



Luddenham Advanced Resource Recovery Centre

BIODIVERSITY MANAGEMENT PLAN

Prepared for Coombes Property Group | 11 March 2025







Luddenham Advanced Resource Recovery Facility

BIODIVERSITY MANAGEMENT PLAN

Prepared for Coombes Property Group
11 March 2025

PR371

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DOCUMENT CONTROL

Revision	Date	Description	Prepared by	Reviewed by
D0	19 July 2024	For internal QA review	Element Environment	Mark Roberts
D1	22 July 2024	Comments actioned	Element Environment	Mark Roberts
D2	23 July 2024	For ECE review	Element Environment	Mark Roberts
R0	30 August 2024	ECE comments actioned	Element Environment	Mark Roberts
R1	21 November 2024	Client review	Element Environment	Coombes Property Group
R2	22 November 2024	ER & DCCEEW consultation	Element Environment	Coombes Property Group
R3	22 January 2025	For approval	Element Environment	Coombes Property Group
R4	27 January 2025	For approval	Element Environment	Coombes Property Group
R5	05 March 2025	Revised to address DPHI comments	Element Environment	Coombes Property Group

ABBREVIATIONS

Abbreviations	Definition
ARRC	Advanced Resource Recovery Centre
BC Act	<i>Biodiversity Conservation Act 2016</i>
BMP	Biodiversity Management Plan
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CPG	Coombes Property Group
DA	Development Application
DPHI	NSW Department of Planning, Housing and Infrastructure
DPI Fisheries	NSW Department of Primary Industries - Fisheries
E&H Group	NSW Department of Environment and Heritage
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
NSW	New South Wales
PCT	Plant community type - the finest level in the NSW vegetation classification hierarchy
SSD	State Significant Development
TECs	Threatened Ecological Communities
TPZ	Tree Protection Zone
WSA	Western Sydney International (Nancy-Bird Walton) Airport

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1 INTRODUCTION

The site is located at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool Local Government Area. The Advanced Resource Recovery Centre (ARRC) is approved as State significant development (SSD) application 10446 (SSD-10446).

The adjoining existing shale/clay quarry is approved by Development Approval (DA) 315-7-2003, issued by the NSW Minister for Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The site is owned by CFT No 13 Pty Ltd, a member of the Coombes Property Group (CPG).

1.1 Project Description

The broader site at 275 Adams Road is approximately 19 hectares (ha). The approved development footprint for ARRC is approximately eight hectares of the total site area. Immediately south of the proposed ARRC, there is an existing operational shale and clay quarry on the site which occupies approximately six hectares of the total site area.

The ARRC development includes the construction of the following:

- Sealed driveway access from Adams Road.
- Internal sealed roads.
- Hard surfacing for the warehouse floor and external areas.
- An approx. 13,000 m² metal clad fully enclosed warehouse, with an elevation of 16 m.
- Two site offices with the larger office located in the outside parking area and the smaller office located over the car parking area on the western side of the ARRC warehouse.
- Surface water drainage system.

The project also includes the installation of:

- Marked traffic and pedestrian areas.
- Approximately 47 parking spaces for staff and customers to the west and northwest of the ARRC warehouse.
- Four weighbridges: two inbound and two outbound weighbridges.
- Two ticket booths: one for incoming and one for outgoing vehicles.
- A wheel wash for outbound vehicles.
- Awnings attached to the warehouse at each warehouse entry/exit point.
- Separate tanks for firewater supply (above ground) and containment (below ground), and a fire suppression system.
- A stormwater management system, including rainwater tanks and an onsite detention basin.
- An on-site surface water management system consisting of a water treatment plant, onsite leachate and water detention areas.
- An on-site wastewater management system comprising a septic tank.
- Connection to services.
- Fencing and signage at the front of the site.
- Landscaping.

The construction phase outlined above is expected to take 12-18 months.

Once operational, the ARRC will operate 24 hours a day, seven days a week, and is expected to process up to 600,000 tonnes per annum (tpa) of waste for recycling, and it will dispatch up to about 540,000 tpa of recycled product.

The ARRC will accept general solid waste (non-putrescible), including building and demolition waste as well as selected commercial and industrial waste, such as wood waste, glass, plastic,

rubber, plasterboard, ceramics, bricks, concrete, metal, paper, cardboard, asphalt waste, cured concrete, soils, and excavated natural material. The ARRC will not receive any putrescible vegetative waste, garden waste, restricted solid waste, hazardous waste, special waste or asbestos waste.

Approximately 80–90% of materials will be recovered, with the remaining 10–20% of non-recyclable residues disposed of at an offsite licensed facility.

The regional context is shown in Figure 1.1, ARRC layout in Figure 1.2 and road upgrade extent in Figure 1.4.

1.2 Consent conditions

This Biodiversity Management Plan (BMP) has been prepared per the requirements set out in SSD-10446 as summarised in Table 1.1 and the approved Management and Mitigation Measures in Appendix 2 of the consent.

Table 1.1 Compliance with DA 10446

Condition no.	Condition	Section in BMP
B101	<p>Prior to clearing for construction of the Development, the Applicant must prepare a Biodiversity Management Plan (BMP) for the Development in consultation with the E&H Group to the satisfaction of the Planning Secretary. The Biodiversity Management Plan must be approved by the Planning Secretary prior to the commencement of clearing for construction and must form part of the CEMP in accordance with condition C2. The Plan must include the following:</p> <ul style="list-style-type: none"> a. be prepared by a suitably qualified and experienced ecologist; b. be prepared in consultation with E&H Group; c. include: <ul style="list-style-type: none"> i. a description of the environmental management framework that would be implemented to manage biodiversity impacts; ii. details who will be responsible for monitoring, reviewing, and implementing the plan; iii. a program to monitor and report on the effectiveness of the above measures which includes tailored, quantitative performance measures and targets, completion criteria, monitoring and trigger points for corrective action that adhere to the SMART principles (specific, measurable, achievable, realistic, timely); and iv. revegetation of the riparian zone of Oaky Creek. 	<p>Signature page</p> <p>Section 1.6.2</p> <p>Section 3 and 4</p> <p>Section 4.10 Section 5</p> <p>Section 5</p> <p>Section 4.1 Figure 1.3 Figure 2.1</p>
B102	<p>The Applicant must:</p> <ul style="list-style-type: none"> b. not commence any clearing or construction of the Development until the Biodiversity Management Plan is approved by the Planning Secretary; and c. implement the most recent version of the Biodiversity Management Plan approved by the Planning Secretary. 	Noted
C1	<p>Management plans required under this consent must be prepared in accordance with relevant guidelines and include:</p> <ul style="list-style-type: none"> a. detailed baseline data b. details of: 	<p>Section 2</p> <p>Section 4</p>

Condition no.	Condition	Section in BMP
	<ul style="list-style-type: none"> i. the relevant statutory requirements (including any relevant approval, licence of lease conditions); ii. any relevant limits of performance measures and criteria; and iii. the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the Development or any management measures 	Section 3 Table 3.1 Section 4.2.1 Section 3
	c. a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria	Section 4
	d. a program to monitor and report on the: <ul style="list-style-type: none"> i. impacts and environmental performance of the Development; and ii. effectiveness of the management measures set out in pursuant to paragraph c above 	Section 5
	e. a contingency plan to manage any unpredicted impacts and their consequences and the ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible	Section 5.6
	f. a program to investigate and implement ways to improve the environmental performance of the Development over time	Section 5
	g. a protocol for managing and reporting any: <ul style="list-style-type: none"> i. incident and any non-compliance (specifically including and exceedance of the impact assessment criteria and performance criteria; ii. complaint; iii. failure to comply with statutory requirements; and 	Section 5
	h. a protocol for periodic review of the plan.	Section 5

1.3 Objective

This BMP's purpose is to identify, manage, and mitigate potential environmental impacts for activities proposed to be undertaken during the construction/operation of the ARRC and associated road upgrades.

Specifically, this BMP outlines:

- measures to protect and maintain rehabilitation carried out in the Oaky Creek riparian zone;
- measures to protect other native vegetation on site outside of the approved operational areas;
- measures to ensure vegetation cover is maintained on the noise attenuation bunds;
- a protocol for monitoring and relocating native fauna;
- a protocol for a preclearance inspection of the native vegetation within the approved impact footprint including the salvage of material for use in rehabilitation;
- measures to minimise the attraction of wildlife; and
- a weed control measures.

The BMP applies to all native vegetation and potential habitat for native species (including water bodies) on the site.

1.4 Roles and responsibilities

The BMP and supporting documentation will require endorsement by CPG and the Environmental Representative before commencement of construction. The BMP will be included in the

Construction Environmental Management Plan (CEMP) and made available to all personnel and sub-contractors via the project document control management system.

The document is uncontrolled when printed. One controlled hard copy of the CEMP and supporting documentation will be maintained at the project site and be electronically available at the site office.

Registered copies of the BMP will also be distributed to:

- Environmental Representative;
- Project Director;
- Construction Manager;
- Site Manager;
- Project Environment Manager; and
- Stakeholder & Community Relations Manager.

1.5 Scope

This BMP has been prepared to demonstrate compliance with the DA approval.

The approved works as shown in Figure 1.4 includes the following impacts to biodiversity:

- remove 0.42 hectares of native vegetation;
 - 0.11 ha is BC Act listed Cumberland Plain Woodland CEEC (PCT 849) and
 - 0.31 ha is BC Act listed Swamp Oak Floodplain Forest EEC (PCT 1800);
- remove pond 1 and pond 4 (Figure 1.5);
- replace pond 4 with a stormwater detention basin in the same location. Pond 4 is to be netted to reduce the risk of bird or bat strikes on planes utilising the airport.

