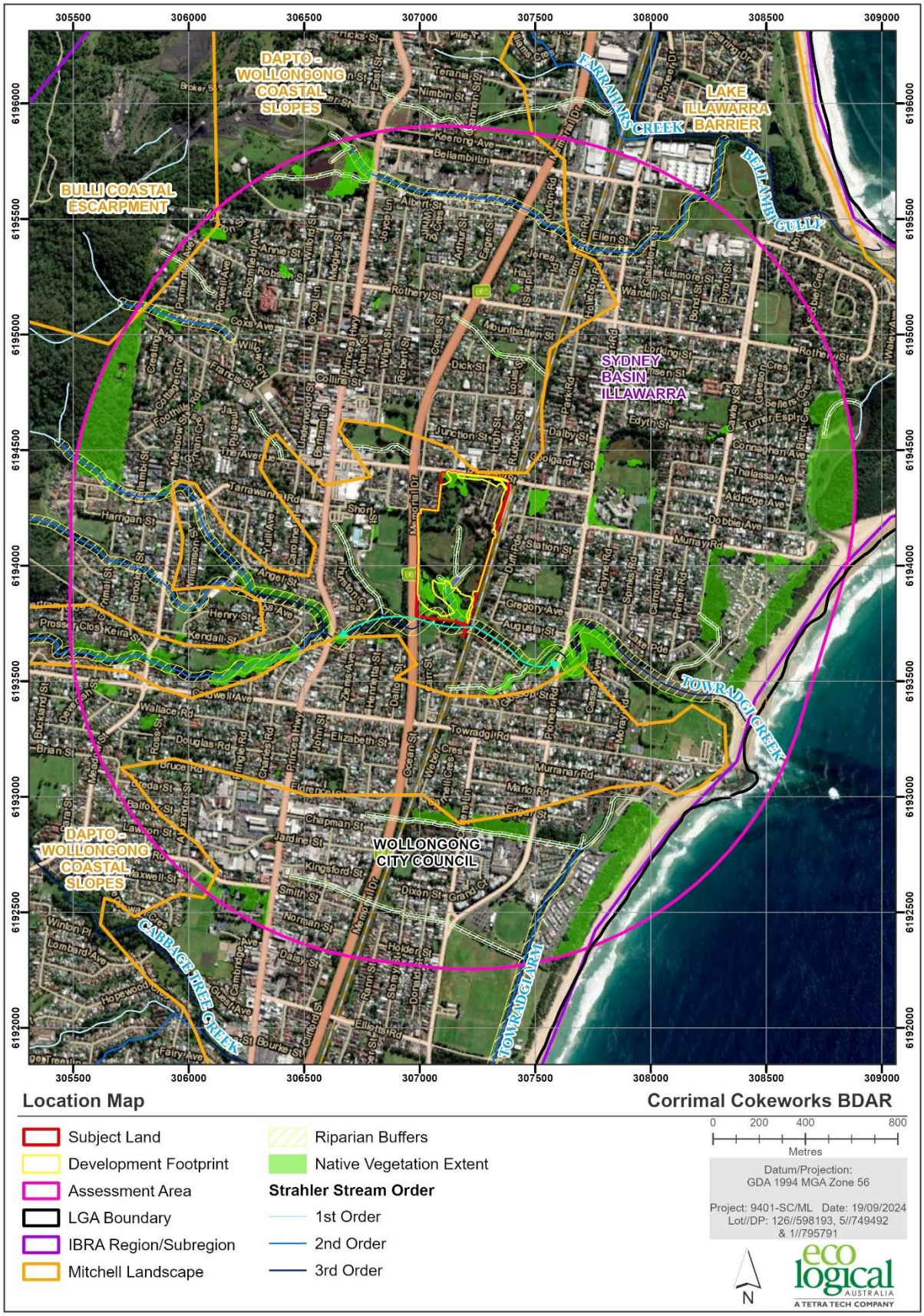


Figure 1: Study area location.

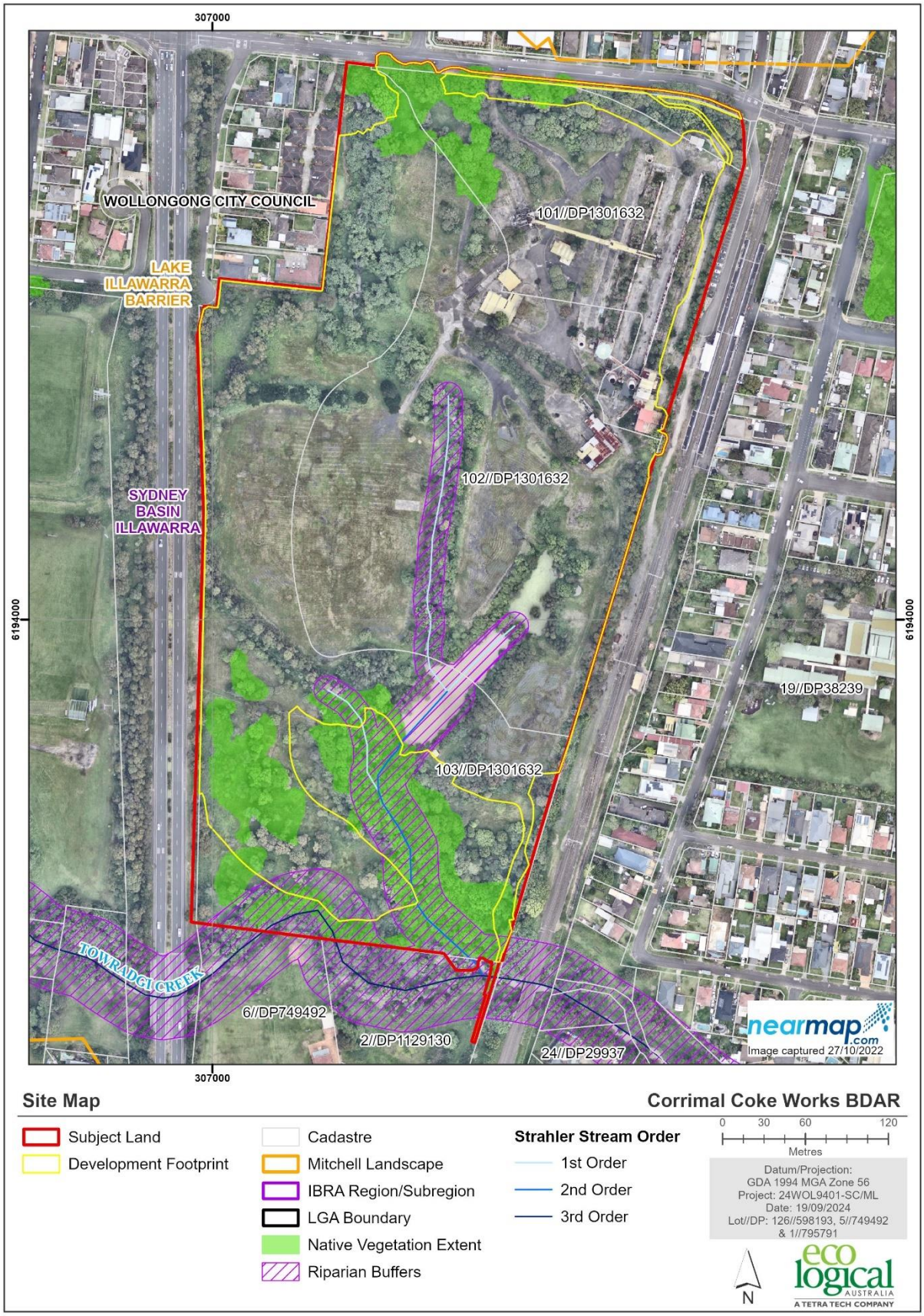


Figure 2: Site Map

2. Existing environment

2.1. Location

The study area is bounded by Memorial Drive on the western side, Railway Street and residential housing to the north, the railway line and residential housing to the east, and the vegetated riparian area of Towradgi Creek to the south. Both had been subject to high levels of modification and disturbance associated with the coke works and contained high proportions of exotic flora species. The VMP area is approximately 6.93 ha in size and aligns with the RCZ running from the northwest of the site to the southeast and to the western and southern edges of the development. The VMP area also includes land adjacent to the future riparian corridor that is proposed as open space and does not form part of the development footprint (**Figure 2**).

2.2. Existing land use

Flora and fauna inspections (ELA 2022) identified that the study area contains remnant native vegetation, planted and exotic vegetation, cleared land, landscaped land, roads, abandoned infrastructure, and water bodies as part of the previous use of the study area as a coke works facility which ceased operations in 2014.

2.3. Topography and drainage

Topography at the site gently undulates, with a general decline occurring to the south-east towards Towradgi Creek (formerly North Corrimal Creek). One second order stream enters the site from the north and converges with two highly modified first order streams which then exit to the south of the site and eventually into Towradgi Creek, a Strahler third order stream, which exits into Corrimal Beach approximately 1.5 km to the east of the site. An elbow of Towradgi Creek meanders slightly over the southern boundary of the site, showing signs of disturbance and degradation similar to the remainder of the site's riparian areas.

2.4. Proposed works

The proposed realignment of the riparian corridor and bulk earthworks required to facilitate the final built form of the development for stages 1-4 will occupy 14.40 ha (**Figure 2**).

2.5. Existing vegetation (native and exotic)

Within the proposed riparian corridor field surveys confirmed the presence of three vegetation communities (**Figure 6**) which were:

- PCT 3327 - Red Gum Thin-leaved Stringybark Grassy Woodlands (good and degraded condition)
- Planted Native Vegetation
- Exotic Vegetation.

Planted Native Vegetation and Exotic Vegetation were grouped separately. All vegetation groups were identified as having been subjected to moderate to high levels of disturbance (including vegetation

clearing / thinning of the canopy layer, infestation of exotic species and modification to the landform and soil profiles).

2.5.1. PCT 3327 Illawarra Lowland Red Gum Grassy Forest – good condition

The Illawarra Lowland Red Gum Grassy Forest vegetation community forms part of the *'Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion',* an endangered ecological community listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). This PCT is also listed as critically endangered as a subset of the Illawarra and south coast lowland forest and woodland ecological community under the EPBC Act. The Illawarra Lowlands Grassy Woodland is broadly characterised by the following species assemblage:

Canopy

Angophora floribunda, Eucalyptus amplifolia, Eucalyptus bosistoana, Eucalyptus botryoides, Eucalyptus botryoides/saligna, Eucalyptus eugenioides, Eucalyptus longifolia, Eucalyptus pilularis and *Eucalyptus tereticornis*.

Midstorey

Acacia falcata, Acacia implexa, Acacia maidenii, Acacia mearnsii, Acacia stricta, Allocasuarina littoralis, Daviesia ulicifolia, Bursaria spinosa, Daviesia genistifolia, Dodonaea viscosa var. *angustifolia, Melaleuca decora* and *Melaleuca styphelioides*.

Groundcover

Aristida ramosa, Aristida vagans, Arthropodium milleflorum, Boronia polygalifolia, Bothriochloa macra' Brunoniella pumilio, Carex longebrachiata, Cheilanthes sieberi, Citriobatus pauciflorus, Commelina cyanea, Cymbopogon refractus, Desmodium rhytidophyllum, Desmodium varians, Dianella revoluta, Dichondra repens, Echinopogon caespitosus, Echinopogon ovatus, Entolasia stricta, Eragrostis sp., *Gahnia radula, Geitonoplesium cymosum, Glycine* sp., *Goodenia hederacea* subsp. *hederacea, Hardenbergia violacea, Hibbertia aspera, Hypericum gramineum, Hypoxis hygrometrica, Jacksonia scoparia, Kennedia rubicunda, Lepidosperma laterale, Leucopogon juniperinum, Lomandra filiformis, Lomandra multiflora, , Microlaena stipoides, Oplismenus aemulus, Oplismenus imbecillis, Panicum* sp., *Parsonsia straminea, Plectranthus parviflorus, Poa labillardieri, Pratia purpurascens, Pultenaea retusa, Pultenaea villosa, Rubus parvifolius, Stellaria flaccida, Themeda australis, Tricoryne elatior, Veronica calycina* and *Wahlenbergia* sp..

Good condition Illawarra Lowland Red Gum Forest (PCT 3327) occurred in approximately 0.36 ha of the proposed riparian corridor. This community was dominated by a canopy of *Eucalyptus tereticornis* and *Eucalyptus paniculata* subsp. *paniculata* with *Eucalyptus pilularis* and *Syncarpia glomulifera* occurring less frequently. *Eucalyptus botryoides* was also recorded, although it is unclear if this species was naturally occurring or planted.

The patch of *Illawarra Lowland Red Gum Forest* in the VMP area contained a canopy of *Eucalyptus tereticornis, Eucalyptus botryoides* and *Syncarpia glomulifera.* The midstorey was dominated by exotic species including *Olea europaea* subsp. *cuspidata* (African Olive), *Ligustrum lucidum* (Large-leaved Privet), *Ligustrum sinense* (Small-leaved Privet) and *Ochna serrulata (*Mickey Mouse Plant*).* Where native species were present, they included *Backhousia myrtifolia* (Grey Myrtle), *Pittosporum undulatum*

(Sweet Pittosporum) and *Parsonsia straminea* (Common Silkpod). The groundcover was sparse and contained natives and exotic species including *Entolasia marginata* (Bordered Panic), *Eustrephus latifolius* (Wombat Berry) and *Asparagus aethiopicus* (Bridal Creeper).



Figure 3: Illawarra Lowland Red Gum Grassy Forest

2.5.2. PCT 3327 Degraded

Degraded PCT 3327 was identified within some parts of the southern portion of the proposed riparian corridor (approximately 0.54 ha). This vegetation community occurred as a tall dense shrubland to low closed forest with the height and density of the canopy increasing in proximity to the tributary of Towradgi Creek (**Figure 4**). This is a derived vegetation community resulting from colonisation by Acacias and other species, following historic clearing of the original vegetation community. Acacia species including *Acacia mearnsii, A. maidenii, A. floribunda* and *A. longifolia* generally dominated this community with the exotic, *Lantana camara* occurring throughout. Along the margins of the tributary of Towradgi Creek a number of mesic species displaced or co-occurred with the canopy of *Acacia* spp. including the exotics *Ligustrum lucidum* and *Cinnamomum camphora* and the native species *Pittosporum undulatum, Acmena smithii* and *Guioa semiglauca.* Isolated individual emergent trees were present including *Syncarpia glomulifera, Eucalyptus pilularis* and *Eucalyptus tereticornis,* which may have been indicative of the original vegetation before the dense colonisation of Acacias and exotic species.

Several other native mesic species were observed within this vegetation community including *Notelaea venosa (*Veined Mock-olive)*, Pittosporum multiflorum* (Orange Thorn)*, Oplismenus aemulus* (Australian Basket Grass)*, Parsonsia straminea* (Common Silkpod)*, Backhousia myrtifolia* (Grey Myrtle)*, Pittosporum revolutum* (Wild Yellow Jasmine)*, Glochidion ferdinandi* (Cheese Tree)*, Streblus brunonianus* (Whalebone Tree) and *Myrsine variabilis* (Muttonwood). It is unclear whether these species were part of the original vegetation type, or if they have colonised this area following the formation of a dense canopy of Acacias and exotic species. Acacia scrub, as described by NPWS (2002), are noted to occur in combination with species common to rainforest and wet sclerophyll forest types.



Figure 4: Urban Native and Exotic (foreground) and PCT 3327 Degraded Acacia Scrub (background)

2.5.3. Planted Native

Within and surrounding the most disturbed parts of the proposed riparian corridor were stands of Planted Native Vegetation (1.24 ha). This was comprised of rows of non-local native planted trees with a disturbed predominately exotic understorey (**Figure 4**). Plantings present included *Lophostemon confertus, Casuarina glauca, Eucalyptus scoparia, Eucalyptus robusta, Eucalyptus saligna* and *Corymbia maculata.*

2.5.4. Exotic Vegetation

Areas of Exotic Vegetation occupying approximately 0.88 ha of the proposed riparian corridor included large stands of *Lantana camara, Salix* sp. (Willow), *Arundo donax* (Giant Reed) and *Erythrina X sykesii* (Coral Tree).



Figure 5: Exotic cover in the riparian zone

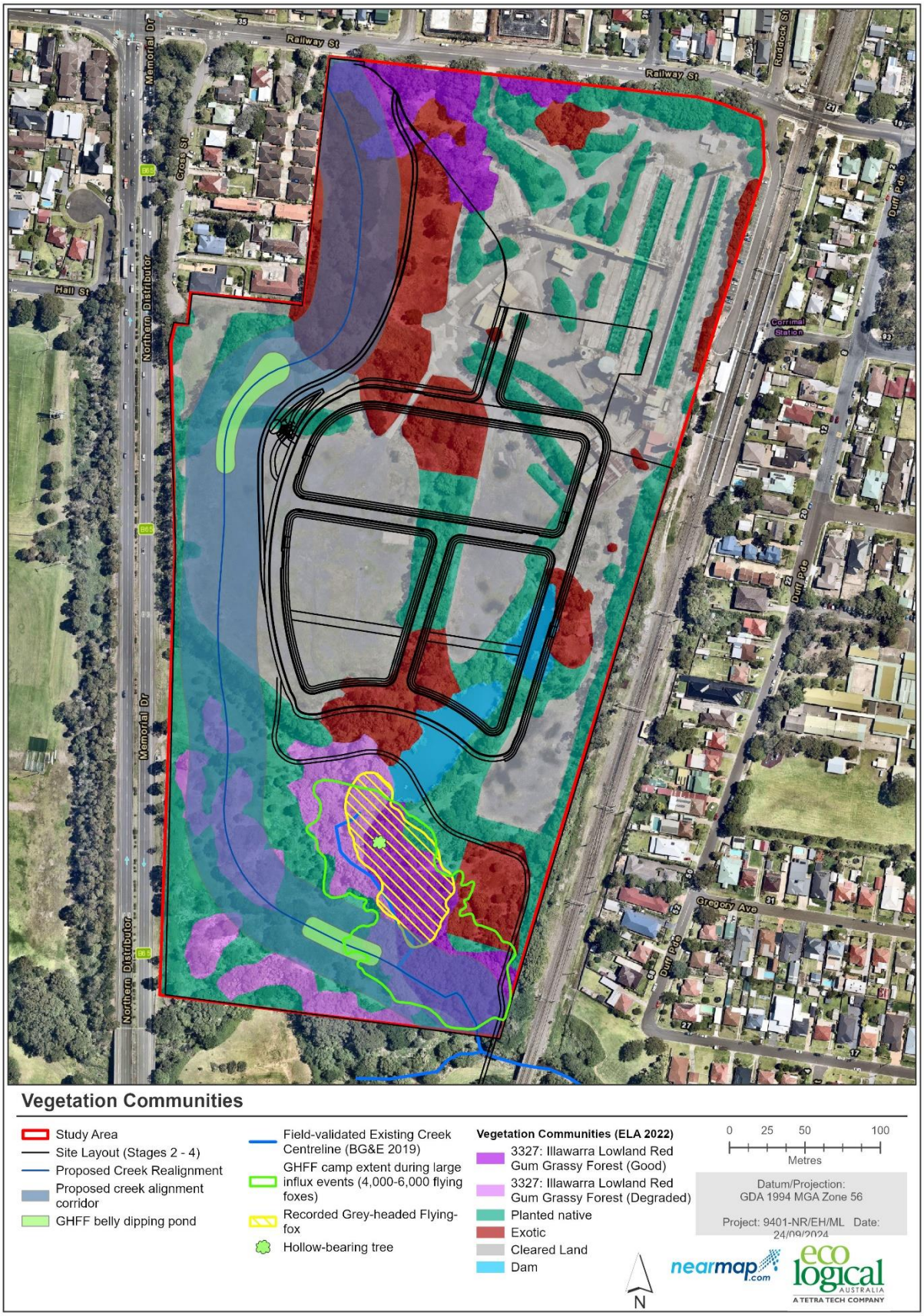


Figure 6: Validated vegetation communities within the study area

2.6. Weeds

Weed species identified within the study area included weeds of National, State and regional priority concern (**Appendix A**). The *Biosecurity Act 2015* (BA Act) and regulations provide specific legal requirements for the state level priority weeds. Under the BA Act all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as reasonably practicable. Plans for the management of weeds in the Wollongong LGA are detailed in the South East Regional Strategic Weed Management Plan 2017-2022 (South-East-Regional-Weed-Mgmt-Plan.pdf (nsw.gov.au)).

Preliminary works relating to revegetation of the VMP area are to occur either before or whilst development is occurring onsite. All works are assumed to be undertaken by the developer or the civil construction company.

2.7. Grey-headed Flying-fox controls

A fauna habitat assessment was undertaken within the study area as part of the Flora and Fauna Assessment (ELA 2022a) and the Biodiversity Development Assessment Report (ELA 2022b), please refer to these reports for details. There is a known camp of *Pteropus poliocephalus* (Grey-headed Flying-fox) in the subject land, to the south of the development footprint. Monitoring surveys since 2019 have identified breeding females in the camp. Any works related to this VMP must be undertaken in accordance with the 'Corrimal Residential Development Grey-headed Flying-fox Management Plan (ELA 2024) and the 'Threatened Species Licences for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development' issued by the The Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW). Controls that must be put in place when implementing the VMP include:

General Controls:

- All staff and contractors are to undertake environmental inductions regarding disease risk associated with flying-foxes and stop work triggers.
- Ensure all plant and equipment is maintained to Australian Standards to minimise noise generation
- Shield noise at its source, where possible
- Modify equipment to produce less noise or use alternative construction techniques
- Avoid shining lights toward the GHFF camp
- Do not stockpile materials within 75m of the camp when the camp is occupied
- Works are not to be undertaken during times of extreme heat events (>38°C)
- Mowing and brush-cutting within the core habitat must be managed under strict protocols to promote vegetation regrowth and prevent disturbance to the camp.
- Chainsaws cannot be used within the core habitat unless it is to reduce a health and safety risk.
- Chippers must not be used within 75m of the camp.
- The use of powered machinery is permitted in adjacent areas (within the 100m buffer off the development and retained lands) to maintain grass with scattered trees under strict protocol.
- Any incident of harmed GHFF's:

    - Must be reported immediately to a local wildlife carer group for welfare response and collection
    - In conjunction with a suitably qualified ecologist / flying fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the GHFF
    - Report and liaise with DPE to implement the management strategies to reduce future harm to GHFF
- If the GHFF camp shows signs of breeding, minimise disturbance within 200m of the camp.

Revegetation Controls:

- The future riparian corridor is to be constructed and revegetated with native vegetation from PCT 3327 Illawarra Lowland Red Gum Grassy Forest that is currently occupying the subject land.
- The planting list must include a range of native *Eucalyptus sp.* and midstorey species to provide foraging and roosting habitat where it is close to the current camp extent. Additionally, favoured feed trees from PCT 3327 should be prioritised, these are represented by an * in **Appendix B**.
- Vegetation management in the core camp habitat will be carried out by suitably qualified and experienced bush regenerators, with at least one supervisor knowledgeable about flying-fox habitat requirements and experience working under a camp.Vegetation modification, including weed removal, will not alter the conditions of the site such that it becomes unsuitable habitat.
- Weed removal should follow a mosaic pattern, maintaining refuges in the mid- and lower storeys at all times.
- Weed control in the core habitat area will be undertaken using methods to minimise time in the core habitat for most effective outcomes.
- Landscape maintenance outside the core habitat must be aware of the triggers and protocols and initiate risk reduction from 50m radius.
- A suitably qualified ecologist will provide monthly reports to DPIE upon commencement of vegetation management implementation.

2.7.1. Threatened Species Licence conditions

Any actions on the development site that may cause harm to the grey-headed flying-foxes must be conducted under the Threatened Species Licence. In additional to the measures outlined above, VMP works are to adhere to the following Threatened Species Licences that are relevant for each stage of works:

- Licence DOC24/644921-3 for Stage 1 Bulk Earthworks DA, DA-2023/166 (Appendix A).
- Licence DOC24/536883-5 for Demolition DA, DA22/1249 (Appendix B).
- Licence DOC24/537230-3 for Sewer Lead-in works (Approved activity under Part 5 of the Environmental Planning and Assessment Act 1979) (Appendix C).
- A licence will be sought following approval of Stage 2-4 Bulk Earthworks DA.

The licence conditions are identical across all three licences except for the Sewer-lead in works Licence which includes an additional condition, Condition 10, which provides measures around the removal of habitat trees within the potential grey-headed flying-fox area. Condition 7 of the Stage 1 Bulk Earthworks Licence also includes an additional provision for continuous supervision for stockpiling

materials within 75-200m of the camp. The conditions outlined below include all conditions across all licences.

The holder of the certificate must ensure that:

Condition 1: Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated

Condition 2: Any incident/s of harmed/dead grey-headed flying-foxes

a. Must be reported immediately to a local wildlife carer group for welfare response and collection
b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the greyheaded flying-fox
c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes

Condition 3: At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 5).

Condition 4: If the camp is deemed empty of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert

Condition 5: When the grey-headed flying-fox camp is occupied and on-site actions are planned:

a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for

- Grey-headed flying-fox numbers
- The camp footprint
- The distance from on-site actions to the camp
- General health of flying-foxes (including signs of malnourishment)
- Signs of breeding including
- The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant.
- Birthing or lactating females
- Females carrying young
- Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
- Courtship and/or mating behaviours
- Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps

d. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site works have commenced

i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request.

Condition 6: Signs of stress in the grey-headed flying-foxes are defined as any of the following

- More than 30% of the camp takes flight and remains in flight for more than 20 minutes
- Saliva spreading (i.e. licking themselves other than for grooming)
- Grey-headed flying-foxes located on or within 2 metres of the ground
- Aborting young
- Dependant young abandoned for greater than 20 minutes during the day
- An increase in the number of flying-foxes being taken into local care
- Harmed/dead flying-fox/es found under or adjacent to the camp
- New grey-headed flying-fox camps forming within 5 kilometres of the on-site actions

Condition 7: If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 6) **when any on-site works are being undertaken.** Disturbances include, but are not limited to, loud noises such as building demolition, tree removal, wood-chipping, slamming car doors and utility trays, and use of machinery. This also includes the stockpiling of materials within the future Stage 2 area of the site (refer to Condition 8 for works 75-200 metres from the edge of the camp).

Condition 8: If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp,**

e. In addition to on-site personnel continuous monitoring requirements (Condition 7) a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 5 including for signs of breeding. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au.
f. If any signs of breeding are observed the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed:

    i. All works contributing to the signs of stress must cease immediately for the day (i.e., no second chance)
    ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be onsite to monitor for signs of stress and advise site-managers on response

g. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 6). Should any of the signs of stress be observed, the site manager must:

    i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress
    ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert
    iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response
v. All signs of stress incidents and responses must be included in the monthly report to DCCEEW

Condition 9: If the grey-headed flying-fox camp is occupied, for any works within **75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 5 including for signs of breeding, prior to the works commencing. Weekly monitoring reports must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au
b. If any signs of breeding are observed, no works within 75 metres of the edge of the camp are permitted
c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 6). If signs of stress are observed;

    i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress
    ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence
    iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day
    iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works causing the signs of stress are appropriate to continue or should be deferred to a later date.
    v. All signs of stress incidents and responses for works within 75 metres of the edge of the camp must be included in a weekly monitoring report forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au

d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 metres of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.
e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately.

Condition 10: In the area denoted as the potential extent (typical camp extent) of the flying-fox camp as shown an MZ5 in **Figure 7**.

a. Vegetation/trees providing habitat for the flying-fox camp must not be felled, lopped or have large branches removed if it has not been identified for removal in this VMP.
b. "Vegetation/trees must not be felled, lopped or have large branches removed when flying foxes are in them or within 30 metres of the vegetation/tree being felled, lopped or modified, or when flying-foxes are within a distance where they are likely to be harmed by the vegetation/tree that is being felled, lopped or modified (which may include a distance >30 metres)."

Condition 11: When temperatures are predicted to be above 35°C

a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including

    - Panting
    - Saliva spreading (i.e. licking themselves other than for grooming)
    - Grey-headed flying-foxes located on or within 2 metres of the ground
    - Grey-headed flying-foxes clumping around tree trunks
    - Grey-headed flying-foxes on the ground
    - Grey-headed flying-foxes dying

b. b. Should any signs of heat-stress be noted,

    i. On-site actions that cause any disturbance to the camp must cease immediately
    ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

Condition 12: When temperatures are predicted to be above 38°C

a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease
b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress
c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

Condition 13: A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage

a. a. Minimise disturbance within 200 metres of the grey-headed flying-fox camp
b. b. Monitor for signs of stress
c. c. Cease actions should the grey-headed flying-foxes show signs of stress

Condition 14. New grey-headed flying-fox camps that establish within 5 kilometres of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.