The approval requires the applicant to:

- avoid direct impacts to Oaky Creek riparian corridor (Figure 1.3);
- avoid works on the Elizabeth Drive bridge over Cosgrove Creek, which would have resulted in impacts to the adjoining vegetation;
- minimise impacts to PCT 849, by avoiding areas outside the road corridor;
- minimise impacts to PCT 1800, by only impacting on small areas of the fragmented habitat and vegetation present within the road corridor;
- minimise impacts to PCT 1800, by avoiding impacts to the vegetation on the south-western boundary;
- utilise the existing cleared areas wherever feasible; and
- design a water management system to minimise potential impacts to Oaky Creek.

1.6 Consultation

This BMP has been prepared in consultation with the Biodiversity, Conservation and Science (BCS) Group of the Department of Climate Change, Energy, the Environment and Water (DCCEE) in accordance with Condition B101(b) of SSD-10446.

1.6.1 Consultation process

The draft BMP (dated 22 November 2024) was submitted to DCCEE on 2 December 2024 via the Major Projects Portal for review and consultation. Formal written advice was received from BCS on 20 December 2024.

1.6.2 Regulator's comments and responses

Table 1.1 summarises key comments provided by BCS and how they have been addressed in this BMP.

Table 1.2 Biodiversity, Conservation and Science group comments

BCS comments	Response
Baseline monitoring report should be included, with six-monthly monitoring during construction instead of annual monitoring.	<p>The Biodiversity Development Assessment Report (BDAR) completed for the EIS provides a solid baseline. Section 2 of this plan has been updated to include plant community type descriptions for the ARRC project.</p> <p>The broader site at 275 Adams Road is approximately nineteen (19) hectares (ha). The approved development footprint for ARRC is approx. three (3) hectares of the total site area subject to SSD 10446. Immediately to the south of the proposed ARRC, there is an existing operational shale and clay quarry on the site subject to DA 315-7-2003. The previous quarry operator has carried out the required revegetation. The revegetation within the riparian corridor has been fenced to prevent access and exclude inadvertent impacts from current quarrying operations.</p> <p>A Biodiversity Management Plan (BMP (EMM, 2021) has been prepared in accordance with the requirements set out in DA 315-7-2003 (as modified), Schedule 4, Conditions 33–36. Under this BMP the following measures are being implemented:</p> <ul style="list-style-type: none"> ▪ Revegetation of the riparian zone of Oaky Creek; ▪ Protection, establishment and maintenance of the riparian zone; ▪ Protection of remnant native vegetation; ▪ Restoration of any areas within the riparian zone disturbed by the development (quarry operation). <p>Oakey Creek riparian zone (refer to Figure 2.1 of this plan) is outside of the ARRC development footprint and will continue to be managed in accordance with the approved BMP (EMM, 2021) and Rehabilitation Management Plan for Luddenham Clay / Shale Mine developed to satisfy requirements of MLA 592 (Act 1992).</p>
Revegetation and baseline reporting for Oaky Creek riparian zone required, including PCT classification, weed assessment, and bush regeneration needs.	<p>All construction and operational aspects of the ARRC are located outside the Oaky Creek riparian zone (refer to Figure 1.3) and Figure 2.1 of this plan). The Oaky Creek riparian zone will remain a No Go Zone during and after construction.</p> <p>The previous quarry operator has carried out the required revegetation. The revegetation within the riparian corridor has been fenced to prevent access and exclude inadvertent impacts from current quarrying operations.</p> <p>Section 2 of this plan has been updated to include plant community type descriptions for the ARRC project.</p> <p>Oakey Creek riparian zone and site outside of the ARRC development footprint will continue to be managed in accordance with the approved BMP (EMM, 2021) and the Rehabilitation Management Plan for Luddenham Clay / Shale Mine developed to satisfy requirements of MLA 592 (Act 1992).</p> <p>Following the completion of quarry operations in December 2024 the following actions will be carried out to revegetate the areas of quarry disturbance in the south-east corner of the site. Restoration actions will include:</p> <ul style="list-style-type: none"> ▪ selection of species associated with PCT 1800 (Swamp Oak open forest on river flats of the Cumberland Plain) with reference to Western Sydney Airport and Aerotropolis specific guidance material on preferred species to minimise wildlife attraction; ▪ revegetation where practicable will occur during the months of March to May to facilitate optimal climatic conditions for plant establishment and growth; ▪ weed assessment and control measures

BCS comments	Response
Guidance is needed for plant species selection, planting density, and monitoring to meet Vegetation Integrity (VI) benchmarks.	<p>The previous quarry operator has carried out the required revegetation. The revegetation within the riparian corridor has been fenced to prevent access and exclude inadvertent impacts from current quarrying operations.</p> <p>All construction and operational aspects of the ARRC are located outside the Oaky Creek riparian zone (refer to Figure 1.3 and Figure 2.1 of this plan). This BMP focuses on protecting the riparian zone during construction and operation of the ARRC.</p> <p>Oakey Creek riparian zone and site outside of the ARRC development footprint will continue to be managed in accordance with the approved BMP (EMM, 2021) and the Rehabilitation Management Plan for Luddenham Clay / Shale Mine, which was developed to satisfy the requirements of MLA 592 (Act 1992).</p>

1.6.3 Ongoing engagement

DCCEEW's feedback has been incorporated into this BMP to ensure compliance with Condition B101 and best-practice biodiversity management. CPG will continue to engage with DCCEEW, as required during implementation, monitoring, and reporting.

Figure 1.1
Regional context

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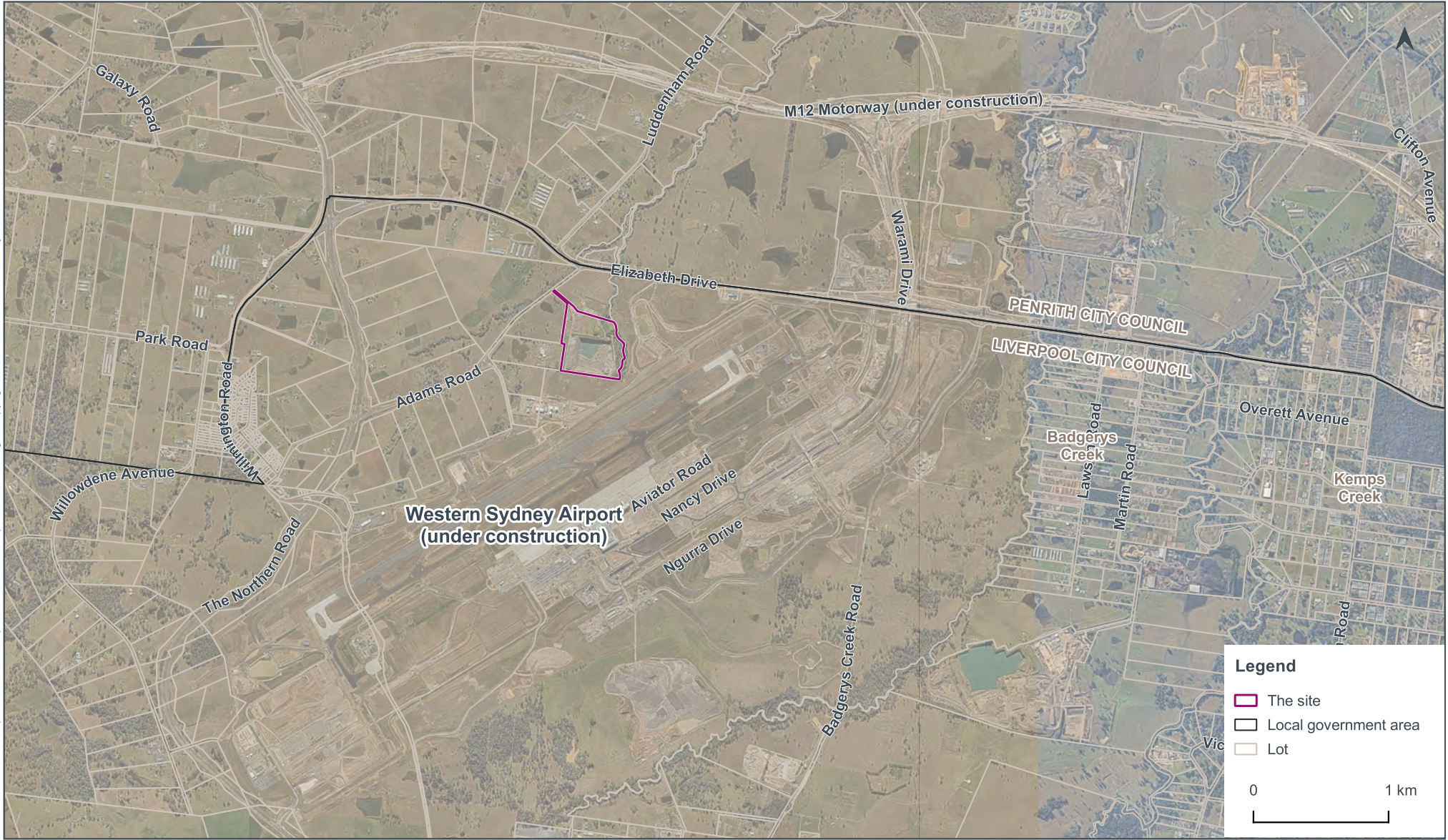


Figure 1.2
ARRC layout

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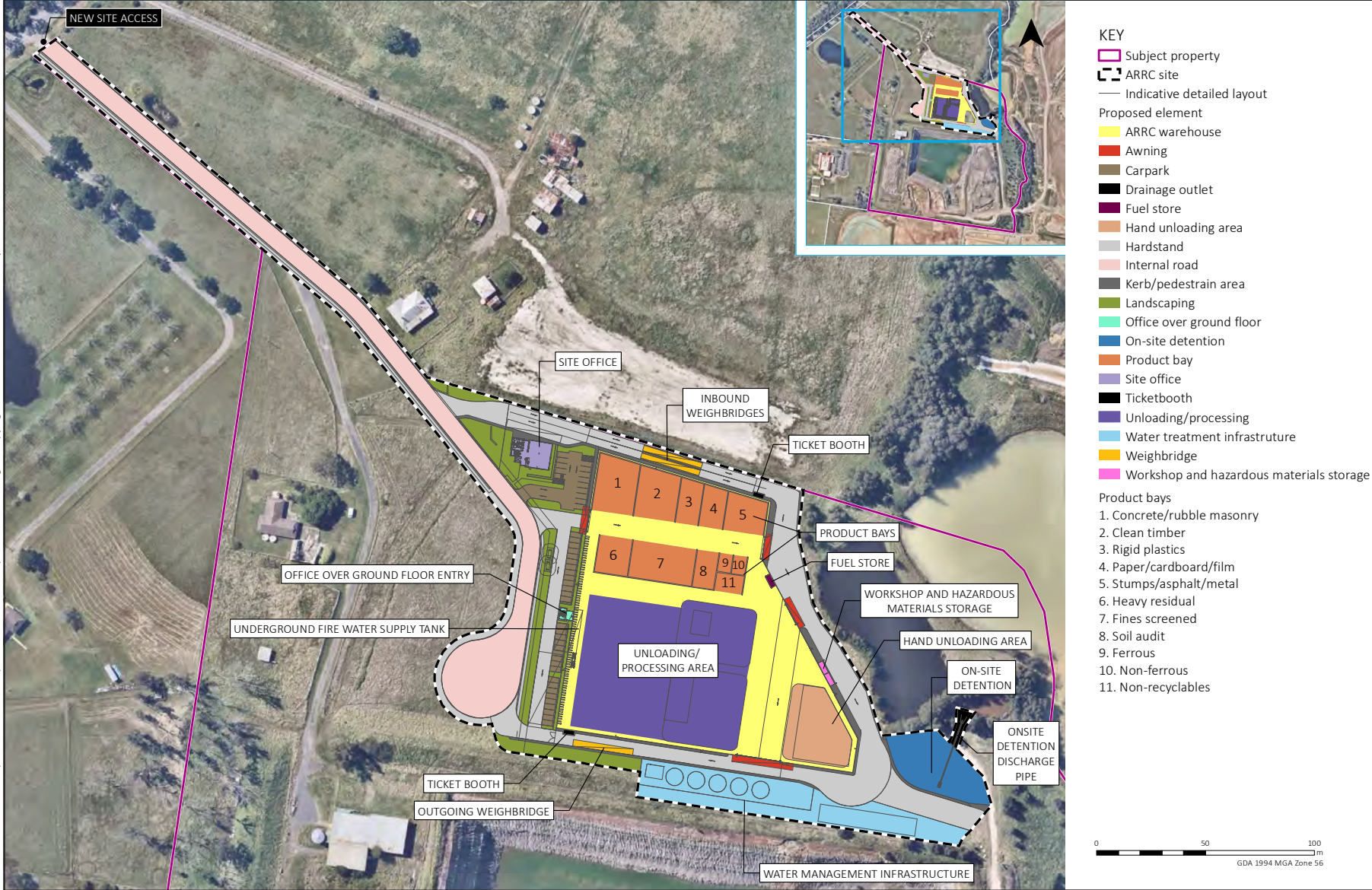


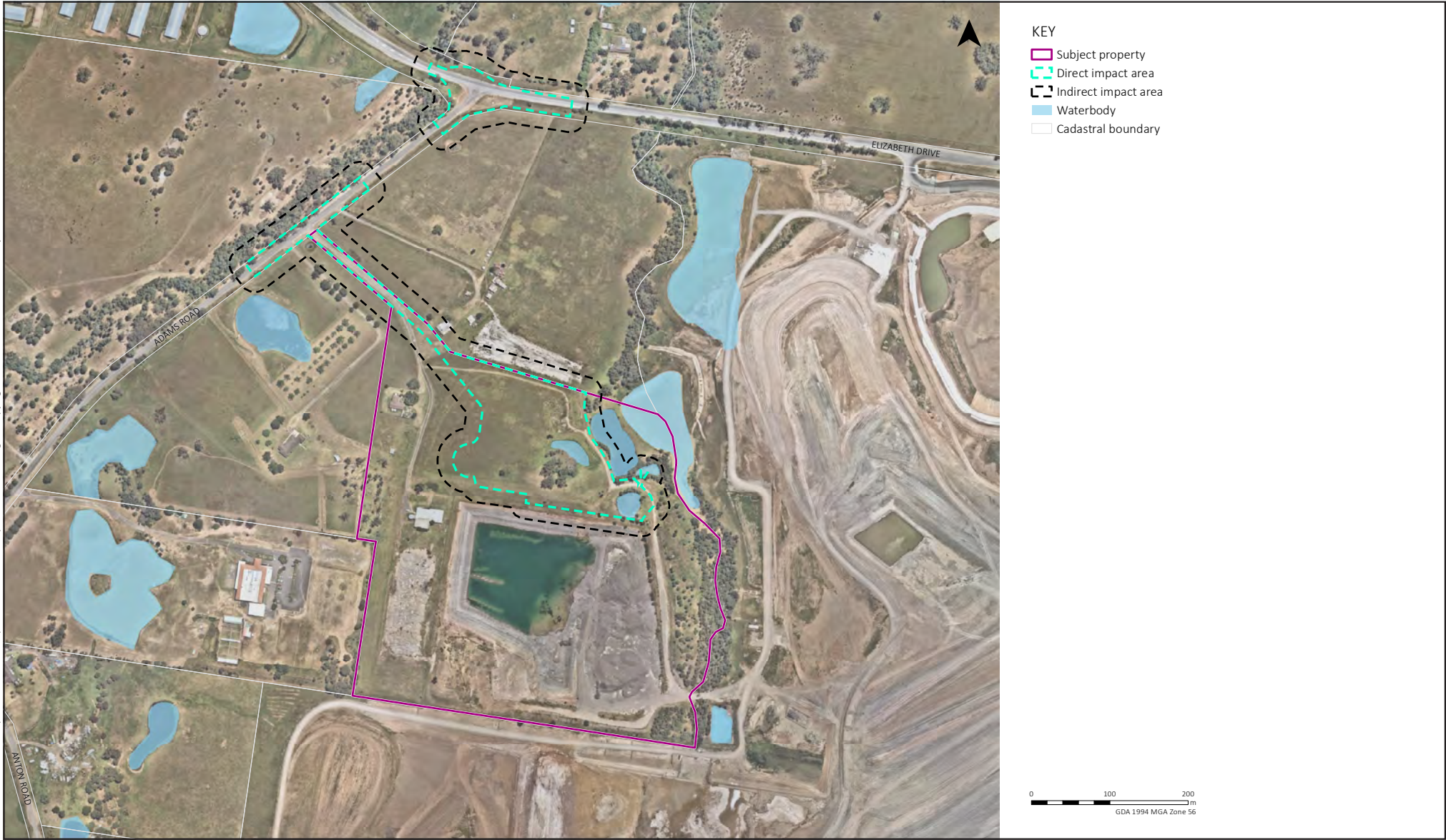
Figure 1.3
Consolidated constraints map

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Figure 1.4
Approved impact areas

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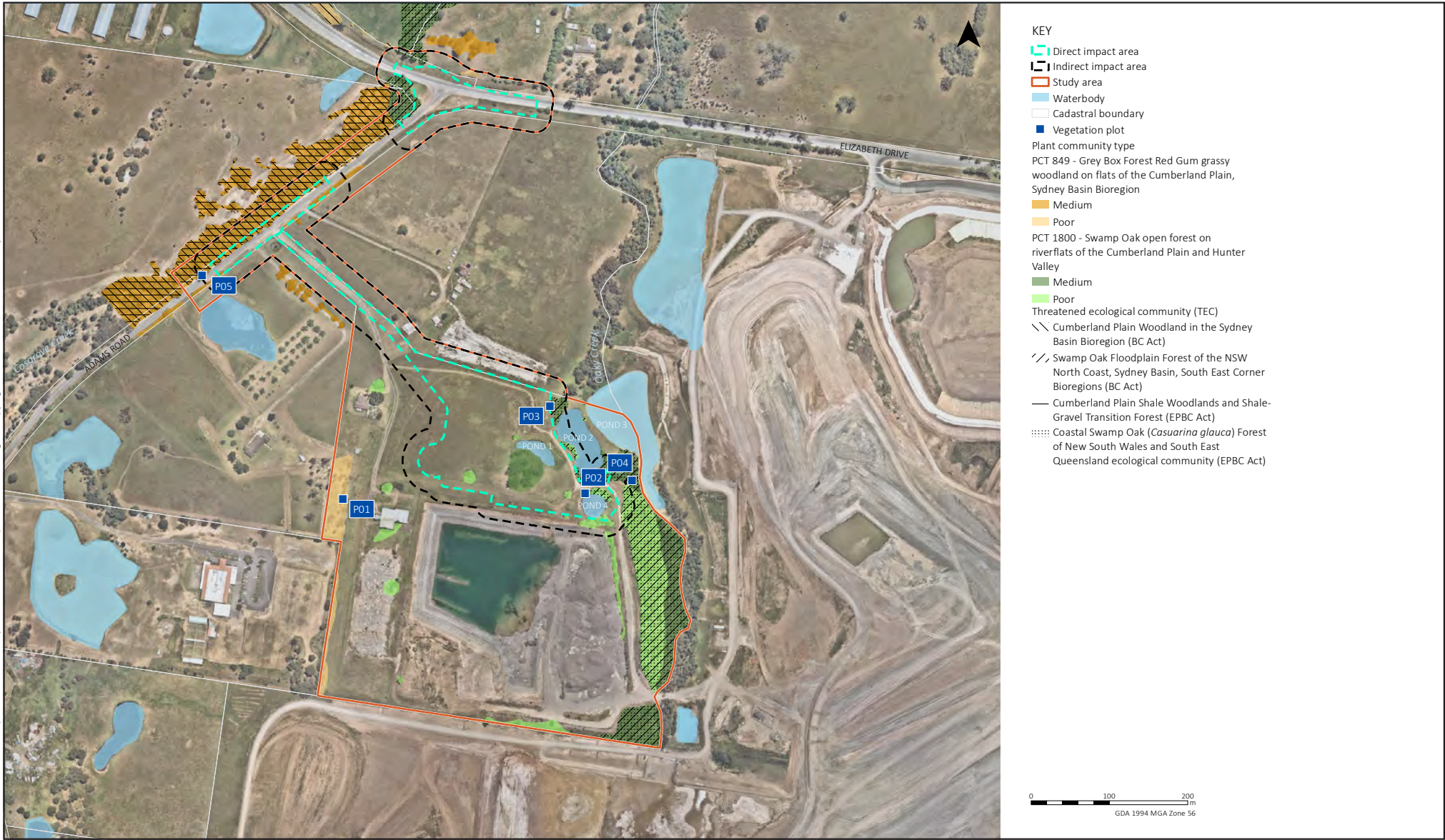