Condition 15. A suitably qualified ecologist/flying-fox expert will provide monthly reports to DCCEEW on commencement of the action including

- Information about camp occupation dates
- Grey-headed flying-fox numbers
- The camp footprint (providing maps to show any temporal and spatial changes)
- The distance from on-site actions to the camp
- Signs of breeding (providing details on what signs were observed)
- General health of flying-foxes (including signs of malnourishment)
- Any stress incidents and responses
- Feedback on flying-fox responses to any works undertaken within 75 metres of
- the edge of the camp (including details on what the works were, and what the
- immediate and short-term responses were)
- Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management

3. Construction and preliminary works

3.1. Fencing and interpretive signage

3.1.1. Temporary fencing

To prevent encroachment of civil machinery onto the VMP area temporary protection fencing will be erected along the interface between the VMP area and the development area prior to bulk earthworks and development being undertaken. Temporary fencing is to be a chain-wire or parra-webbing fence.

3.1.2. Permanent fencing

At the end of the construction period the perimeter of the VMP area should be protected from further disturbances using permanent fencing. Fencing must allow for fauna movement but restrict motorised vehicle access into the VMP area.

3.1.3. Signage and gates

Interpretative signage is recommended to be placed at strategic locations on the perimeter fencing to advise residents of the importance of the bushland area. Suggested text for the interpretative signage is as follows:

'Native vegetation has been installed within this precinct for habitat and biodiversity values and should be protected. Taking or damaging native vegetation, bushrock or native fauna is prohibited as well as dumping of garden waste or other forms of rubbish.'

Access gates will be required to allow bush revegetation contractors access to the VMP area, including with vehicles or machinery, as needed.

3.2. Soil and water management

An Erosion and Sediment Control Plan, preferably as part of a Construction Environmental Management Plan, must be established and implemented prior to the commencement of development works. These plans should be in accordance with best management practices (e.g., Landcom Blue Book 2004).

Prior to construction commencing, sediment fencing is to be installed at the base of the temporary construction fencing to prevent sediment running into the VMP area and limit the spread of weed propagules in soil sediments during the construction period.

3.3. Vegetation clearance

When clearing areas of existing native vegetation outside the VMP area during construction activities, earthworks and tree removal should be undertaken with a fauna ecologist or wildlife carer present to capture and release any displaced fauna (i.e., in suitable habitat adjacent to or near the clearing footprint), and/or to care for injured fauna as needed. Fallen logs and branches should be retained on-site for use within the VMP area (or potentially were needed in other bushland settings such as public reserves) as ground habitat for native fauna. It is highly recommended that where possible, seed and genetic material (i.e., cuttings or transplants) are collected in advance of clearance in the development footprint for use in the VMP area (as per planting recommendations). Proper planning, timelines and protocols should be established to facilitate this activity.

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3.4. Soil preparation

The success of survival, and reduced future costs, depend heavily on soil preparation during the development phase. Compaction and upturned soil profiles hamper later stages of revegetation and site establishment. It is highly advisable to use machinery with weight distributed evenly to reduce on ground pressure.

It is assumed that all areas of civil construction within the VMP area will be left in a suitable condition for revegetation by the civil contractor. This means that these areas will be shaped and levelled with suitable topsoil and ameliorants added and then ripped and cultivated to a light friable consistency.

Furthermore, environmental hygiene is highly recommended to prevent the introduction or the transfer of pathogens or noxious/WoNS seed. Safe Work Method Statements (SWMS) need to incorporate these measures for machinery and all pedestrians including work teams, monitoring/reporting etc.

Soil studies in Western Sydney have identified considerable chemical change ins soils between the A and B horizons. The B horizons are highly sodic and are prone to deflocculation, erosion and water logging. B horizon soils also significantly reduce the success of revegetation works.

If excavation works are proposed to a level at or below the B horizon, then will be required to be treated in the following way:

- Stockpile topsoil in the A horizon
- Excavate to a level 300 mm below finished surface level
- Place stockpiled A horizon and topsoil on top of B horizon soils, minimum depth of 150mm
- Place a minimum of 150mm of topsoil (from stockpile or imported) on top of replaced A horizon and topsoil
- Add ameliorants, compost and fertiliser as appropriate and cultivate
- Water, allow weed seed to germinate and spray with herbicide
- Jute or mulch as required.

In addition, in any areas of new earthworks or compaction the following actions will be required:

- Ripping to a depth of 200mm to de-compact the topsoil
- Add topsoil as required to achieve levels
- Add ameliorants, compos and fertiliser as appropriate and cultivate
- Water, allow weed seed to germinate and spray with herbicide
- Jute or mulch as required.

3.5. Pest control

Pest control within the VMP area is the responsibility of the landowner. This should be undertaken by suitably qualified contractors and where required, in consultation with relevant authorities (e.g., Local Land Services, Wollongong Council).

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3.6. Fauna habitat enhancement

The protection of diversity is important in fostering the long-term health of native ecological communities. There is some likelihood that vegetation removal may result in the displacement of fauna. Therefore, contractors should take care during clearance activities to minimise impacts/disruption to fauna. *Bringing the bush back* manual (Department of Infrastructure, Planning and Natural Resources, 2003) provides practical management techniques to assist practitioners to minimise impacts to native fauna during revegetation works. Recommendations relevant to this VMP include that vegetation removal is undertaken in a staged or mosaic pattern and that the scheduled removal of canopy or shrubby vegetation (native or weed) is undertaken outside peak bird breeding times.

Eucalypts removed within the development footprint may be useful by providing suitable habitat features within the VMP area (stags, logs, hollows, debris, leaf litter, mulch). Where hollow-bearing trees are removed from the development footprint, best practice for habitat management recommends that nest boxes be installed in the VMP area at the following rates to compensate for hollow removal:

- Microbats – 1 nest box for every small hollow (<5cm) removed (species suitable)
- Birds (parrot species) – 1 nest box for every 5-15cm hollow removed (species suitable)
- Possums/gliders – 1 nest box for every 5-15cm hollow removed (species suitable).

The placement of all faunal habitat augmentation features and nest box installation is to be carried out under the supervision of a qualified ecologist.

The nest boxes required to be installed are as follows:

- 2 x microbat boxes
- 2 x bird boxes
- 1 x possum/glider boxes are to be installed

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4. Vegetation management

4.1. VMP management zones

The VMP area is approximately 7.01 ha and encompasses an area along the north-western, western and southern boundary of the proposed development. Within this, five management zones (MZs) have been defined (**Figure 7**):

- Zone 1: Low flow channel -2.5m buffer around drain line
- Zone 2: Channel bed -from edge of low flow channel zone to Riparian Inner Boundary (RIB) Line Top of bank
- Zone 3: Batter -between RIB line to Riparian Outer Boundary (ROB) Line
- Zone 4: Revegetation -Retained native vegetation – general
- Zone 5: Selective Revegetation -Retained native vegetation – flying fox camp

4.1.1. Management Zone 1: Low flow channel

Management Zone 1 is approximately 0.58 ha. It should contain planted vegetation suited to low water flow wetland conditions. Actions for MZ1 would primarily focus on the installation of native species, primarily sedges, rushes, and flaxes. This would involve the formation of watercourses, wetland basins, the removal of emergent weeds, and the installation of native plants. Plantings should install native rushes and sedges at a high density of 8/m^2 to form thick erosion resistant root beds. Suggested species in **Appendix C** should be used as a general guide. Propagation material for planting stock should be sourced from pre-clearance collections, nearby locations, or from within the catchment region following current Florabank Guidelines (Harrison et al. 2021). Appropriate planning and timelines for sourcing propagation and planting material should be allowed for.

If weed control works are required inside the 'GHFF camp extent' they will be limited to activities consistent with Section 4.2.1.

Where cut logs from the development zone are available, these should be used to create habitat and/or stabilising features in this zone if this is appropriate from a hydrology and flooding perspective. Monitoring to track the success of restoration and weed control actions should take place over the full VMP period.

It is assumed that bulk earthworks and realignment of the riparian corridor is to be undertaken for the area to achieve its final form and therefore existing native species will be impacted. Based on this assumption 90% of this zone is expected to require revegetation.

Summary management aims for MZ1 are:

- Soil preparation work
- Treat emergent weeds following earthworks
- Enhance habitat features across the zone (e.g., logs, rocks)
- Install native vegetation
- Ongoing monitoring to track progress and identify potential issues.

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4.1.2. Management Zone 2: Channel bed

Management Zone 2 is approximately 1.80 ha. It contains planted vegetation suited to low frequency inundation conditions (i.e., 1 in 5-yr flood frequency). Actions for MZ2 would primarily focus on the installation of native species, primarily ground layer, with low tree numbers. This would involve the formation of the channel bed, bed stabilisation using jute mat, removal of emergent weeds, the and the installation of native plants. Plantings should install native rushes, sedges and grasses at 6/m^2, with additional tubestock planting of trees at 1/100 m^2. Suggested species in **Appendix C** should be used as a general guide. Propagation material for planting stock should be sourced from pre-clearance collections, nearby locations, or from within the defined bioregion following current Florabank Guidelines (Harrison et al. 2021). Appropriate planning and timelines for sourcing propagation and planting material should be allowed for.

It is assumed that bulk earthworks and realignment of the riparian corridor is to be undertaken for the area to achieve its final form and therefore existing native species will be impacted. Based on this assumption 90 % of this zone is expected to require revegetation.

If weed control works are required inside the 'GHFF camp extent' they will be limited to activities consistent with Section 4.2.1.

Where possible, cut logs from the development zone should be used to create habitat and/or stabilising features in this zone. Monitoring to track the success of restoration and weed control actions should take place over the full VMP period.

Summary management aims for MZ2 are:

- Soil preparation works
- Treat emergent weeds following earthworks
- Stabilise planting surfaces (using jut mat or equivalent)
- Enhance habitat features across the zone (e.g., logs, rocks)
- Install native vegetation into matted area
- Ongoing monitoring to track progress and identify potential issues.

4.1.3. Management Zone 3: Batter

Management Zone 3 is approximately 2.15 ha and occurs on a slightly sloping batter and runs from the inner edge of the batter to the outer boundary of the riparian corridor. Species planted in this zone should be consistent with species from *Illawarra Lowland Red Gum Grassy Forest* – particularly the ground layer component. Actions for MZ3 should primarily focus on the installation of native grasses and forbs with some canopy trees. This would involve the preparation of top of bank soil surfaces, the removal of emergent weeds, the stabilisation of ground surfaces using jute mat (or organic mulch if flow and inundation frequency is low enough) and the installation of native plants. Plantings should install native grasses at 4/m^2, and forbs at 2/m^2, with additional tubestock planting of trees at 2/100 m^2. Suggested species from Appendix C should be used as a general guide. Propagation material for planting stock should be sourced from pre-clearance collections, nearby locations, or from within the defined bioregion following current Florabank Guidelines (Harrison et al. 2021). If direct seeding is used as an alternative restoration approach in this zone, methods should be consistent with current Florabank guidelines (Gibson-Roy et al. 2021). Appropriate planning and timelines for sourcing planting material or seed for direct sowings should be allowed for.

It is assumed that bulk earthworks and realignment of the riparian corridor is to be undertaken for the area to achieve its final form and therefore existing native species will be impacted. Based on this assumption 100% of this zone is expected to require revegetation.

If weed control works are required inside the 'GHFF camp extent' they will be limited to activities consistent with Section 4.2.1.

Where possible, stags, cut logs, woody/leafy debris from the development zone should be used to create habitat features and organic cover in this zone if this is appropriate from a hydrology and flooding perspective. Monitoring to track the success of restoration and weed control actions should take place over the full VMP period.

Summary management aims for MZ3 are:

- Soil preparation works
- Treat emergent weeds following earthworks
- Stabilise planting surfaces (using organic mulch)
- Enhance habitat features across the zone (e.g., stags, logs, debris, rocks, nest boxes)
- Install native vegetation into mulched area
- Ongoing monitoring to track progress and identify potential issues.

4.1.4. Management Zone 4: Revegetation

Management Zone 4 is approximately 2.02 ha and consists of two separate areas occurring either side of the constructed channel which is characterised by retained *Illawarra Lowland Red Gum Grassy Forest* and planted native vegetation. Eucalypts and Acacias are the predominant features in terms of dominance and biomass, while there is a mix of native and exotic species at the ground layer.

It is assumed that bulk earthworks and realignment of the riparian corridor is to be undertaken for the area to achieve its final form and therefore existing native species will be impacted. Under the presumption that the entire zone will be disturbed by these works, a nominal revegetation proportion of 100% revegetation has been recommended however, if native vegetation can be retained it should be and where relevant, the revegetation proportion re-evaluated.

If weed control works are required inside the 'GHFF camp extent' they will be limited to activities consistent with Section 4.2.1.

Following soil preparation works and weed treatment, actions for MZ4 would focus on the installation of native groundlayer diversity but also increasing that of tree and shrub layers. Tree and shrub plantings will occur across 100% of the zone to the densities provided in Table 3. Native herbaceous plantings should aim to install native grasses at 3/m^2, and forbs at 1/m^2 as 'patch mosaics' randomly across the Zone in clearances between woody areas. Mulch will be required in planting areas where regeneration of native species is absent, to supress weed regrowth, retain soil moisture and reduce erosion.

Propagation material for planting stock should be sourced from pre-clearance collections, nearby locations, or from within the defined bioregion following current Florabank Guidelines (Harrison et al. 2021). If direct seeding is used as an alternative restoration approach in this zone, methods should be

consistent with current Florabank guidelines (Gibson-Roy et al. 2021). Appropriate planning and timelines for sourcing planting material or seed for direct sowings should be allowed for.

Where possible, stags, cut logs, woody/leafy debris from the development zone should be used to create habitat features and organic cover in this zone if this is appropriate from a hydrology and flooding perspective. Monitoring to track the success of restoration and weed control actions should take place over the full VMP period.

Summary management aims for MZ4 are:

- Undertake soil preparation works
- Treat existing weeds
- Enhance habitat features across the zone (e.g., stags, logs, debris, rocks, nest boxes)
- Install native vegetation
- Ongoing monitoring to track progress and identify potential issues.

4.1.5. Management Zone 5: Selective revegetation

Management Zone 5 is approximately 0.46 ha and is characterised by the presence of good quality *Illawarra Lowland Red Gum Grassy Forest* and exotic woody strata. A large extent of this zone is also characterised by the presence of a Flying Fox colony camp. Actions for this MZ primarily aim to preserve the roosting attributes for Flying Fox as best as is possible, while still treating and replacing existing exotic trees which are overwhelmingly Privets. Weed control works inside the 'GHFF camp extent' will be limited to activities consistent with Section 4.2.1.