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Source: Luddenham ARRC Submissions Report, EMM, 2021

Figure 1.5
Ponds and existing vegetation

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2 EXISTING ENVIRONMENT

This section provides an overview of the site characteristics and addresses Condition C1(a) of the development consent by presenting baseline environmental data derived from the Environmental Impact Statement (EIS). The information includes key ecological attributes, vegetation communities, and threatened species relevant to the Luddenham Advanced Resource Recovery Centre.

2.1 Location and setting

The development is within the Sydney Basin Interim Biogeographic Regionalisation of Australia (IBRA) region and Cumberland subregion. The subject property is located within the upper reaches of the Hawkesbury River catchment, with Oaky Creek running along the eastern boundary.

The locality is considered highly cleared and fragmented, with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land. The subject property itself has previously been utilised for quarrying and agricultural land uses. The Western Sydney International (Nancy-Bird Walton) Airport (WSA) site is located immediately to the east and south of the subject property, and its construction has, or will, remove native vegetation across the footprint of the WSA during the course of that project.

There are no areas of outstanding biodiversity value, as defined in Part 3 of the NSW *Biodiversity Conservation Act 2016* (BC Act) within a 1,500 m buffer of the subject property.

2.2 Vegetation

Site investigations, including the determination of vegetation communities, were conducted as part of the EIS using the methods described in Section 5.2 of the BAM (OEH 2017). Table 2.1 describes the PCTs identified, their condition, listing status, and extent.

Cleared or exotic vegetation covers 22.61 ha of the study area. The exotic vegetation lacks a canopy and only occasionally contains a midstorey, which is dominated by African Boxthorn (*Lycium ferocissimum*), Blackberry (*Rubus fruticosus aggregate*) and European Olive (*Olea europaea*). The ground layer supports a sparse and patchy cover of native species, primarily Kangaroo Grass (*Themeda triandra*) and Speargrass (*Austrostipa* spp.). However, the dominant species within exotic areas are Kikuyu (*Pennisetum clandestinum*) and Rhodes Grass (*Chloris gayana*).

Other less common species present include Fennel (*Foenecium vulgare*), African Lovegrass (*Eragrostis curvula*), Salsify (*Tragopogon porrifolius*), Bull Thistle (*Cirsium vulgare*), Sow Thistle (*Sonchus oleraceus*), Prairie Grass (*Bromus catharticus*), Common Sida (*Sida rhombifolia*), Onion Grass (*Romulea rosea*), Fleabane (*Conyza* spp.), Slender Celery (*Cyclospermum leptophyllum*), Hedge Mustard (*Sysimbrium officinale*) and Flat weed (*Hypochaeris radicata*).

Table 2.1 Plant Community Types, condition, status and extent

PCT ID	PCT Name	Condition	Association with BC Act TEC	Association with EPBC Act TEC ¹	Direct impact area (ha)	Indirect impact area (ha)	Study Area (ha)
849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Medium	Cumberland Plain Woodland in the Sydney Basin Bioregion CEEC	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest CEEC	0.11 (0.09)	0.51 (0.48)	0.92 (0.84)
		Poor		Not associated	0	0.01	0.037
1800	Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Medium	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions ECC	Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and Southeast Queensland EEC	0.24 (0.05)	0.35 (0.35)	1.44 (1.24)
		Poor			0.07 (0.03)	0.12 (0.07)	1.23 (0.88)
-	Cleared or exotic plantings	n/a	nil	nil	4.13	8.40	22.61
Total:					4.24	8.93	23.90

¹ Area in brackets is area of vegetation which meets EPBC Act condition thresholds, see Figure 4.1 for location of vegetation considered to be consistent with EPBC Act vegetation community definitions.

2.2.1 Plant community type descriptions

Descriptions of the PCTs are provided in the tables below.

PCT 1800 – Cumberland Swamp Oak riparian forest description	
PCT ID	1800
Common name	Cumberland Swamp Oak riparian forest
Condition classes	Two vegetation zones were mapped within the subject property: Medium Poor
Extent within the study area	Total area 2.67 ha 1.44 ha (medium) 1.23 ha (poor)
Extent within subject land	Total area 0.78 ha 0.59 ha (medium) 0.19 ha (poor)
Description	The below description relates to vegetation surveyed within the study area. The poor vegetation zone inside the subject property – but outside the ARRC site – includes a greater variety of canopy and midstorey species, such as Cabbage Gum (<i>Eucalyptus amplifolia</i>), Woollybutt (<i>E. longifolia</i>) and an unknown Ironbark (<i>Eucalyptus</i> sp.). The greater diversity appears to

PCT 1800 – Cumberland Swamp Oak riparian forest description

	<p>have resulted from previous planting of native species within the 'riparian zone' as part of the Vegetation Management Plan prepared under the quarry consent (UBM Ecological 2009). The PCT comprises a canopy dominated by Swamp Oak. The midstorey is sparse, comprising African Boxthorn (<i>Lycium ferocissimum</i>) and Moth Vine (<i>Araujia sericifera</i>) in the ARRC site, and Native Blackthorn (<i>Bursaria spinosa</i>) and Paperbark (<i>Melaleuca</i> sp.) in the roadside area. The groundlayer is dominated by exotic species. Exotic grasses are: Kikuyu (<i>Cenchrus clandestinus</i>), Paspalum (<i>Paspalum dilatatum</i>) and Marsh Bristlegrass (<i>Setaria parviflora</i>). Exotic forb species are: Alligator Weed, Black-berry Nightshade (<i>Solanum nigrum</i>), Bridal Creeper (<i>Asparagus asparagoides</i>) and Paddy's Lucerne (<i>Sida rhombifolia</i>). Native grasses and forbs comprise Common Couch (<i>Cynodon dactylon</i>), an Oxalis (<i>Oxalis exilis</i>), Climbing Saltbush (<i>Einadia</i> spp.), Indian Pennywort (<i>Centella asiatica</i>), Kidney Weed (<i>Dichondra repens</i>), Red Grass (<i>Bothriochloa macra</i>), Slender Rat's Tail Grass (<i>Sporobolus elongatus</i>), Variable Glycine (<i>Glycine tabacina</i>), Weeping Grass (<i>Microlaena stipoides</i>), Cockspur Flower (<i>Plectranthus parviflorus</i>) and Wiry Spurge (<i>Phyllanthus virgatus</i>).</p>
Survey effort	<p>Three plots/transects within the subject property: Medium: 2 plots (plots 3 and 4) Poor: 1 plot (plot 2) One plot occurs within the impact area: Medium: 1 plot</p>
Condition description	<p>The community is in medium to poor condition with a high cover of introduced plant species due to past and current grazing activities. Vegetation zones were delineated largely based off whether the canopy was dense or sparse</p>

PCT 1800 – Cumberland Swamp Oak riparian forest

Characteristic species used for identification of PCT	<p>This PCT could align with PCT 1800 or PCT 835. According to the NSW VIS Classification (OEH 2014), PCT 1800 Cumberland Swamp Oak Riparian Forest (Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter Valley) is found on the riverflats of the Cumberland Plain in western Sydney and in the Hunter Valley. The distinguishing feature is the prominent stands of Swamp Oak found along or near streams. This community features an open grassy and herbaceous understorey, as is typical of riverflat forests.</p> <p>It may be that this is a pioneering community that is re-establishing following clearing. It is known that many creeklines in western Sydney are slightly saline, particularly during drought (Benson and Howell 1990).</p> <p>The NSW VIS Classification for PCT 835 Cumberland River-flat Forest (Forest Red Gum - Roughbarked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion) is found on broad alluvial flats of the Hawkesbury and Nepean River system. It also forms narrower ribbons alongside streams and creeks that drain the Cumberland Plain. Typically, the canopy includes one of either rough-barked apple (<i>Angophora floribunda</i>) or broad-leaved apple (<i>Angophora subvelutina</i>) and one or both of forest red gum (<i>Eucalyptus tereticornis</i>) and cabbage gum (<i>Eucalyptus amplifolia</i>). The understorey within this riverflat forest is characterised by an occasional sparse to open small tree stratum of paperbark (<i>Melaleuca</i> spp.) and wattles (<i>Acacia</i> spp.).</p>
Justification of evidence used to identify the PCT	<p>PCT 1800 is chosen because: the study area is on the Cumberland Plain;</p> <ul style="list-style-type: none"> a canopy of Swamp Oak is characteristic of this PCT. The description of Cumberland Riverflat Forest in the Sydney Metro veg classification, lists Swamp Oak as an 'uninformative' (nondiagnostic) species sometimes found (22% frequency) in the community; the area mapped is regularly inundated, providing swamp conditions; and

PCT 1800 – Cumberland Swamp Oak riparian forest

	<ul style="list-style-type: none"> analysis of plot data against key characteristic species provides: – 20% (Canopy), 7% (Understorey) and 11% (Groundlayer), noting that VIS treats Swamp Oak as both a canopy and understorey species; otherwise, the score for understorey would be 0%. <p>The description of PCT 1800 acknowledges that “It may be that this is a pioneering community that is re-establishing following clearing”.</p> <p>In conclusion, PCT 1800 has been chosen as the current best fit, based on landform subject to periodic inundation and species currently present, in particular that the vegetation is dominated by Swamp Oak. However, it is noted that the vegetation has likely colonised responding to past clearing; and is probably vegetation in a transitional state between PCT 1800 and PCT 835.</p>
Status	<p>PCT 1800 Cumberland Swamp Oak riparian forest Bioregion is associated with the BC Act Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community listing and EPBC Act listing as Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland Endangered Ecological Community. The PCT aligns with the BC Act listing because:</p> <ul style="list-style-type: none"> it occurs on the Cumberland plains; it comprises a dense tree canopy; it is regularly waterlogged; and the canopy comprises Swamp Oak. <p>The PCT aligns with the EPBC Act listing because:</p> <ul style="list-style-type: none"> the patch is greater than 2 ha; Non-native species comprise less than 80% of total understorey vegetation cover; and Transformer species (eg. Kikuyu) comprise less than 50% of total understory vegetation cover.
Estimate of percent cleared value of PCT within NSW	60%

PCT 1800 – Cumberland Swamp Oak riparian forest

Cumberland Swamp Oak riparian forest within the ARRC site (Medium condition - plot ID P03).



PCT 849 - Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion description

PCT ID	849
Common name	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
Condition classes	Two vegetation zones were mapped within the study area: <ul style="list-style-type: none"> ▪ Medium ▪ Poor
Extent within the study area	Total area: 1.29 ha 0.92 ha (medium) 0.37 ha (poor)
Extent within subject land	Total area: 0.63 ha 0.62 ha (medium) 0.01 ha (poor)
Description	The canopy in the poor condition vegetation comprises dying Grey Box (<i>Eucalyptus moluccana</i>). It is assumed that they are dying from either the drought conditions or from dieback. Due to the absence of fruiting material, adult leaves or a healthy tree form, identification was based on juvenile leaves, bark, and the local species in the area. Trees inspected in the road corridor just outside the property are predominantly Grey Box. The canopy in the medium condition vegetation is much healthier and is dominated by Grey Box. It also comprises Kurrajong (<i>Brachychiton populneus</i>), River


PCT 849 - Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion description

	<p>Oak (<i>Casuarina cunninghamiana</i>), Forest Red Gum (<i>Eucalyptus tereticornis</i>) and an unknown Stringybark (<i>Eucalyptus</i> sp.). The midstorey is absent in the poor condition vegetation, and dense in the medium condition vegetation. Midstorey vegetation comprises mainly native Blackthorn, and exotic European Olive (<i>Olea europaea</i> subsp. <i>cuspidata</i>) and African Boxthorn. The groundlayer is co-dominated by exotic grass and forb species. Exotic grass and grass-like species include: Kikuyu, Rhodes Grass (<i>Chloris gayana</i>), Paspalum and Marsh Bristlegrass, African Lovegrass (<i>Eragrostis curvula</i>), and Phalaris (<i>Phalaris aquatica</i>), which are all commonly associated with exotic grasslands and are often cultivated. Exotic forb and vine species are Moth Vine, Turnip Weed (<i>Rapistrum rugosum</i>), Paddy's Lucerne (<i>Sida rhombifolia</i>), Small-flowered Mallow (<i>Malva parviflora</i>), Lamb's Tongues (<i>Plantago lanceolata</i>), Apple of Sodom (<i>Solanum linnaeanum</i>), Black-berry Nightshade, Onion Grass (<i>Romulea rosea</i>) and Shore Vervain (<i>Verbena caracasana</i>). The native grasses, grass-like species and forbs include: Common Couch, Weeping Grass, Kangaroo Grass, Tick-trefoil (<i>Desmodium</i> sp.), Old Man's Beard (<i>Clematis aristata</i>), Saltbush (<i>Einadia</i> spp.), Early Spring Grass (<i>Eriochloa pseudoacrotricha</i>), Kidney Weed (<i>Dichondra repens</i>), Paspalidium distans, Senecio spp., Dock (<i>Rumex</i> spp.), Toad Rush (<i>Juncus bufonius</i>), and Cockspur flower (<i>Plectranthus parviflorus</i>).</p>
Survey effort	<ul style="list-style-type: none"> Medium: 1 plot (plot 5) Poor: 1 plot (plot 1)
Condition description	<p>The community is in poor and medium condition with a high cover of introduced or cultivated plant species. In poor condition areas, the overstorey consists of dead and dying trees, where the healthier specimens are covered in large juvenile leaves, but no adult leaves are visible.</p>

PCT 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

	<p>Medium condition areas of the community have a mixed native groundlayer and understorey. The native canopy is present on the western side of Adams Road and northern side of Elizabeth Drive, but absent on the eastern side of Adams Road. Surrounding land use (mostly grazing) and associated edge impacts contribute to the degraded condition of this PCT.</p>
Characteristic species used for identification of PCT	<p>The canopy is dominated by Grey Box, which is a dominant species of both PCT 849 and 850. The midstorey is sparse. The groundlayer includes Kidney Weed (which is characteristic of PCT 849 and 850) and Paspalidium distans (characteristic of PCT 849 only).</p>
Justification of evidence used to identify the PCT	<p>According to the NSW VIS Classification (Version 2.1.9), grassy woodlands in the Cumberland Plains are likely to fit one of two PCTs, which together are known as Cumberland Plain Woodland in the Sydney Basin Bioregion EEC: PCT 849 and 850. These PCTs are very similar. Both comprise a canopy of two to three dominant species, of which Grey Box is one. The elevation is 69 m, which could fit either PCT description. PCT 849 was chosen because:</p> <ul style="list-style-type: none"> of the lack of Hickory Wattle (<i>Acacia implexa</i>) within the study area (which the VIS specifically states is a characteristic distinction between the two PCTs); of lack of evidence of shale; the analysis of plot data against key characteristic species fits PCT 849 best: – PCT 849: 100% (canopy), 100% (midstorey), 26% (groundlayer); and – PCT 850: 66% (canopy), 50% (midstorey), 33% (groundlayer).
Status	<p>PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion is associated with the BC Act listing Cumberland Plain Woodland in the Sydney Basin Bioregion Critically Endangered Ecological Community and the EPBC Act listing as Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest Critically Endangered Ecological Community. The PCT aligns with the BC Act listing because:</p> <ul style="list-style-type: none"> it occurs on the Cumberland plains; it has an open tree canopy;

PCT 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

	<ul style="list-style-type: none"> ▪ it contains a continuous groundcover dominated by grasses and herbs; and ▪ the canopy is dominated by Grey Box. <p>The Medium-condition areas of the PCT comprise multiple patches throughout the study area. The vegetation patch to the west of Adams Road aligns with the EPBC Act listing because:</p> <ul style="list-style-type: none"> ▪ the canopy is dominated by native trees (Grey Box and sparse Forest Red Gum); ▪ native trees in the patch provide at least 10% cover; ▪ the patch is greater than 5 ha in size; and ▪ at least 30% of the cover of perennial understorey vegetation is native. <p>The other patches of Medium-condition PCT do not align with the EPBC Act because:</p> <ul style="list-style-type: none"> ▪ One patch lacks 10% overstorey foliage cover (ie. the very thin patch on the east side of Adams Road); and ▪ All other patches are each less than 0.5 ha (ie. All other patches of PCT 849 not discussed above). <p>The Poor-condition areas of the PCT do not align with the EPBC Act listing because they are less than 0.5 ha in area, are isolated from other patches of vegetation, and native midstorey is absent</p>
Estimate of percent cleared value of PCT within NSW	93%
Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion within the subject property (Poor condition – plot ID P01).	

2.3 Threatened species

No threatened flora species were recorded across the study area.

Targeted surveys were undertaken for the Green and Golden Bell Frog, targeting the ponds, exotic grasslands, and current quarry pit, but the species was not detected. However, due to a lack of access to potential habitat along Cosgroves Creek to the west of Adams Road, the presence of the species in this area was assumed.

Southern Myotis (*Myotis macropus*) was recorded within the subject property, foraging over ponds along Oaky Creek and roosting within a culvert over Oaky Creek, underneath the old eastern access road. This culvert sits within Commonwealth land that is part of the WSA. None of the activities on the site propose changes to the culvert, and the old access road has been fenced off and will no longer be utilised due to the WSA development.

A shed associated with the quarry occurs to the southwest of the ARRC site. This building is an open large tin shed, with no roof voids with no features considered likely to support fauna species.