Plantings will occur across 100% of this zone. Propagation material for planting stock should be sourced from pre-clearance collections, nearby locations, or from within the defined bioregion following current Florabank Guidelines (Harrison et al. 2021). If direct seeding is used as an alternative restoration approach in this zone, methods should be consistent with current Florabank guidelines (Gibson-Roy et al. 2021). Appropriate planning and timelines for sourcing planting material or seed for direct sowings should be allowed for. Mulch will be required in planting areas where regeneration of native species is absent in order to supress weed regrowth, retain soil moisture and reduce erosion.

Where possible, stags, cut logs, woody/leafy debris from the development zone should be used to create habitat features and organic cover in this zone if this is appropriate from a hydrology and flooding perspective. Monitoring to track the success of restoration and weed control actions should take place over the full VMP period.

Summary management aims for MZ5 are:

- Treat existing woody and herbaceous (while retaining large Privets)
- Install mulch to supress Privet germination
- Enhance habitat features (e.g., stags, logs, debris, rocks, nest boxes)
- Replace removed exotic woody strata with native species (tubestock) to improve GHFF habitat
- Incrementally thin large exotic trees (Yr 2-5) following establishment of suitable replacement roost trees
- Replace removed exotic trees with comparable established native trees to improve GHFF habitat
- Ongoing monitoring to track progress and identify potential issues.

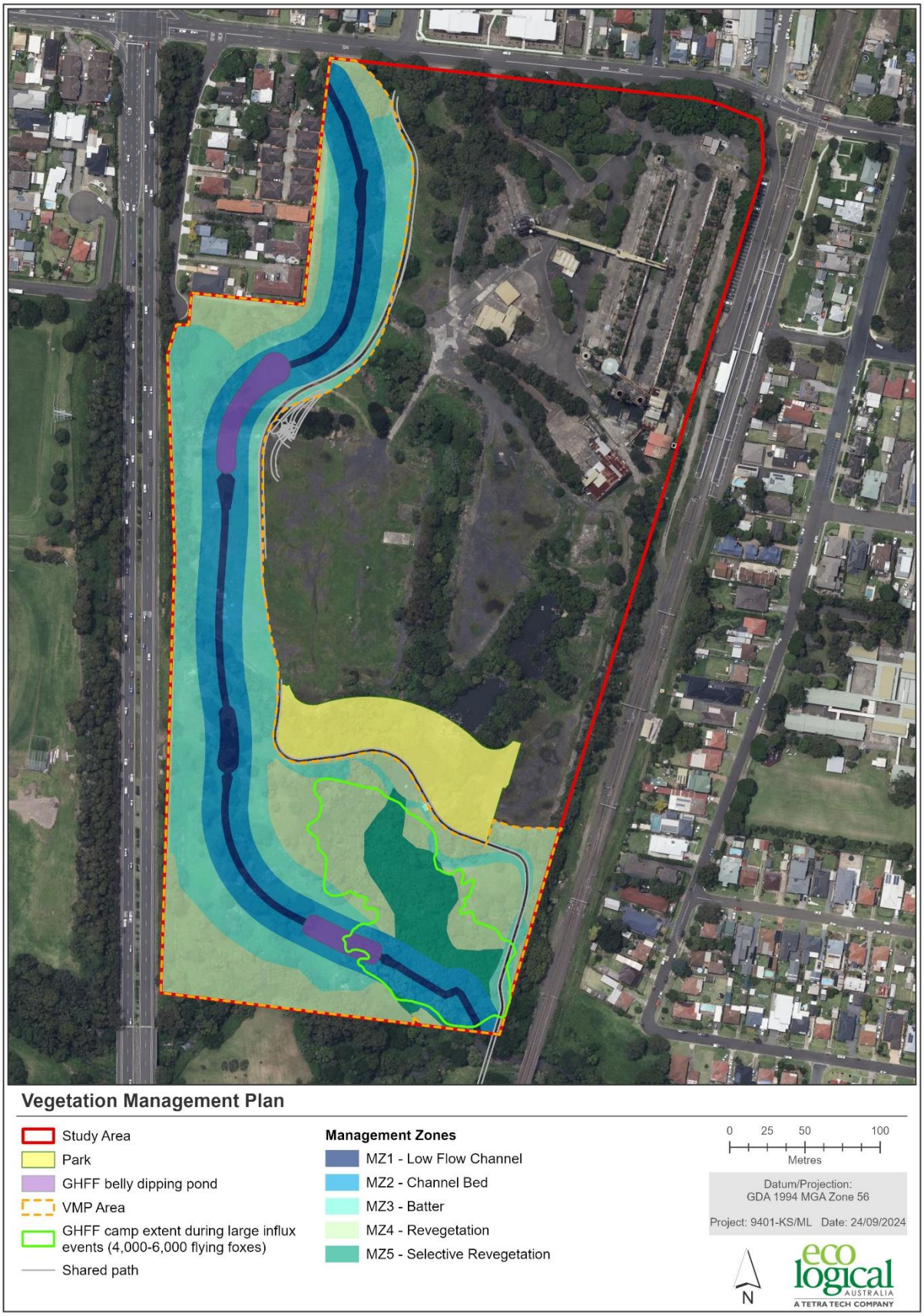


Figure 7: VMP Management Zones

4.2. Weed control

4.2.1. Weed control inside GHFF camp extent

The exotic vegetation present inside the GHFF camp extent may present roosting habitat for GHFF and as such established exotic trees over 8m high should be staged in their gradual removal or potentially retained if that retention does not impede implementation of the VMP programme. This gradual removal is to ensure that potential existing roosting trees are not removed prior to suitable roosting native trees being planted and established to replace them. The removal of large trees is to only be done when the bats are absent. Staging of removal may require some proportion of revegetation be moved into the maintenance period.

To reduce the direct impact to grey-headed flying-foxes, Privet removal should be characterised by:

- Retaining all large Privets with >15cm DBH (Y1).
- Remove all Privets <15cm DBH (Y1).
- Mulch ground areas to supress Privet seedling regeneration.
- Replant cleared areas with native canopy and shrub species.
- Remove 20% of Privets with DBH >15cm each year (Yrs 2-5).
- Replant cleared areas with same numbers of native trees.

The VMP works must be undertaken in accordance with the grey-headed flying-fox Threatened Species Licences and the Corrimal Residential Development Grey-headed Flying-fox Management Plan (ELA 2024). Condition 10 of the Sewer lead-in Works Threatened Species licence (DOC24/537230-3) is particularly important for VMP works in MZ4 and MZ5 as these are areas where flying foxes are known to roost. Condition 10 outlines that in the area denoted as the potential extent of the flying-fox camp in **Figure 7**:

> *Vegetation/trees must not be felled, lopped or have large branches removed when flying foxes are in them or within 30 metres of the vegetation/tree being felled, lopped or modified, or when flying-foxes are within a distance where they are likely to be harmed by the vegetation/tree that is being felled, lopped or modified (which may include a distance >30 metres).*

4.2.2. Maintenance

All MZs will require ongoing maintenance for the five-year VMP period to manage planted vegetation and treat weed colonisation or weed emergence from the soil seed bank. Maintenance will be undertaken at a higher frequency during peak growing seasons (i.e., spring and summer), and with less frequency during cooler periods (i.e., autumn and winter). Maintenance may also include (where appropriate) actions that assist native regeneration such as through the restriction of excessive grass biomass (e.g., slashing), by niche planting or transplantation of natives.

4.3. Revegetation

Revegetation works for MZs should be undertaken by qualified bush revegetation contractor(s). Where feasible, propagation material for VMP restoration is sourced from the subject land development zone in advance of vegetation removal (following current Florabank Guidelines - Harrison et al. 2021). Where

this is not possible it should be undertaken from nearby locations, or from within the defined bioregion (following current Florabank Guidelines - Harrison et al. 2021).

Hiko / Viro cells are recommended container formats for ground cover and grass plantings and forestry tubes for trees and shrubs.

Where required, surface mulch should be laid to a depth of 100 mm. If feasible, it is recommended that mulch is sourced as a by-product of cleared native vegetation from the development zone. Where this is not possible, sourced mulch should be of appropriate quality and to Australian Standards (i.e., AS 4454 (2012): Composts, soil conditioners and mulches). Jute matting should be used to stabilise ground surfaces in areas where there is some erosion potential (e.g., slopes) or below the five-year flooding extent when determined based on final contours.

Revegetation plantings should preferably be undertaken in spring or autumn when soil and atmospheric temperatures and soil moisture levels are optimal for plant establishment. Grass and forb plantings should be arranged in naturalistic patterns. For canopy species, trees should be installed as patches or clumps (rather than as linear or scattered individuals). Where beneficial, plants should be installed with establishment aids such as water crystals and native fertiliser (e.g., Terracottem® or similar). Plantings should be watered on the day of installation and depending on weather conditions, ongoing watering/irrigation would be required to aid establishment for 4 - 6 weeks following installation. Any irrigation material installed to aid watering of the plantings is to be removed at the completion of the maintenance period.

Guards may be required for protection of planted trees and shrubs (e.g., heat, herbivory, herbicide drift). This requirement should be determined by the revegetation contractor. If used, bio-degradable guards are recommended. Guards have not been included in the VMP costing. Infill planting is likely to be required to replace plants lost through natural attrition or from other factors (e.g., vandalism), and it is estimated that at least 10% of all plantings will require replacement.

General specifications for revegetation activities are provided in Table 2 and Table 3. A list of recommended revegetation species is provided in Appendix C.

Table 2: Planting assumptions

Zone	Description	Total area (m^2)	Revegetation area (%)	Revegetation area (m^2)	Jute Matt (%)	Mulch (%)
MZ1	Riparian	5,761	90	5,185	0%	0%
MZ2	Channel bed	17,975	90	16,177	100%	0%
MZ3	Batter	21,542	100	21,542	100%	0%
MZ4	Revegetation	20,202	100	20,202	0%	100%
MZ5	Selective Revegetation	4,574	100	4,574	0%	100%
Totals (m^2)		**70,054**		**67,680**	**37,719**	**24,777**

Table 3: Planting numbers

Zone	Description	Revegetation Area (m²)	Total plant number requirements				
			Tree	Shrub	Herbs / scramblers	Sedge	*Total*
MZ1	Riparian	5,185	0	0	0	8.00	*41,479*
MZ2	Channel bed	16,177	1/100	0	1.00	5.00	*97,225*
MZ3	Batter	21,542	1/20	1/5	1.00	3.00	*91,553*
MZ4	Revegetation	20,202	1/20	1/5	1.00	3.00	*85,860*
MZ5	Selective Revegetation	4,574	1/20	1/5	0	2.00	*10,292*
Totals	**-**	**67,680**	**2,478**	**9,264**	**57,921**	**256,746**	**326,408**

5. Implementation schedule

5.1. Implementation schedule

The VMP period is five years, which is to be followed by ongoing maintenance in perpetuity. An indicative implementation schedule with responsibilities and actions assigned has been provided in Table 4.

5.2. Adaptive management

This project is to be implemented over several years, and so the use of adaptive management approaches is recommended. This will enable contractors to learn from and respond to successful and unsuccessful techniques employed. In its simplest form, adaptive management may include substituting species identified in the planting table for those that are more readily available or for undertaking differing installation techniques in response to new opportunities or conditions.

The success of VMP actions will be determined by meeting performance criteria identified in Section 6.4. In keeping with adaptive management approaches, contractors should utilise the flexibility to implement alternative techniques to those recommended in this document providing that performance criteria are still met. However, major departures from the VMP or proposed changes to performance criteria should first receive approval in writing by a Wollongong Council environment officer.

5.3. Long-term (in perpetuity) site management

Following project completion, on-going inspections should be carried out at least every three years by a qualified person to ensure the health and integrity of native vegetation within the VMP area has been maintained. Inspections should identify any areas that fail to conform to performance criteria (Table 4), and to prescribe actions required to rectify (e.g., weed control or rehabilitation).

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Table 4: Indicative implementation schedule.

Treatment	Development		Maintenance																	
			Year 1				Year 2				Year 3				Year 4				Year 5			
	Preliminary	Establishment	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Preliminary works																						
Install construction fencing																						
Install sediment fencing																						
Install informational signage																						
Install permanent fencing																						
Set up photo points																						
Revegetation works																						
Seed collection, cleaning, storage																						
Site preparation																						
Install jute matt and mulch																						
Tubestock, supply and install																						
Replacement tubestock																						
Irrigation																						
Weed control works																						
Primary and secondary																						
Maintenance																						
Other works																						
Monitoring and reporting																						
Bush regeneration contractor =																						
Construction contractor =																						

6. Monitoring and reporting

It is recommended that the revegetation contractor (or the landowner) should be responsible for monitoring restoration actions and vegetation change over time. The aim of monitoring is to measure the effectiveness of restorative actions. Information gained through monitoring (and its reporting) will help to identify actions that have or have not been successful, and ideally, highlight reasons for success or failure. It may also identify non-conformance with VMP recommendations. Information derived from monitoring will also inform adaptive management decisions. Finally, monitoring and reporting of findings will be important in quantifying the various costs related to restoration and weed management and to determining the overall cost effectiveness of the VMP.

6.1. Monitoring

Monitoring will entail a combination of photo monitoring and vegetation surveys. To establish a benchmark for performance monitoring must be implemented prior to works commencing, and thereafter on an annual basis until project completion to track change against the baseline towards meeting performance criteria. Monitoring results must be presented in an annual progress report.

Photo monitoring points should be established using a permanent marker point to provide a visual reference for changes in vegetation composition and condition. Photo monitoring should include:

- Establishing a minimum of ten photo monitoring points across the VMP area, with two in each zone and located in areas where change is expected
- Installing one six-foot star picket at each photo point (marked with permanent label) with central picket vein facing in direction of assessment
- Recording GPS location of each star picket (eastings and northings)
- Taking initial and annual digital images from each star picket (along direct of central vein and recording photograph direction)
- Labelling digital images with a unique reference number indicating photo location (i.e., the photo monitoring point) and date (e.g., 01_231030 for a photo taken at the first photo monitoring point on the 30 October 2023).

6.2. Quadrat vegetation surveys

Permanent survey quadrats will be established in association photo points within each management zone. Quadrat surveys should assess and quantify vegetation change through time by establishing baseline and ongoing progress against performance criteria for the five-year duration of the VMP. Each quadrat should measure 10 x 10m. Within each, data should be collected on species richness (number), vegetative cover (native/exotic) and native plant density (number).

6.3. Progress reports

Annual progress reports must be provided to Wollongong Council environmental officer until project completion. Reporting should include a description of implemented works and monitored outcomes against specified performance criteria (Section 6.4). Reports should include (at a minimum):

- Reporting period

- Contractor details (e.g., qualifications/experience)
- Seed and plant sourcing details (e.g., provenance, species, seed/plant quantities)
- Works implemented summary, including:
    - date of site visits
    - works conducted per MZ
    - table detailing total person hours per task carried out (e.g., weed control, planting, seeding)
    - details of weed control methods (e.g., method, herbicide type, rate)
    - details of restoration actions (e.g., tubestock planting, planting number, planting area)
    - details of assisted regeneration methods (e.g., installation of logs/woody debris/litter, biomass removal, habitat features)
- Photo point images and comments
- Quadrat monitoring results (e.g., diversity (native), cover (native/exotic), abundance (native/exotic)
- Issues/problems encountered and if/how these were overcome
- General observations including new plant species recorded (native and weed species), comments on rates of regeneration, details regarding rare or threatened entities found on site, faunal observations and interactions, social implications including community interactions (interest or complaints), rubbish dumping, trail bike, dog walking or other movement within site, breaches/damage to fences or vegetation
- Summary comments on site attributes and progress to-date.

6.4. Performance criteria

Yearly performance criteria (Table 5) must be satisfactorily met before works prescribed for subsequent periods can commence (unless under agreement with Council Officers). This means that if performance criteria have not been achieved for any annual reporting period, then the timing of subsequent works may need to be adjusted (and brought forward) to the satisfaction of Council representatives. This will ensure site management remains adequate and will be undertaken to the appropriate degree to achieve VMP objectives. Management and maintenance actions must continue for the full five year period or until Council representatives provides written agreement that performance criteria objectives have been satisfactorily met and the maintenance period has concluded. For the final report to Council, the author of this VMP, or a suitably qualified person must prepare a *completion of works statement* that certifies compliance with Year-5 performance criteria.

In addition to Table 5**,** the following performance criteria must be achieved in perpetuity across the VMP area:

- To approximately maintain Year 5 levels of native and exotic cover, allowing for seasonal and annual variations as well as natural changes to the vegetation structure
- To ensure that the RCZ area is appropriately fenced and signed and that residents are aware of their responsibilities
- To ensure that there is no dumping of rubbish or garden waste in the RCZ.

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Table 5: VMP performance criteria

Establishment period (un-timed)	Maintenance period				
	Year-1	Year-2	Year-3	Year-4	Year-5
Civil construction works					
· Construction and sediment fencing installed					
· Information signage installed					
· Earthworks completed (with ecologist or revegetation contractor input/sign-off)					
· Soil preparation/stabilisation works completed (including creation of light, friable soil suitable for planting and installation of jute matting)					
· All rubbish and debris removed					
Vegetation management works					
· Seed and plant supply actions implemented					
· Habitat features installed					
· No erosion or sedimentation into the VMP area, either from the adjacent development or from upstream of the VMP area					
· No bare areas greater than 2m x 2m (i.e., without native vegetation or organic debris)					
· Monitoring points established, and baseline assessments undertaken					
Installation of tube stock plantings using at least 40% of the species identified in Appendix C or an equivalent number of other, suitable species	90% survival of each stratum or equivalent native regeneration at the end of each year. Replacement plantings undertaken where required				
Maintain existing levels of native cover in each zone	>15% native ground cover in each zone	>25% native ground cover in each zone	>50% native ground cover in each zone	>60% native ground cover in each zone	>70% native ground cover in each zone
Maintain existing levels of native cover in each zone	>5% native shrub and mid-layer cover in each zone	>10% native shrub and mid-layer cover in each zone	>20% native shrub and mid-layer cover in each zone	>35% native shrub and mid-layer cover in each zone	>50% native shrub and mid-layer cover in each zone
Primary weed control implemented in each zone. Where large weed trees are left for GHFF habitat, these should be tagged, marked on GPS and a timeline for removal identified.	<40% weed cover for any 1,000m^2 area	<30% weed cover for any 1,000m^2 area	<20% weed cover for any 1,000m^2 area	<10% weed cover for any 1,000m^2 area	<5% weed cover for any 1,000m^2 area. Any remaining large weed trees kept for

Establishment period (un-timed)	Maintenance period				
	Year-1	Year-2	Year-3	Year-4	Year-5
					GHFF habitat tagged, marked on GPS and a timeline for removal recommended.
Targeting and suppression of priority weeds in each zone	<20% Priority Weed cover in each zone	<15% Priority Weed cover in each zone	<10% Priority Weed cover in each zone	<5% Priority Weed cover in each zone	<2% Priority Weed cover in each zone

Table 6: PCT benchmark condition

PCT ID	PCT Common name (community) (BioNet 2022)	Species richness			Cover (%)		
		Canopy	Shrub	Ground cover	Canopy	Shrub	Ground cover
3327	Illawarra Lowland Red Gum Grassy Forest	5	8	26	52	15	68

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7. Costs

The implementation cost of this VMP over five-years is approximately **$2,475,000** (exclusive of GST and CPI). An indicative annual costing timeline is provided in Table 7. Costs are based on typical commercial rates and assumptions regarding the estimation of costs have been outlined in the sections below.

7.1. Construction and site preparation works

Civil construction activities are identified in Section 2 and these items have not been included in Table 7.

7.2. Vegetation management works

7.2.1. Site preparation

Zone 4 will require jute matting to suppress weeds as tube stock are establishing. Jute matting works have assumed a product comprised of 100% biodegradable jute fibres with a minimum weight of 680g/m² (~6 mm thickness), pegged (3 x 150 mm pins per m²) and each roll overlapped by 100 mm. Should further jute matting be required in other areas of the VMP area, additional costs will apply.

7.2.2. Weed control

Bush regeneration contractors will implement weed controls identified in this VMP. These works have been estimated to cost **$2,850** for a team of four bush regenerators, including a supervisor, per day. The cost of bush regeneration works includes the use of herbicide, vehicles and equipment which are required to implement the VMP.

7.2.3. Revegetation treatment

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. Tube stock costs have been budgeted at an estimated **$3.50** per tree and shrub including planting and **$2.75** per herb, grass, sedge, and groundcover including planting. If direct seeding is used, then this cost would need to be adjusted.

A total of approximately **325,000** plants are assumed to be required to achieve the densities identified in the VMP, plus a 10% rate for replacement plantings to be installed throughout the remainder of the VMP period after initial revegetation works.

7.2.4. Seed collection

Budget for the collection of seed has been included as a separate task. This is an indicative figure and does not consider seasonal and annual climatic variation which may increase or decrease the efficiency of seed collection. If further seed collection works are required, this may be an addition cost.

7.2.5. Monitoring and reporting

An allowance for monitoring and reporting actions as identified for this VMP including for:

- initial setup of the photo points and conducting the baseline surveys
- preparation and delivery of yearly reports to project completion.

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Table 7: Indicative VMP implementation cost

Treatment	Preliminary	Establishment	Maintenance					Total
			Year 1	Year 2	Year 3	Year 4	Year 5	
Revegetation								
Seed collection, cleaning, storage	$ 32,641	$ -	$ -	$ -	$ -	$ -	$ -	*$ 32,641*
Site Preparation	$ -	$ 33,840	$ -	$ -	$ -	$ -	$ -	*$ 33,840*
Jute Matting / Mulch	$ -	$ 493,494	$ -	$ -	$ -	$ -	$ -	*$ 493,494*
Tubestock, supply and install	$ -	$ 918,170	$ -	$ -	$ -	$ -	$ -	*$ 918,170*
Replacement tubestock, supply and install	$ -	$ -	$ 91,817	$ -	$ -	$ -	$ -	*$ 91,817*
Irrigation	$ -	$ 76,140	$ 8,460	$ -	$ -	$ -	$ -	*$ 84,601*
Weed control								
Establishment	$ -	$ 105,081	$ -	$ -	$ -	$ -	$ -	*$ 105,081*
Maintenance - Year 1 - 2	$ -	$ -	$177,324	$137,919	$ -	$ -	$ -	*$ 315,243*
Maintenance - Year 3 - 5	$ -	$ -	$ -	$ -	$116,757	$ 93,405	$ 70,054	*$ 280,216*
Associated costs								
Disbursements	$ -	$ 10,508	$ 17,732	$ 13,792	$ 11,676	$ 9,341	$ 7,005	*$ 70,054*
Monitoring & Reporting	$ -	$ 8,173	$ 8,173	$ 8,173	$ 8,173	$ 8,173	$ 8,173	*$ 49,038*
Totals	**$ 32,641**	**$ 1,645,407**	**$303,507**	**$159,884**	**$136,605**	**$110,919**	**$ 85,232**	***$ 2,474,194***

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South East Regional Strategic Weed Management Plan 2017-2022 http://southeast.lls.nsw.gov.au

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Appendix A Flora species recorded within the study area

*** = Exotic species. # = non-local planted native. + = species listed under the EPBC Act or BC Act. 1=WoNS, 2=Regional Priority weed, 3=NSW declared weed.**

Scientific name	Common name	EPBC/BC Act Status	WoNs (1), Regional (2) NSW (3)
Acacia binervata	Two-veined Hickory		
Acacia floribunda	White Sally Wattle		
Acacia longifolia var. *longifolia*	Sydney golden wattle		
Acacia maidenii	Maiden's Wattle		
Acacia mearnsii	Black Wattle		
Acmena smithii	Lilly Pilly		
Adiantum formosum	Giant Maidenhair		
Adiantum hispidulum	Rough Maidenhair		
**Ageratina adenophora*	Sticky snakeroot		
**Ageratina riparia*	Mistflower		
Allocasuarina littoralis	Black She-oak		
**Andropogon virginicus*	Whiskey Grass		
**Araujia sericifera*	Moth Vine		
**Arundo donax*	Giant Reed		
**Asparagus aethiopicus*	Asparagus Fern		1/2/3
**Asparagus plumosus*	Climbing Asparagus Fern		2
Asplenium flabellifolium	Necklace Fern		
**Axonopus fissifolius*	Narrow-leafed Carpet Grass		
Backhousia myrtifolia	Grey Myrtle		
**Bidens pilosa*	Beggarticks		
**Briza subaristata*	Chilean Quaking grass		
**Bromus catharticus*	Rescuegrass		
Brunoniella australis	Blue Trumpet		
Carex appressa	Tall Sedge		
Carex longebrachiata	Drooping Sedge		
Casuarina glauca	Swamp Oak		
Centella asiatica	Native Pennywort		
**Chloris gayana*	Rhode's Grass		
**Cinnamomum camphora*	Camphor Laurel		
Clerodendrum tomentosum	Hairy Clerodendrum		
Commelina cyanea	Native Wandering Jew		
**Conyza* sp.	Sunflower		

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Scientific name	Common name	EPBC/BC Act Status	WoNs (1), Regional (2) NSW (3)
**Coreopsis lanceolata*	Lance-leaved coreopsis		
Corymbia maculata	Spotted Gum		
Cryptocarya microneura	Murrogun		
Cupressus spp.	-		
**Cynodon dactylon*	Couch		
**Cyperus* sp.	Cyperus		
**Cytisus scoparius* subsp. *scoparius*	Scotch Broom		1/2/3
**Delairea odorata*	Cape ivy		
Desmodium gunnii	Slender Tick-trefoil		
Desmodium varians	Slender Tick-trefoil		
Dianella longifolia	Blue-flax Lilly		
Dichondra repens	Kidney Weed		
**Digitaria* sp.	-		
Doodia aspera	Prickly Rasp Fern		
Echinopogon ovatus	Forest Hedgehog Grass		
Entolasia marginata	Bordered Panic		
**Ehrharta erecta*	Panic veldtgrass		
**Eragrostis curvula*	African Lovegrass		
**Erythrina X sykesii*	Coral Tree		
Eucalyptus amplifolia	Cabbage Tree		
Eucalyptus botryoides	Bangalay		
Eucalyptus paniculata subsp. *paniculata*	Grey Ironbark		
Eucalyptus pilularis	Blackbutt		
#Eucalyptus robusta	Swamp Mahogany		
Eucalyptus saligna	Sydney Blue-gum		
Eucalyptus saligna x botryoides			
#Eucalyptus scoparia	Wallangarra White Gum	E – BC Act; V – EPBC Act	
Eucalyptus tereticornis	Forest Red-gum		
Eustrephus latifolius	Wombat Berry		
Geitonoplesium cymosum	Scrambling lily		
Glochidion ferdinandi	Cheese Tree		
Glycine clandestina	Twining glycine		
**Gomphocarpus fruticosus*	Swan plant		
#Grevillea sp. Cultivar			
Guioa semiglauca	Guioa		

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Scientific name	Common name	EPBC/BC Act Status	WoNs (1), Regional (2) NSW (3)
Gymnostachys anceps	Settlers' Twine		
**Hypochaeris radicata*	Catsear		
**Ipomoea cairica*	Coastal Morning Glory		
**Ipomoea indica*	Morning Glory		3
Kunzea ericoides	Burgan		
**Lantana camara*	Lantana		1/2/3
**Ligustrum lucidum*	Large-leaved Privet		3
**Ligustrum sinense*	Small-leaved Privet		3
**Lonicera japonica*	Japanese honeysuckle		
#*Lophostemon confertus*	Brush Box		
Marsdenia suaveolens	Scented Marsdenia		
Microlaena stipoides	Weeping Grass		
Muellerina eucalyptoides	Creeping Mistletoe		
Myrsine variabilis	Muttonwood		
Notelaea venosa	Veined Mock-olive		
**Ochna serrulata*	Mickey Mouse Plant		
**Olea europaea subsp. cuspidata*	African Olive		3
Oplismenus aemulus	Australian Basket Grass		
Oplismenus imbecillis	Creeping Beard Grass		
Pandorea pandorana	Wonga Vine		
Parsonsia straminea	Common Silkpod		
**Paspalum dilatatum*	Paspalum		
**Paspalum urvillei*	Vasey's grass		
**Pennisetum clandestina*	Kikuyu		
**Phoenix* sp.	Date Palm		
Pittosporum multiflorum	Orange Thorn		
Pittosporum revolutum	Yellow pittosporum		
Pittosporum undulatum	Sweet pittosporum		
**Plantago lanceolata*	Ribwort Plantain		
Platycerium bifurcatum	Elkhorn Fern		
Pratia purpurascens	Whiteroot		
Pseuderanthemum variabile	Pastel Flower		
**Psoralea pinnata*	African scurf-pea		
Pyrrosia rupestris	Rock Felt Fern		
**Rubus fruticosus*	Blackberry		1/3
**Salix* sp.	Willow		1/2/3