A bridge crosses Oaky Creek in the southeast of the subject property and is considered to provide potential microbat habitat.

2.4 Watercourses and water bodies

The site is located within the Oaky Creek catchment. The headwaters of Oaky Creek form the eastern boundary of the site. Upstream of the site, the Oaky Creek catchment is heavily modified by the construction of the WSA. The creek continues downstream of the site for approximately 0.9 km before joining Cosgroves Creek.

There is an online dammed storage on Oaky Creek which does not form part of the quarry's water management system (shown as pond 3 on Figure 1.5).

There are three water bodies on or adjacent to the site. These ephemeral dams and swamps are shown as Ponds 1, 2 and 4 in Figure 1.5. The ground layer is either absent or dominated by wetland plants, depending on the frequency and duration of flooding events.

Oaky Creek riparian corridor extends 30 m from between the eastern edge of the site down to the banks of Oaky Creek (as shown in Figure 1.3). The riparian corridor has been restored, fenced and continually monitored in accordance with the BMP v4 for the quarry operations as approved under DA 305-7-2003 (as modified). There are no works proposed under this DA within the Oaky Creek riparian corridor.

Figure 2.1
Oaky Creek riparian zone revegetated under DA 315-7-2003

Luddenham Advanced Resource Recovery Centre
 BIODIVERSITY MANAGEMENT PLAN

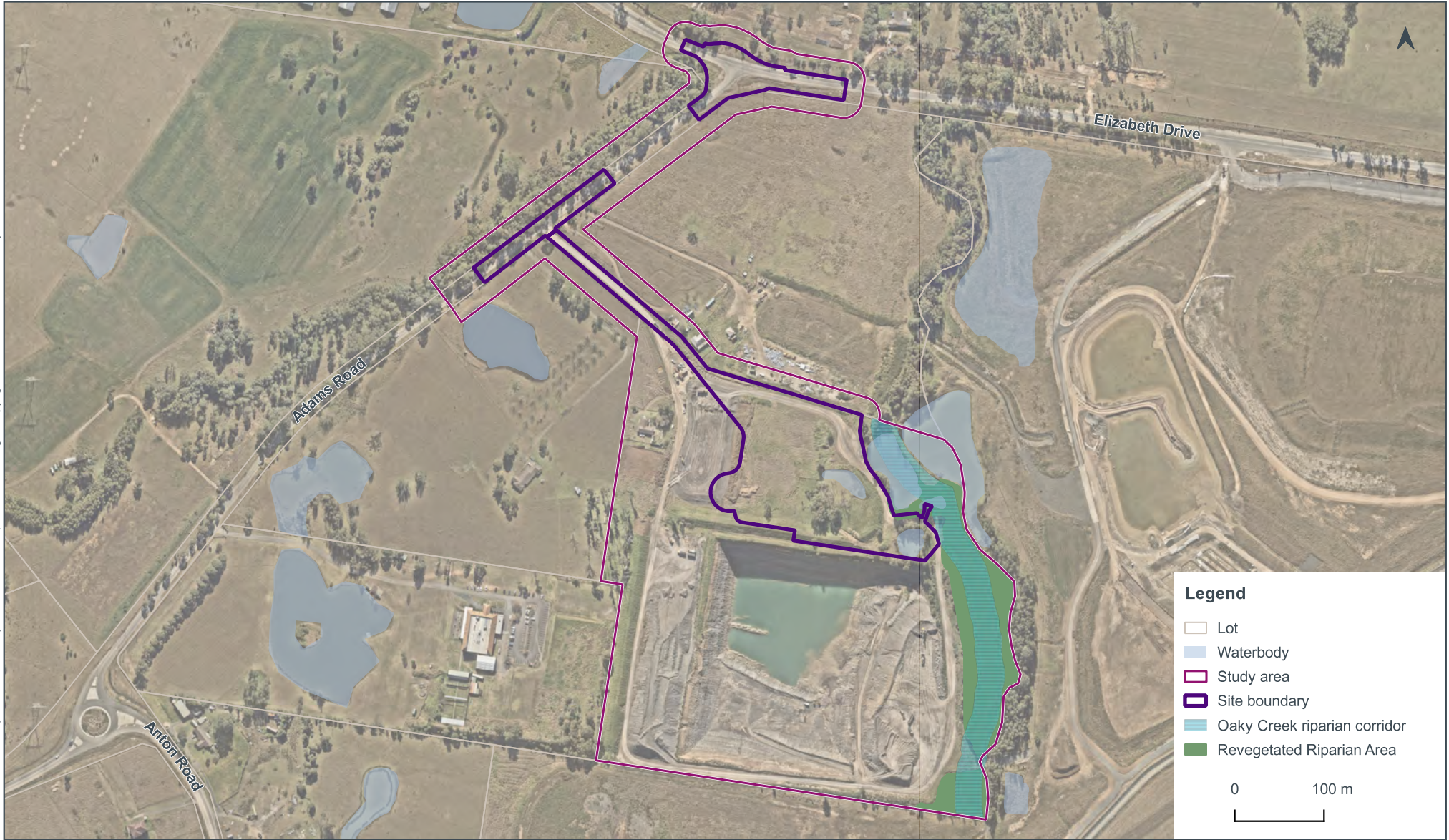


Figure 2.2
Green and Golden Bell Frog

Luddenham Advanced Resource Recovery Centre
BIODIVERSITY MANAGEMENT PLAN

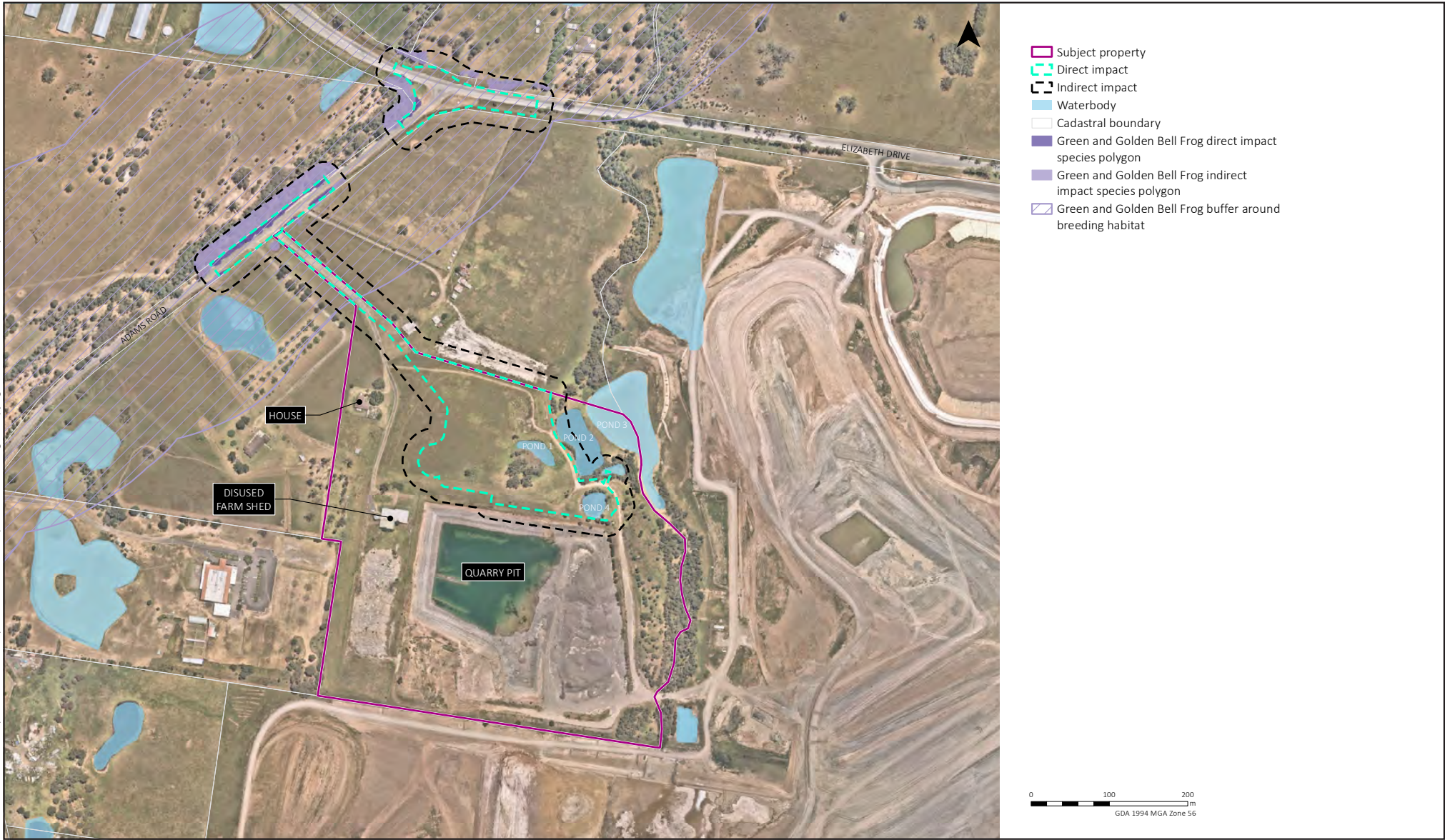
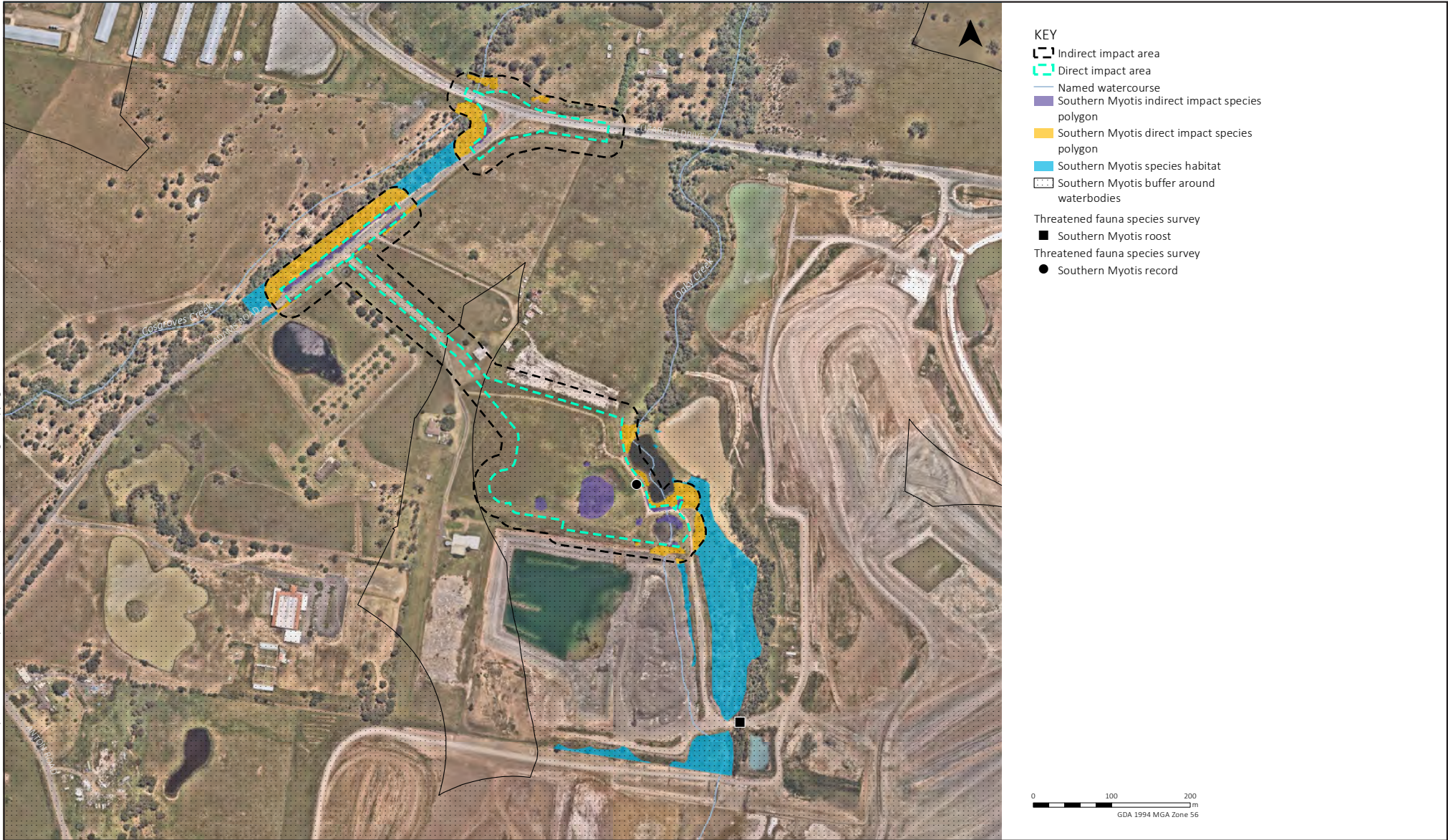