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Scientific name	Common name	EPBC/BC Act Status	WoNs (1), Regional (2) NSW (3)
Sarcopetalum harveyanum	Pearl Vine		
**Senecio madagascariensis*	Fireweed		1/2/3
**Senna pendula* var. *glabrata*	Easter cassia		
**Setaria parviflora*	Marsh Bristlegrass		
**Sida rhombifolia*	Common sida		
**Solanum mauritianum*	Wild Tobacco Bush		
**Solanum nigrum*	Black nightshade		
Streblus brunonianus	Whalebone Tree		
Syncarpia glomulifera	Turpentine		
**Taraxacum officinale*	Dandelion		
**Tradescantia fluminensis*	Trad		
**Trifolium repens*	White clover		
**Verbena bonariensis*	Purple top		3
**Verbena quadrangularis*	Brazilian verbena		
**Vicia tetrasperma*	Slender Vetch		

Appendix B Recommended planting list

Growth Form	Species	Common Name	MZ1	MZ2	MZ3	MZ4	MZ5
Tree	*Acacia binervata*	Two-veined Hickory		X	X	X	X
	Acacia maidenii	Maiden's Wattle		X	X	X	X
	Acacia melanoxylon	Blackwood			X	X	X
	Allocasuarina littoralis	Black She-Oak			X	X	X
	*Alphitonia excelsa**	Red Ash		X	X	X	X
	*Angophora floribunda**	Rough-barked Apple		X	X	X	X
	Brachychiton acerifolius	Illawarra Flame Tree			X	X	X
	Brachychiton populneus	Kurrajong			X	X	X
	Casuarina glauca	Swamp Oak			X	X	X
	Clerodendrum tomentosum	Hairy Clerodendrum		X	X	X	X
	*Corymbia maculata**	Spotted Gum			X	X	X
	Cryptocarya microneura	Murrogun			X	X	X
	*Diospyros pentamera**	Myrtle Ebony			X	X	X
	*Eucalyptus amplifolia**	Cabbage Gum			X	X	X
	Eucalyptus bosistoana	Coast Grey Box			X	X	X
	*Eucalyptus botryoides <--> saligna**	-			X	X	X
	Eucalyptus eugenioides	Thin-leaved Stringybark		X	X	X	X
	Eucalyptus globoidea	White Stringybark			X	X	X
	*Eucalyptus paniculata**	Grey Ironbark			X	X	X
	*Eucalyptus pilularis**	Blackbutt			X	X	X
	Eucalyptus quadrangulata	White-topped Box		X	X	X	X

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Growth Form	Species	Common Name	MZ1	MZ2	MZ3	MZ4	MZ5
	Eucalyptus scias	Large-fruited Red Mahogany			X	X	X
	*Eucalyptus tereticornis**	Forest Red Gum		X	X	X	X
	*Ficus macrophylla subsp. macrophylla**	Moreton Bay Fig			X	X	X
	*Ficus obliqua**	Small-leaved Fig			X	X	X
	Geijera salicifolia	Brush Wilga			X	X	X
	Glochidion ferdinandi	Cheese Tree			X	X	X
	Guioa semiglauca	Guioa			X	X	X
	*Melia azedarach**	White Cedar		X	X	X	X
	Notelaea longifolia	Large Mock-olive		X	X	X	X
	Streblus brunonianus	Whalebone Tree		X	X	X	X
	Toona ciliata	Red Cedar			X	X	X
Shrub	*Acacia floribunda*	White Sally				X	X
	Acacia implexa	Hickory Wattle				X	X
	Acacia longifolia					X	X
	Acacia mearnsii	Black Wattle				X	X
	Alectryon subcinereus	Wild Quince				X	X
	Backhousia myrtifolia	Grey Myrtle				X	X
	Breynia oblongifolia	Coffee Bush				X	X
	Bursaria spinosa	Native Blackthorn				X	X
	Callistemon salignus	Willow Bottlebrush				X	X
	Claoxylon australe	Brittlewood				X	X
	Daviesia genistifolia	Broom Bitter Pea				X	X
	Diospyros australis	Black Plum				X	X
	Dodonaea viscosa	Sticky Hop-bush				X	X

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Growth Form	Species	Common Name	MZ1	MZ2	MZ3	MZ4	MZ5
	Elaeodendron australe					X	X
	Exocarpos cupressiformis	Cherry Ballart				X	X
	Hibiscus heterophyllus subsp. heterophyllus	Native Rosella				X	X
	Homalanthus populifolius					X	X
	Indigofera australis	Australian Indigo				X	X
	Leucopogon juniperinus	Prickly Beard-heath				X	X
	Melaleuca decora					X	X
	Melaleuca styphelioides	Prickly-leaved Tea Tree				X	X
	Melicope micrococca	Hairy-leaved Doughwood				X	X
	Melicytus dentatus	Tree Violet				X	X
	Monotoca elliptica	Tree Broom-heath				X	X
	Myoporum acuminatum	Boobialla				X	X
	Myrsine howittiana	Brush Muttonwood				X	X
	Myrsine variabilis					X	X
	Notelaea venosa	Veined Mock-olive				X	X
	Olearia viscidula	Wallaby Weed				X	X
	Pittosporum multiflorum	Orange Thorn				X	X
	Pittosporum revolutum	Rough Fruit Pittosporum				X	X
	*Pittosporum undulatum**	Sweet Pittosporum				X	X
	Pomaderris intermedia					X	X
	Rubus parvifolius	Native Raspberry				X	X
	Santalum obtusifolium	Sandalwood				X	X
	Seringia arborescens					X	X
	*Syzygium austral**	Brush Cherry				X	X

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Growth Form	Species	Common Name	MZ1	MZ2	MZ3	MZ4	MZ5
	Trema tomentosa var. aspera	Native Peach				X	X
	Zieria smithii	Sandfly Zieria				X	X
Grass and Grasslike	*Aristida ramosa*	Purple Wiregrass			X	X	
	Austrostipa ramosissima	Stout Bamboo Grass			X	X	
	Bothriochloa biloba	Lobed Bluegrass			X	X	
	Bothriochloa decipiens var. decipiens	Pitted Bluegrass			X	X	
	Bothriochloa macra	Red Grass			X	X	
	Carex appressa	Tall Sedge	X	X	X	X	
	Carex breviculmis				X	X	
	Carex inversa	Knob Sedge	X	X	X	X	
	Carex longebrachiata				X	X	
	Chloris divaricata var. divaricata	Slender Chloris			X	X	
	Chloris ventricosa	Tall Chloris			X	X	
	Cymbopogon refractus	Barbed Wire Grass			X	X	
	Cyperus gracilis	Slender Flat-sedge	X	X	X	X	
	Cyperus imbecillis		X	X	X	X	
	Cyperus laevis		X	X	X	X	
	Cyperus polystachyos		X	X	X	X	
	Dichelachne inaequiglumis				X	X	
	Dichelachne micrantha	Shorthair Plumegrass			X	X	
	Dichelachne rara				X	X	
	Digitaria parviflora	Small-flowered Finger Grass			X	X	
	Digitaria ramularis	Finger Panic Grass			X	X	
	Echinopogon caespitosus	Bushy Hedgehog-grass			X	X	

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Growth Form	Species	Common Name	MZ1	MZ2	MZ3	MZ4	MZ5
	Echinopogon ovatus	Forest Hedgehog Grass			X	X	
	Elymus scaber				X	X	
	Entolasia marginata	Bordered Panic			X	X	
	Entolasia stricta	Wiry Panic			X	X	
	Eragrostis brownii	Brown's Lovegrass			X	X	
	Eragrostis leptostachya	Paddock Lovegrass			X	X	
	Fimbristylis dichotoma	Common Fringe-sedge	X	X	X	X	
	Gahnia aspera	Rough Saw-sedge	X	X	X	X	
	Imperata cylindrica	Blady Grass	X	X	X	X	
	Juncus prismatocarpus		X	X	X	X	
	Juncus usitatus		X	X	X	X	
	Lepidosperma laterale	Variable Sword-sedge	X	X	X	X	
	Lomandra filiformis	Wattle Matt-rush	X	X	X	X	
	Lomandra longifolia	Spiny-headed Mat-rush			X	X	
	Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush			X	X	
	Microlaena stipoides	Weeping Grass			X	X	
	Oplismenus aemulus				X	X	
	Oplismenus imbecillis				X	X	
	Poa labillardierei var. labillardierei	Tussock			X	X	
	Poa sieberiana	Snowgrass			X	X	
	Poa tenera	Slender Tussock-grass			X	X	
	Rytidosperma pilosum	Smooth-flowered Wallaby Grass			X	X	
	Rytidosperma racemosum	Wallaby Grass			X	X	
	Rytidosperma tenuius	A Wallaby Grass			X	X	

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Growth Form	Species	Common Name	MZ1	MZ2	MZ3	MZ4	MZ5
	Schoenus apogon	Fluke Bogrush	X	X	X	X	
	Themeda triandra		X	X	X	X	
Forb	*Arthropodium minus*	Small Vanilla Lily			X	X	
	Arthropodium sp. South-east Highlands				X	X	
	Arthropodium strictum				X	X	
	Asperula conferta	Common Woodruff			X	X	
	Atriplex australasica				X	X	
	Brunoniella australis	Blue Trumpet			X	X	
	Centella asiatica	Indian Pennywort	X	X	X	X	
	Commelina cyanea	Native Wandering Jew			X	X	
	Desmodium gunnii	Slender Tick-trefoil			X	X	
	Dianella caerulea	Blue Flax-lily	X	X	X	X	
	Dianella longifolia	Blueberry Lily	X	X	X	X	
	Dichondra repens	Kidney Weed	X	X	X	X	
	Dipodium punctatum				X	X	
	Einadia hastata	Berry Saltbush			X	X	
	Geranium homeanum				X	X	
	Geranium retrorsum	Cranesbill Geranium			X	X	
	Geranium solanderi	Native Geranium			X	X	
	Gonocarpus tetragynus	Poverty Raspwort			X	X	
	Goodenia hederacea	Ivy Goodenia			X	X	
	Hydrocotyle sibthorpioides				X	X	
	Hydrocotyle tripartita	Pennywort			X	X	
	Lagenophora stipitata	Common Lagenophora			X	X	

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Growth Form	Species	Common Name	MZ1	MZ2	MZ3	MZ4	MZ5
	Lobelia pedunculata	Matted Pratia, Trailing Pratia			X	X	
	Lobelia purpurascens	whiteroot			X	X	
	Plectranthus parviflorus				X	X	
	Poranthera microphylla	Small Poranthera			X	X	
	Pseuderanthemum variabile	Pastel Flower			X	X	
	Veronica plebeia	Trailing Speedwell			X	X	
	Viola betonicifolia	Native Violet			X	X	
	Viola hederacea	Ivy-leaved Violet			X	X	
	Wahlenbergia communis	Tufted Bluebell			X	X	
	Wahlenbergia gracilis	Sprawling Bluebell			X	X	
	Xerochrysum bracteatum	Golden Everlasting			X	X	
Other	*Aphanopetalum resinosum*	Gum Vine				X	
	Billardiera scandens	Hairy Apple Berry				X	
	Cayratia clematidea	Native Grape				X	
	Clematis aristata	Old Man's Beard				X	
	Clematis glycinoides	Headache Vine				X	
	Desmodium varians	Slender Tick-trefoil				X	
	Eustrephus latifolius	Wombat Berry				X	
	Geitonoplesium cymosum	Scrambling Lily				X	
	Glycine clandestina	Twining glycine				X	
	Glycine microphylla	Small-leaf Glycine				X	
	Glycine tabacina	Variable Glycine				X	
	Hardenbergia violacea	False Sarsaparilla				X	
	Hibbertia scandens	Climbing Guinea Flower				X	

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Growth Form	Species	Common Name	MZ1	MZ2	MZ3	MZ4	MZ5
	Kennedia rubicunda	Dusky Coral Pea				X	
	*Livistona australis**	Cabbage Palm				X	
	*Maclura cochinchinensis**	Cockspur Thorn				X	
	Macrozamia communis	Burrawang				X	
	Marsdenia flavescens	Hairy Milk Vine				X	
	Marsdenia rostrata	Milk Vine				X	
	*Melodinus australis**	Southern Melodinus				X	
	Pandorea pandorana subsp. pandorana	Wonga Wonga Vine				X	
	Parsonsia straminea	Common Silkpod				X	
	Passiflora cinnabarina	Red Passionfruit				X	
	*Passiflora herbertiana subsp. herbertiana**	Native Passionfruit				X	
	Smilax australis	Lawyer Vine				X	
	Stephania japonica var. discolor	Snake Vine				X	
	Tylophora barbata	Bearded Tylophora				X	

* GHFF favoured feed trees to be prioritised for revegetation to support the species.

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Appendix C Weed control techniques and specifications

WEED CONTROL

Weed control involves a combination of mechanical, physical, and chemical techniques to remove unwanted weeds and prevent their regrowth. Selecting weed control methods may depend on several factors including:

- The weed species or combination of weed species being targeted
- The density of the weeds
- Resources available (time, labour, equipment and finances)
- Weather conditions of the day (windy, hot, rain)
- Time of the year (winter/summer)
- Knowledge and/or expertise of the contractor.

Weed control techniques for bushland settings are varied and described in Brodie 1999, Buchanan 2000 and Muyt 2001 (often deferring to 'Bradley Method' principles of bush regeneration). General approaches for different weed types are provided below.

ANNUAL GRASSES

Where isolated or in low concentrations annual grasses should be hand removed or spot herbicide sprayed. Larger patches can be slashed/brush-cut in late spring to early summer, after flowering, but prior to seed set, to prevent seed re-entering the soil seed bank. For some species, this can promote vigorous regrowth and retreatment may be required to prevent seed production. Some annual grasses continue to grow and produce seed at various times of the year if conditions are suitable (e.g., high rainfall and warm temperatures). Sites should be monitored to identify if secondary flushes of weeds require treatment. All vegetative material removed should be bagged, removed from site and disposed of appropriately.