Figure 2.3
Southern Myotis

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Source: Revised Biodiversity Development Assessment Report, EMM, 2021

Figure 2.4
Large-eared Pied Bat

Luddenham Advanced Resource Recovery Centre
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Source: Revised Biodiversity Development Assessment Report, EMM, 2021

3 PERFORMANCE INDICATORS

3.1 Maintenance and monitoring

The Project Environment Manager will oversee the following:

- monitor the health of retained vegetation and seek advice from an AQF5 arborist if vegetation shows signs of stress (discolouration, die back, wilting);
- at least weekly inspections of exclusion zones and tree protection zones. Repairs to fencing are made where required;
- additional checks should be undertaken following storms where there is a higher risk of material falling on fencing;
- inspections of exclusion zones should form part of regular site environmental checks;
- regular assessments of the adequacy and location of exclusion zones by including this as an auditable item in the project audit schedule;
- maintain exclusion fencing until the risk of disturbance within the excluded zone has been eliminated through other means;
- removal of fencing should be undertaken in consultation with the Authorised Representative;
- communication of the importance of tree protection zones, and any changes to the zones, to all site staff (e.g. in toolbox talks). Carry out formal inductions (including visitor inductions) regarding the location and purpose of exclusion zones on site;
- use only defined access tracks and entry/exit points for all vehicle movements;
- ensure tree protection zones (TPZ) are maintained and not impacted by construction activities. Seek advice from AQF5 Arborist if necessary to identify a suitable TPZ when planning and undertaking unavoidable encroachments within the TPZ; and
- reporting any breaches of the exclusion zone and TPZs through the EMS Environmental Incident Procedure.

3.2 SMART Principles

In accordance with the requirements of CoA B101(c) (iii), this BMP has been developed considering SMART principles. This is achieved as follows:

- **Specific:** The measures listed in Section 4 of this Plan are specific to flora and fauna management during construction. They include developing and implementing plans and procedures tailored to address flora and fauna impacts, identifying and managing specific issues like unexpected finds of threatened species and threatened ecological communities and weed and pathogen control.
- **Measurable:** The document provides specific measures, requirements, and references that enable the evaluation and measurement of the effectiveness of each control measure. Monitoring programs and reporting requirements are outlined, allowing for assessing impacts on flora and fauna.
- **Achievable:** The control measures outlined in the document are practical and achievable within the construction context. They involve implementing plans, investigations, and management strategies that can be feasibly executed during the construction phase.
- **Relevant:** The measures relate to flora and fauna management during construction and operation. They address potential impacts, such as those associated with vegetation clearing, fauna encounters and impacts to aquatic habitats. These measures are designed to mitigate or prevent these impacts on flora and fauna.
- **Time-bound:** The document specifies when each measure should be implemented, such as before and during construction and operations. It also assigns responsibilities to specific roles, indicating the timeline and accountability associated with each measure.

3.3 Construction

The performance indicators outlined in Table 3.1 will be used to determine whether the construction objectives of this plan have been achieved. The performance indicators will be reviewed and, where required, revised throughout the ARRC's construction period.

Table 3.1 Performance indicators - construction

Performance indicators	Target	Addressed	Responsibility
Monitoring indicates that natural regeneration is occurring in the Oaky Creek riparian zone.	Annual rehabilitation monitoring illustrates that the plant cover and abundance have increased during successive rehabilitation monitoring events.	Conduct rehabilitation of surface disturbance areas following the approved BMP (EMM, 2021) and the Rehabilitation Management Plan for Luddenham Clay / Shale Mine developed to satisfy requirements of MLA 592 (Act 1992).	Coombes Property Ground (CPG) engaged a qualified company to regularly inspect the Oaky Creek riparian zone and the entire Quarry site. CPG will continue monitoring the quarry approval requirements and performance criteria.
The majority of trees are healthy and growing in the Oaky Creek riparian zone.	There is no evidence of vegetation stress or dieback.	Monitor the vegetation health and composition of Oaky Creek in accordance with the approved BMP (EMM, 2021) and the Rehabilitation Management Plan for Luddenham Clay / Shale Mine, which was developed to satisfy the requirements of MLA 592 (Act 1992).	Coombes Property Ground (CPG) engaged a qualified company to regularly inspect the Oaky Creek riparian zone and the entire Quarry site. CPG will continue monitoring the quarry approval requirements and performance criteria.
There is no significant weed infestation such that the weeds do not compromise a significant portion of species in any stratum of native vegetation onsite.	Annual weed monitoring results show that the percentage of weed coverage has not increased across the project area.	Implement a weed control program. Annual monitoring of the Oaky Creek riparian corridor will note the incidence of weeds.	CPG engaged a suitable, qualified company to control the weeds in the Oaky Creek riparian zone and the Quarry site. CPG will continue the implementation of weed control measures.
Accurate records are being maintained, substantiating all monitoring associated with the Oaky Creek riparian zone and weed control activities.	There are no significant weed infestations, and weeds do not comprise a significant proportion of the species in any stratum based on visual inspection.	Vegetation monitoring results (as above) will be provided for annual review.	CPG will obtain the inspection reports and make them available upon request.
No aquatic fauna deaths arising from water management or dam dewatering activities.	Draining occurs following the dewatering procedure so that	Implementation of dewatering procedure, Appendix C of the Erosion and Sediment Control Plan.	Site Inspection by Contractor's Site Manager

Performance indicators	Target	Addressed	Responsibility
	vegetation is not impacted.		CPG Environmental and Planning Manager
No significant erosion or runoff impacts are present outside the impact zone.	No signs of erosion are present, and there is no laden water discharge to the Oaky Creek riparian zone.	Implementation of Erosion and Sediment Control Plan.	Site Inspection and Post-rain inspection by Contractor's Site Manager CPG Environmental and Planning Manager
There are no direct impacts on the riparian corridor zone or water quality of Oaky Creek.	No unauthorised disturbance occurs.	Maintenance and monitoring protocol.	Site Inspection by Contractor's Site Manager CPG Environmental and Planning Manager
There is no impact on retained vegetation.	Temporary fencing is maintained for the duration of construction.	Install temporary fencing and signage before construction to demarcate TPZ using flagging, bunting, parawebbing or similar.	Site Inspection by Contractor's Site Manager CPG Environmental and Planning Manager
There are no impacts on vegetation in no-go zones.	Temporary fencing is maintained for the duration of construction	Install temporary fencing and signage before construction to demarcate No-Go Zones or Environmentally Sensitive Areas using flagging, bunting, parawebbing or similar.	Site Inspection by Contractor's Site Manager CPG Environmental and Planning Manager
No fauna deaths arising from vegetation removal or during construction.	No unauthorised disturbance occurs.	Pre-clearance protocols.	Site Inspection by Contractor's Site Manager CPG Environmental and Planning Manager
Maximise the salvage of vegetative and soil resources within the approved disturbance area.	Where appropriate and practicable, stripped topsoil and mulched non-hollow bearing vegetation will be salvaged and utilised during groundcover restoration.	Erosion and Sediment Control Plan Construction Waste Management Plan	Site Inspection by Contractor's Site Manager CPG Environmental and Planning Manager
Maximise the salvage of vegetative and soil resources within the approved disturbance area.	Where practicable, retained large hollow-bearing trees and limbs will be used as hollows for placement into rehabilitated areas or retained native vegetation.	Pre-clearance protocols (s4.3) Detailed Design	Site Inspection by Contractor's Site Manager CPG Environmental and Planning Manager

3.4 Operation

The performance indicators outlined in Table 3-2 can be used to determine whether the operational objectives of this plan have been achieved. The performance indicators will be reviewed and, where required, revised throughout the ARRC's operational life.