PERENNIAL GRASSES

Where isolated or in low concentrations perennial weedy grasses (e.g., *Cynodon dactylon* - Common Couch, *Paspalum dilatatum* - Paspalum, *Cenchrus clandestinus* - Kikuyu Grass) should be hand removed or spot herbicide sprayed. Larger patches can be slashed/brush-cut prior to seed production in spring or summer and the regrowth spot herbicide sprayed 2-3 weeks later when foliage begins to actively grow (e.g., ~10 cm). Outcomes should be monitored and if plants survive and begin resetting seed, the same treatment will be required. Slashing will not remove exotic grasses, only reduce their biomass. For removal, treatments such as chemical, mechanical, or other (e.g., biological, fire) must be used to reduce weed densities and allow for native regeneration. Actions should be monitored to identify if secondary weed flushes require treatment. All vegetative material removed should be bagged, removed from site and disposed of appropriately.

WOODY WEEDS

Woody weed treatment can be achieved with various techniques. Where plants are too numerous or large for hand/mechanical removal, chemical herbicides can be applied using techniques such as stem injections ('cut and paint', 'drill and fill'), foliar sprays, gas or splatter gun (e.g., low volume of high concentration), rope or wick application (Control techniques using herbicides (nsw.gov.au)). Choosing the

most appropriate technique will depend various factors including site conditions, topography, population density and size of individuals to be removed and resources available. Actions should be monitored to identify if secondary flushes of weeds require further treatment. All vegetative material removed should be bagged, removed from site and disposed of appropriately.

CREEPERS AND CLIMBERS

Creeper weed control can vary depending on the species. For the most part, seedlings should be hand pulled, while mature plants can be chemically controlled using the stem-scrape method or spot foliage sprays. The choice of method will depend on the species, plant size and reproductive status. All vegetative material removed should be bagged, removed from site and disposed of appropriately. Actions should be monitored to identify if secondary flushes of weeds require treatment.

HERBACEOUS WEEDS

Where isolated or in low concentrations herbaceous weeds (e.g., non-woody and non-grass), can be hand removed or spot sprayed prior to flowering. Where large swaths of these species occur at a height above native ground-layer species, chemical wick or rope wipers can be used to selectively treat weeds. Herbaceous weeds can also be slashed to prevent flowering and seeding, and regrowth treated chemically (e.g., spot spray, or mounted wick application). All removed vegetative material should be bagged, taken from site and disposed of appropriately. Actions should be monitored to identify if secondary flushes of weeds require retreatment.

MANAGEMENT OF WEED WASTE

Weed material containing propagules (especially priority weeds) should be securely bagged and disposed of as directed by regulation (e.g., facilities licenced to receive green waste).

ACTION ON PRIORITY AND OTHER WEEDS

Broad weed management compliance with the *Biosecurity Act 2015* can be achieved by:

- Prevent, eliminate, minimise and manage priority weeds by direct control on Council owned land
- Achieve compliance with priority weeds on private property by a process of routine, equitable and strategic inspections
- Develop, coordinate and measure weed programs by creating and maintaining policy, processes, operational plans and regular reporting
- Maintain records on control, education and inspection functions and make these available to NSW Department of Primary Industries and the community as required.

HERBICIDE USE

Herbicides form an important and useful component of integrated weed management and can represent the most appropriate methods for control and eventual eradications of some weed species in some locations. However, the use of chemicals controls should be carefully considered. Herbicides must only be used for the purpose described on the product label, as per the NSW *Pesticides Act 1999.* Herbicide use should assess potential long-term impacts of the product/technique, including whether the proposed use adequately addresses the weed infestation and/or has unintended consequences for non-target species/organisms. Herbicides should ideally be applied during the plants active growing season for more effective uptake of the chemical. Herbicide choice should consider the type of weed,

surrounding non-target species and conditions at the growing location. Where non-selective herbicides are required, glyphosate-based products are often used, including for control in or near waterways where glyphosate-based products suitable for that purpose have been formulated (e.g., Roundup Biactive®). Selective herbicides, such as those that target broad-leaf or grass species are also available. Whatever the herbicide type or mode of action, all must be used in accordance with labelled specifications to avoid non-target impacts or harm to users and others. Herbicides must also be used in accordance with NSW *Pesticides Regulation 2017 i*n regard to licencing, record keeping, training, notification and exemptions (Pesticides Regulation 2017 (nsw.gov.au). The NSW Weed Control Handbook (DPI 2018) provides further guidance of herbicide choice and use.

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Appendix D Revegetation techniques and specifications

REVEGETATION WORKS

Revegetation has the aim of re-establishing the original native PCT within the VMP and reducing erosion at the site - which can carry greatly increased peak flows due the increased run-off from hard surfaces created by residential development.

Planting of forestry tubes for trees and shrub species and Hiko or Viro cells for grasses and other groundcover species are the preferred methods. Where possible, Planting should be done using low impact installation approaches such as hand digging or hand augers. Planting holes should be at least 1.5x the width and 2x the depth of the plants root ball. Fertiliser, water crystals or wetting agents can be added to planting holes as required and per the label specifications to increase plant growth, soil water holding capacity and to reduce watering schedules unless there is sufficient rainfall at the time of installation (~10-20mm), early/immediate irrigation of revegetation is essential to ensure plants are properly hydrated and so that soil forms around the root ball to remove large air pockets. Timing of plantings should always take into consideration prevailing climatic and site conditions (e.g., civil works and erosion/sediment control implementation). An attrition rate of 10% is to be expected and should be allowed for. If direct seeding us used as an alternative restoration method, viable seed should be sown onto friable soil surfaces as per FloraBank Guidelines (Gibson-Roy et al. 2021).

Tree guards may be required on trees and shrubs to protect plants from weather extremes (frosts and heat), herbivore grazing and herbicide drift (during maintenance works). Bio-degradable tree guards are recommended.

Following installation, temporary irrigation may be required to assist planted vegetation establishment and should be provided for at least 8 weeks following planting. Irrigation rates and frequencies will be determined by prevailing site rainfall and temperature conditions. Irrigation installed onsite must be removed at the completion of the maintenance period.

Organic mulch is used for weed suppression, erosion control and soil moisture retention. It can be sourced from native vegetation clearance at the development site but should not contain weed material (seeds or buds) or be derived from diseased trees). Where used, commercial products should be comprised of suitably composted material (preferably wood waste), with a particle size of 15 mm to 40 mm, with minimal fines, and suitable air-filled porosity and comply with Australian Standards (AS 4454 (2012): Composts, soil conditioners and mulches). Mulch is typically installed to a depth of 100 mm.

Jute matting is also used for erosion control, weed suppression and soil moisture retention. It should be comprised of 100% biodegradable jute fibres with a minimum weight of 680 g / m^2 (~6 mm thickness). Jute should be pegged with at least 3 x 150 mm pins per m^2 and each roll overlapped by 100 mm.

SEED COLLECTION

Propagation material (seed and cuttings) for groundcovers, shrubs and trees used in revegetation works should where feasible be collected locally or from the same catchment following Florabank guidelines (Harrison et al, 2021). It is also important for collections to attempt to match habitat types by matching soil, type, slope position, aspect, altitude and rainfall.

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

Record keeping for seed collections and planting locations should follow current Florabank guidelines (Harrison et al, 2021). A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* may be required to undertake seed collection activities. The bush regeneration contractor is responsible for securing permits (if required) and maintaining collection information and providing it to council officers (if required).

BUSH REGENERATION CONTRACTORS

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

HYGIENE PROTOCOLS

To avoid introducing soil pathogens / diseases in particular *Phytophthora cinnamomi* (Root Rot Disease) onto site a hygiene protocol should be enacted as per the guidelines developed by the Royal Botanic Gardens in '*Best Practice Management Guidelines for Phytophthora cinnamomi with the Sydney Metropolitan Catchment Management Authority' (*Microsoft Word - Best Practice Guidelines SMCMA _edits Erin 2 Sept .doc (spiffa.org.au)*)*. For bush regeneration activities all tools and boots should be washed down and thoroughly cleaned of soil / mud using a solution of water and disinfectants prior to and after undertaking works onsite. Likewise, all machinery should be thoroughly cleaned of all soil / mud / debris prior to and following working within the VMP area.

Myrtle rust (*Puccinia psidii*) is a fungal disease which infects plants in the Myrtaceae family (DPI 2015 - Myrtle rust (nsw.gov.au)). Myrtle rust was first detected in NSW in 2010 and has since spread to common Australian Myrtaceae species including Eucalyptus, Willow Myrtle, Turpentine, Bottlebrush, Paperbark, Tea Tree and Lilly Pilly in bushland reserves, home gardens, commercial operations and amenity settings such as parks and street plantings. Bush regeneration contractors should take proper precautions to limit the spread of myrtle rust where there is potential for its transmission to myrtle rust vulnerable species or plant communities at or beyond the VMP site. Preventative measures taken to reduce the risk of myrtle rust introduction include being familiar with signs of myrtle rust, not moving plants known to be infected with myrtle rust, laundering work clothing, hats and gloves worn during activities in high risk areas before using them in other areas, disinfecting equipment and inspecting purchased tubestock to ensure they are free from myrtle rust or keeping them separate from existing plants until disease freedom can be assured or until treated with an appropriate fungicide.

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A5 Threatened species license

Attached as a separate document.

Department of Climate Change, Energy, the Environment and Water

Thomas Kent
Project Manager
LEGACY PROPERTY
LEGPRO 70 Pty Ltd ATF LEGPR 70 Unit Trust
Level 45/25 Martin Place
Sydney NSW 2000

Date: 28 July 2025
Our ref: DOC25/607586-8
Licence number: DOC25/607586-8
Contact: Lorraine Oliver 02 6229 7120

Dear Mr Kent,

Subject: **Threatened Species Licence for grey-headed flying-fox camp in relation to the proposed Corrimal Cokeworks development – Stages 2-4 Bulk Earthworks DA2023/823.**

I refer to your application to the Department of Climate Change, Energy, the Environment and Water (DCCEEW), with relevant documents emailed 30 June 2025 and 24 July 2025, for a Threatened Species Licence (TS Licence), a class of Biodiversity Conservation Licence under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act), for potential impacts to the on-site grey-headed flying-fox camp relating to the proposed Corrimal Cokeworks residential and commercial development (GDA94 Latitude: -34.378589, Longitude: 150.90239). Specifically, the TS Licence application was for a licence to manage impacts from the following stages of development:

- Stages 2-4 Bulk Earthworks – DA-2023/823.

DCCEEW understands the aim of the actions referred to in the TS Licence application is to prepare the Corrimal Cokeworks site for the establishment of a future residential and commercial development. DCCEEW understands this TS Licence application is for three actions that may impact the on-site grey-headed flying-fox camp: the removal and re-establishment of foraging habitat; the realignment of the water course and draining of the dam; and the disturbance caused by construction noise and activity.

This TS Licence is separate to any development approvals, and any conditions associated with such approvals, relating to the Corrimal Cokeworks residential and commercial development.

This TS Licence and conditions are for Stages 2-4 Bulk Earthworks – DA-2023/823. As discussed, where applicable, the TS Licence conditions will remain consistent across the breadth of TS Licences issued for this development and will only change when an aspect of the staged development impacts differently on the on-site grey-headed flying-fox camp.

Please note there are several extra licence conditions, additional to those of the three previously issued TS Licences, relevant to the proposed waterway and vegetation works.

The TS Licence conditions account for the following possible scenarios regarding the grey-headed flying-fox:

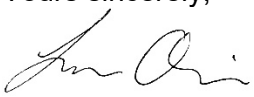
1. Camp occupation
2. Signs of breeding in an occupied camp
3. Proximity of works to the camp
    a. Any on-site works
    b. Any works 75-200 metres from the edge of the occupied camp
    c. Any works within 75 metres of the edge of the occupied camp and including the occupied camp footprint and the previously-mapped core camp extent (as per Figure 1 in the TS Licence application Cover Letter).

Based on the information provided to DCCEEW by Legacy Property, I have assessed your TS Licence application for the proposed Stages 2-4 Bulk Earthworks – DA-2023/823 in accordance with the provisions of the BC Act and the *Biodiversity Conservation Regulation 2017* and determined that the proposed action is not likely to significantly affect threatened species or their habitats if conducted in accordance with the conditions attached to this TS Licence.

A copy of your new biodiversity conservation TS Licence is enclosed. Please note that your TS Licence is subject to conditions. These conditions are outlined in the TS Licence. It is an offence under s2.14(4) of the BC Act to breach a condition of a TS Licence.

A public register of all biodiversity conservation licences and all decisions made to vary, suspend or cancel those licences can be viewed at https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/threatened-species-licences

If you have any further questions regarding this matter, please contact me on 02 6229 7120 or at Lorraine.Oliver@environment.nsw.gov.au.
Yours sincerely,



LORRAINE OLIVER
Senior Team Leader, Ecosystems and Threatened Species, South East Regional Delivery
Conservation Programs, Heritage and Regulation, Department of Climate Change, Energy, the Environment and Water

Threatened Species Licence

Biodiversity Conservation Act 2016

Threatened species licence, a class of biodiversity conservation licence under Part 2 of the *Biodiversity Conservation Act 2016*, to:

- harm or pick a threatened species, threatened ecological community or protected plant or animal
- and/or damage habitat of a threatened species or threatened ecological community

Licence number: **DOC25/607586-8**
Date granted: **28th July 2025**
Date of expiry: **28th July 2030**

Granted To:

LEGPRO 70 Pty. Ltd. ATF LEGPR 70 Unit Trust
ABN: 62 744 723 737
Level 45/25 Martin Place
Sydney NSW 2000

DESCRIPTION OF PROPOSED ACTION
The proposed action:
Legacy Property are proposing a residential and commercial development within the subject land (GDA94 Latitude: -34.378589 Longitude: 150.90239 Wollongong LGA). The development involves the creation of residential lots, commercial space, public open space and retention of the *Pteropus poliocephalus* (grey-headed flying-fox – GHFF) camp.

As per the information provided by Legacy Property and their representatives, DCCEEW understands that Stages 2-4 Bulk Earthworks will involve the following activities:

- removal and re-establishment of grey-headed flying-fox foraging habitat
- realignment of the water course and draining of the on-site dam
- and disturbance to the grey-headed flying-foxes (when present) caused by on-site construction noise and activity.

The proposed works will involve work within 200m of the grey-headed flying-fox camp. While the proposed built form areas are located greater than 75m from the core camp, bulk earthworks for Stages 2-4 of the works are proposed to slightly impact the typical camp extent and remove potential roosting trees. These works are to prepare the ground for the proposed realignment of Towradgi Creek. The large dam present within the development is proposed to be de-watered (i.e. drained) and removed. Prior to the commencement of bulk earthworks, a plan is required to be prepared to de-water the dam closest to the camp and to create a replacement dam. The proposed creek realignment will include an open area of water intended to provide a 'belly dipping' opportunity for the flying-foxes. The new creek realignment and the belly dipping pond will be created prior to the de-watering and removal of the large existing dam.

Bulk earthworks are also proposed within 100m of the camp to prepare for re-establishment of grey-headed flying-fox foraging habitat under a Vegetation Management Plan; works within this

Plan will be undertaken in accordance with the current TS Licences in place for the site and will follow requirements of all future licences.

The area to be affected by the actions for Stages 2-4 Bulk Earthworks for the proposed development is 12.59 hectares. This covers most of the Subject Land area, excepting an area positioned in the northeast, and a small area positioned in the southeast focused on the typical extent of the flying-fox camp. The proposed development will remove 4.4 hectares of potential foraging habitat with the impact footprint slightly encroaching on the camp's typical extent.

DCCEEW understands these works have been approved, as per the Land and Environment Court Judgment on the Class 1 Appeal (an appeal against the deemed refusal of DA-2023/823) as per the hearing on 7 March 2025, and the Date of Decision 9 April 2025. The judgment states: "The Court orders: ……. (3) Development Application No. DA-2023/823, as amended, for bulk earthworks (stage 2-4), vegetation management and realignment and embellishment of an existing riparian corridor at 27 Railway Street, Corrimal NSW 2518 is determined by the grant of development consent subject to the conditions of consent in Annexure A."

DCCEEW notes conditions within the Land and Environment Court's Grant of Consent that may be relevant to the grey-headed flying-foxes and their habitat include, but are not necessarily limited to, Conditions 2, 3, 4, 14, 15, 16, 17, 26, 34, 37, 39, 40, 44, 79, 109, 110, 111, 139, 145 and 146.

This TS Licence applies only to the Stages 2-4 Bulk Earthworks – DA-2023/823, including removal and re-establishment of grey-headed flying-fox foraging habitat, realignment of the water course and draining of the on-site dam, and disturbance to the grey-headed flying-foxes (when present) caused by on-site construction noise and activity. This licence only applies to grey-headed flying-foxes and grey-headed flying-fox habitat.

RELEVANT CONDITIONS

The holder of the certificate must ensure that

1. Grey-headed flying-foxes harmed/dead animals, are not handled or touched by a person unless the person is appropriately trained and vaccinated
2. Any incident/s of harmed/dead grey-headed flying-foxes
    a. Must be reported immediately to a local wildlife carer group for welfare response and collection
    b. In conjunction with a suitably qualified ecologist/flying-fox expert or wildlife carer, investigate possible cause and cease action that was a factor in harming the grey-headed flying-fox
    c. Report and liaise with DCCEEW to implement management strategies to reduce future harm to grey-headed flying-foxes
    d. At project commencement a suitably qualified ecologist/flying-fox expert must inspect the grey-headed-flying-fox camp site to determine if the camp is occupied or empty and whether there are signs of breeding (Condition 4). DCCEEW must be advised on camp status at project commencement via rog.southeast@environment.nsw.gov.au

3. If the camp is **deemed empty** of grey-headed flying-foxes at project commencement, suitably qualified on-site personnel must inspect the camp site daily and immediately report any signs of occupation to a suitably qualified ecologist/flying-fox expert.
4. When the grey-headed flying-fox camp is occupied, and on-site actions are planned:
    a. A suitably qualified ecologist/flying-fox expert monitors the camp weekly for
        - Grey-headed flying-fox numbers
        - The camp footprint
        - The distance from on-site actions to the camp
        - General health of flying-foxes (including signs of malnourishment)
        - Signs of breeding including
            - The presence of female flying-foxes in late-stage pregnancy (i.e. third trimester) or are visibly pregnant.
            - Birthing or lactating females
            - Females carrying young
            - Dependant young (including young that cannot yet fly, or cannot fly well enough to exit the camp of an evening i.e. crèched young)
            - Courtship and/or mating behaviours
            - Note: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps
    b. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue and appropriately vaccinated is notified that the camp is occupied and that on-site actions have commenced
        i. Should the Licensed wildlife carer request to view the response of the camp to the on-site actions, arrangements must be made to facilitate the request
5. Signs of stress in the grey-headed flying-foxes are defined as any of the following
    - More than 30% of the camp takes flight and remains in flight for more than 20 minutes
    - Saliva spreading (i.e. licking themselves other than for grooming)
    - Grey-headed flying-foxes located on or within 2 metres of the ground
    - Aborting young
    - Dependant young abandoned for greater than 20 minutes during the day
    - An increase in the number of flying-foxes being taken into local care
    - Harmed/dead flying-fox/es found under or adjacent to the camp
    - New grey-headed flying-fox camps forming within 5 kilometres of the on-site actions
6. If the grey-headed flying-fox camp is occupied, the camp must be continuously monitored by suitably qualified on-site personnel for signs of stress (Condition 5) **when any on-site works are being undertaken**. Disturbances include, but are not limited to, loud noises

such as building demolition, tree and vegetation removal and landscaping works, use of chainsaws and wood-chipping equipment, slamming car doors and utility trays, use of earth-moving machinery, excavators, heavy rigid trucks, machinery to rip concrete, and impulse noise during building construction. This also includes the stockpiling of materials within the Stage 2 area of the site (refer to Condition 7 for works 75-200 metres from the edge of the camp). Disturbance during the operational phase will involve road noise, noise from inhabitancy of future dwellings and the public use of open space.

7. If the grey-headed flying-fox camp is occupied, for any works **75-200 metres from the edge of the camp**,
    a. In addition to on-site personnel continuous monitoring requirements a suitably qualified ecologist/flying-fox expert must also monitor the camp weekly as per Condition 4 including for signs of breeding. Weekly monitoring reports (see Annexure A) must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

    b. If any signs of breeding (Condition 4) are observed, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 5). If signs of stress are observed:

        i. All works contributing to the signs of stress must cease immediately for the day (i.e. no second chance)

        ii. If the actions which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to monitor for signs of stress and advise site-managers on response

    c. If there are no signs of breeding in the camp, suitably qualified on-site personnel must monitor the camp for any signs of stress (Condition 5). Should any of the signs of stress be observed, the site manager must:

        i. Cease works contributing to the signs of stress until the flying-foxes cease showing signs of stress

        ii. Request the on-site presence of the suitably qualified ecologist/flying-fox expert

        iii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

        iv. If works recommence and grey-headed flying-foxes again show signs of stress, cease all actions contributing to the signs of stress for the remainder of the day and liaise with the suitably qualified ecologist/flying-fox expert about approaches for works the following day, including the on-site presence of the suitably qualified flying-fox expert to monitor for signs of stress and to continue advising site-managers on the response

        v. All signs of stress incidents and responses must be included in the weekly report to DCCEEW

8. If the grey-headed flying-fox camp is occupied, for any works **within 75 metres of the edge of the camp** at the time of the works, including the camp footprint at the time of the works:

a. A suitably qualified ecologist/flying-fox expert must monitor the camp weekly as per Condition 4 including for signs of breeding, prior to the works commencing. Weekly monitoring reports (see Annexure A) must be forwarded to DCCEEW via rog.southeast@environment.nsw.gov.au

b. If any signs of breeding (Condition 4) are observed, no works within 75 metres of the edge of the camp are permitted

c. If there are no signs of breeding, the suitably qualified ecologist/flying-fox expert must remain on-site to monitor for any signs of stress (Condition 5). If signs of stress are observed:

    i. All works contributing to the signs of stress will cease until the flying-foxes cease showing signs of stress

    ii. When the grey-headed flying-foxes cease showing signs of stress, works can recommence

    iii. If works recommence and grey-headed flying-foxes again show signs of stress, cease all works contributing to the signs of stress for the remainder of the day

    iv. If the works which led to the cessation of works for the day recommence the following day, a suitably qualified ecologist/flying-fox expert must be on-site to directly monitor for signs of stress and advise site-managers on the response. Consecutive or multiple calls for cessation of works require the suitably qualified ecologist/flying-fox expert to review whether the works causing the signs of stress are appropriate to continue or should be deferred to a later date.

    v. All signs of stress incidents and responses for works within 75 metres of the edge of the camp must be included in a weekly monitoring report (see Annexure A) forwarded by the suitably qualified ecologist/flying-fox expert to DCCEEW via rog.southeast@environment.nsw.gov.au

d. DCCEEW must be notified via rog.southeast@environment.nsw.gov.au at least 48 hours before works within 75 metres of the edge of the occupied camp commence. Should DCCEEW request an on-site visit during the works, arrangements must be made to facilitate the request.

e. Wildlife carer organisations must be contacted within one week to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, DCCEEW must be notified immediately

9. When temperatures are predicted to be above 35°C

    a. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress including
        - Panting
        - Saliva spreading (i.e. licking themselves other than for grooming)
        - Grey-headed flying-foxes located on or within 2 metres of the ground
        - Grey-headed flying-foxes clumping around tree trunks
        - Grey-headed flying-foxes on the ground

- Grey-headed flying-foxes dying

b. Should any signs of heat-stress be noted,

   i. On-site actions that cause any disturbance to the camp must cease immediately

   ii. A Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

10. When temperatures are predicted to be above 38°C

    a. All on-site actions that cause any disturbance to the grey-headed flying-fox camp within 200 metres of the camp must cease

    b. A suitably qualified ecologist/flying-fox expert must be on-site to monitor the camp for signs of heat-stress

    c. Should any signs of heat-stress be noted a Licensed wildlife carer or wildlife carer organisation trained in flying-fox rescue must be notified immediately

11. A suitably qualified ecologist/flying-fox expert must monitor NSW Statewide alerts for flying-fox food shortage events. If there is a NSW Statewide alert for flying-fox food shortage

    a. Minimise disturbance within 200 metres of the grey-headed flying-fox camp

    b. Monitor for signs of stress

    c. Cease actions should the grey-headed flying-foxes show signs of stress

12. New grey-headed flying-fox camps that establish within 5 kilometres of the work site after the on-site actions commence may be splinter camps resulting from the on-site actions. Responses to these camps must be negotiated with DCCEEW and Wollongong City Council including the on-site responses to diminish disturbance and management of impacts if conflicts with residents or other users arise.

13. For the duration of the project:

    a. When the camp is occupied, a suitably qualified ecologist/flying-fox expert will provide weekly reports (see Annexure A) to DCCEEW via rog.southeast@environment.nsw.gov.au on commencement of the action including

       - Information about camp occupation dates
       - Grey-headed flying-fox numbers
       - The camp footprint (providing maps to show any temporal and spatial changes)
       - The distance from on-site actions to the camp
       - Signs of breeding (providing details on what signs were observed)
       - General health of flying-foxes (including signs of malnourishment)
       - Any stress incidents and responses
       - Feedback on flying-fox responses to any works undertaken within 75 metres of the edge of the camp (including details on what the works were, and what the immediate and short-term responses were)

- Report successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management

b. When the camp is unoccupied, a suitably qualified ecologist/flying-fox expert will provide monthly reports (see Annexure A) to DCCEEW via rog.southeast@environment.nsw.gov.au to confirm the camp remains unoccupied. As soon as the camp is reoccupied, DCCEEW is to be immediately notified via rog.southeast@environment.nsw.gov.au and reporting to DCCEEW reverts to weekly (as per 13a).

14. A new pond must be constructed near the camp and filled prior to any works associated with the de-watering of the existing dam, ensuring continuity of water access for the flying-foxes. That is, the new pond must be completed and be fully operational prior to the decommissioning of the existing dam. The new pond must be designed with similar characteristics to the existing human-made dam. That is, it must allow for the safe belly-dipping of flying-foxes; it must be sufficiently wide and deep, and free from vegetation or debris obstructions to allow the safe entry, skimming and egress of flying-foxes across the water surface during a belly-dipping flight.
15. Proposed vegetation removal should preferably be undertaken when the flying-fox camp is empty whenever possible. If the works proceed when the camp is occupied, please refer to Condition 8. As per the licence application, 88% of the existing roosting vegetation is to be retained for ongoing roosting habitat.
16. Trees must not be felled, lopped or have large branches removed when flying-foxes are in or within 30 metres of the tree or within a distance where they are likely to be harmed.

Note it is an offence under s2.14(4) of the *Biodiversity Conservation Act 2016* to breach a condition of a licence.



LORRAINE OLIVER

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Conservation Programs, Heritage and Regulation, Department of Climate Change, Energy, the Environment and Water
(by Delegation)
28 July 2025

Annexure A: Weekly/Monthly Grey-headed Flying-fox Reporting Template

Corrimal Cokeworks residential and commercial development

Stage of works:

Reporting period (insert dates):

Is the camp occupied? ☐ YES ☐ NO

If YES, please provide the details below.

- Number of flying-foxes present:
- Size/extent of camp footprint: (please insert an image showing the camp's footprint)
- Distance between on-site actions and the camp: (m)

Brief description of development works happening on-site during the reporting period:

What is the general state of health of the flying-foxes (including signs of malnourishment)?

If <u>any signs of breeding (Condition 4)</u> are observed, no works within 75 metres of the edge of the camp are permitted

***Note**: due to changing climatic conditions and food source availability, the flying-fox expert community no longer identifies specific grey-headed flying-fox breeding seasons or identifiable maternity or non-maternity camps*

Signs of breeding observed:

- Females in late-stage pregnancy (i.e. third trimester) or are visibly pregnant. ☐ YES ☐ NO
- Birthing or lactating females. ☐ YES ☐ NO
- Females carrying young. ☐ YES ☐ NO
- Dependant young (including young that cannot yet fly or cannot fly well enough to exit the camp of an evening, i.e. crèched young). ☐ YES ☐ NO

- Courtship and/or mating behaviours. ☐ YES ☐ NO

Were there any incident/s of harmed/dead grey-headed flying-foxes? ☐ YES ☐ NO
If YES, please provide additional details.

Were any signs of stress (Condition 5) observed? ☐ YES ☐ NO
If YES, what works were being undertaken when the signs of stress were observed? What were the responses?

What was the duration of any required stops to the works?

Did the works have to cease completely on any given day due to signs of stress? ☐ YES ☐ NO
If YES, please provide details.

Please provide feedback on flying-fox responses to any works undertaken within 75 metres of the edge of the camp (including details on what the works were, and what the immediate and short-term responses were).

Please provide information on the successes and failures in managing signs of stress to improve on-site work practices and contribute to improved broader knowledge about flying-fox camp management.