Table 3.2 Performance indicators – operational

Performance indicators	Addressed	Responsibility
Monitoring indicates that natural regeneration is occurring in the Oaky Creek riparian zone.	Conduct rehabilitation of surface disturbance areas following the approved BMP (EMM, 2021) and the Rehabilitation Management Plan for Luddenham Clay / Shale Mine developed to satisfy requirements of MLA 592 (Act 1992). Annual rehabilitation monitoring illustrates that the plant cover and abundance have increased during successive rehabilitation monitoring events.	Coombes Property Ground (CPG) engaged a qualified company to regularly inspect the Oaky Creek riparian zone and the entire Quarry site. CPG will continue monitoring the quarry approval requirements and performance criteria.
The majority of trees are healthy and growing in the Oaky Creek riparian zone.	Monitor vegetation health and composition in Oaky Creek in accordance with the approved BMP (EMM, 2021) and the Rehabilitation Management Plan for Luddenham Clay / Shale Mine, which was developed to satisfy the requirements of MLA 592 (Act 1992). There is no evidence of vegetation stress or dieback.	Coombes Property Ground (CPG) engaged a qualified company to regularly inspect the Oaky Creek riparian zone and the entire Quarry site. CPG will continue monitoring the quarry approval requirements and performance criteria.
There is no significant weed infestation such that the weeds do not compromise a significant portion of species in any stratum of native vegetation onsite.	Conduct rehabilitation of surface disturbance areas following the approved BMP (EMM, 2021) and the Rehabilitation Management Plan for Luddenham Clay / Shale Mine developed to satisfy requirements of MLA 592 (Act 1992). Annual rehabilitation monitoring illustrates that the plant cover and abundance have increased during successive rehabilitation monitoring events.	Coombes Property Ground (CPG) engaged a qualified company to regularly inspect the Oaky Creek riparian zone and the entire Quarry site. CPG will continue monitoring the quarry approval requirements and performance criteria.
Accurate records are being maintained, substantiating all monitoring associated with the Oaky Creek riparian zone and weed control activities.	Vegetation monitoring results (as above) will be provided for annual review.	CPG will obtain the inspection reports and make them available upon request.
Wildlife is not using the site in numbers of concern.	Monitored by site environmental representative.	Site Inspection Reports by CPG Environmental and Planning Manager

4 BIODIVERSITY MANAGEMENT

4.1 Management of the Oaky Creek Riparian Corridor

DPIE Water (2022) guides riparian corridors based on the stream order. Oaky Creek is a third-order stream.

The guidelines require a 30 m wide riparian corridor, measured from the top of bank, on each side of a third-order stream. The top of bank of Oaky Creek has been located using GIS. The 30 m wide Oaky Creek riparian zone, measured per DPIE Water (2022), is shown in Figure 1.3.

All construction and operational aspects of the ARRC are located outside the Oaky Creek riparian zone.

The riparian zone will be established as a No-Go Zone before works commence. Sediment and erosion controls will ensure no untreated surface water or sediment enters the riparian zone. The monitoring of the riparian corridor during construction will be carried out following the CEMP schedule; for example, the construction contractor will check all site controls daily.

Condition B101(c)(iv) requires revegetation of the riparian zone of Oaky Creek. This was also an original condition of DA 315-7-2003, the development consent granted to the quarry in 2004. The previous quarry operator has carried out the required revegetation. The revegetation covered the entire 30 m wide riparian corridor adjacent to the ARRC, as required by Condition B101(c)(iv) and the quarry consent obligations. The revegetation within the riparian corridor has been fenced to prevent access and exclude inadvertent impacts from quarrying operations. Figure 1.3 illustrates the extent of the Oaky Creek riparian zone, with the revegetated areas extending along the full length of the corridor adjacent to the ARRC development site. Figure 2.1 indicates the extent of the riparian corridor revegetated per DA 315-7-2003, confirming that the entire corridor has been revegetated per the quarry consent obligations.

The ARRC operation will not disturb any additional vegetation within the Oaky Creek riparian corridor because this area is currently fenced to prevent access.

Accordingly, this BMP focuses on the ongoing protection of the riparian zone during construction.

During construction, the riparian zone's natural regeneration, vegetation health, and composition will be monitored per the approved BMP (EMM, 2021) and the Rehabilitation Management Plan for Luddenham Clay / Shale Mine, which was developed to satisfy the requirements of MLA 592 (Act 1992).

Once the facility is operational, annual monitoring of this previously revegetated area will continue. Monitoring will include:

- Identification of any areas of erosion within the Oaky Creek riparian zone.
- An assessment of plant health.
- An assessment of the level of natural regeneration occurring.
- Identification of any weeds.

An ecologist or an appropriately qualified person will monitor during the operational phase. The monitoring outcomes will be reported in the Compliance Report, prepared per condition C15 of SSD10446.

Management actions will be implemented to rectify rehabilitation deficiencies identified by the monitoring during construction and operation.

Specialist input requirements

Use an Ecologist or person trained in weed management and identification to conduct a site weed assessment before long-term works begin and assist in developing a detailed weed management plan.

A person trained in weed management and identification would hold Australian Qualifications Framework Units AHCPMG301A (Control weeds), AHCPMG302A (Control plant pests, diseases and disorders), or AHCPMG303A (Identify plant specimens), or an equivalent qualification.

4.2 Management of biodiversity outside the Oaky Creek riparian zone

4.2.1 Exclusion zones

Biodiversity outside the Oaky Creek riparian zone will be managed during construction as follows:

- Mark exclusion zones on a suitable plan. Suitable plans should:
 - be based on up-to-date plans for the project, such as design drawings issued 'for construction'. E.g. Vehicle turning circles and parking areas should be marked;
 - include an aerial photograph image underlay;
 - show construction chainages or similar distance markers used in construction;
 - be clearly labelled, including the type of exclusion fence to be used and any other information relevant to the installation and maintenance of the exclusion zone;
 - state what is being excluded;
 - be displayed in prominent places in site sheds, included in environmental management plans, provided in the site induction and communicated through toolbox talks;
 - outline any procedures that must be followed for access into exclusion zones.
- Exclusion zones around all areas containing native vegetation and fauna habitat will be implemented. These areas will be fenced using appropriate fencing materials and designated and signed as 'No-go Zones' or 'Environmentally Sensitive Areas'.
- Where feasible or when required, tree protection zones (TPZs) are to be set up around all trees to be retained within and immediately adjacent to the disturbance footprint. TPZs are to be established in accordance with the Australian Standard AS 4970-2009 Protection of trees on development sites (Standards Australia Committee 2009).
- No clearing of native vegetation outside the approved impact footprint.
- No stockpiling of material outside the approved impact footprint or within TPZs.
- No vehicular access through or in areas of retained native vegetation, inclusive of light vehicles used by site personnel.
- Speed limit of 40 km/h to apply on all sealed site access roads and 20 km/h on unsealed internal roads to minimise fauna strike risk.
- Maintenance of appropriate sediment and erosion control measures on-site.

Specialist input requirements:

- Use a qualified surveyor to mark out exclusion zones and clearing limits where clearing limits have been specified in an approval and in other situations wherever practical.
- For individual trees located within construction boundaries and identified for retention, seek the advice of an AQF Level 5 Arborist when standard TPZ cannot be applied or where incursions to a TPZ are unavoidable.
- Use qualified Ecologists to determine the appropriate type and location of any temporary fauna exclusion measures required.

4.3 Pre-clearance protocol, removal of trees and salvage

No hollows were identified in the vegetation to be removed during fieldwork carried out for the Biodiversity Development Assessment Report (BDAR, EMM 2021). The impact areas are not considered to provide habitat for any threatened species. The site contains minimal areas of fallen timber, with some scattered rubbish providing some habitat in the ground layer.

4.3.1 Pre-clearing survey

In undertaking the pre-clearing survey at least one week before clearing, the Ecologist should:

- confirm the locations of biodiversity features identified in the environmental assessment, including delineating the boundary of threatened ecological communities (TECs) as appropriate and any clearing limits prescribed in any approval conditions/environmental safeguards;
- identify any fauna that has the potential to be disturbed, injured or killed as a result of clearing activities (e.g. nesting birds, native bees);
- identify suitable locations for fauna relocation;
- Identify weed species and presence;
- check for the presence of threatened flora and fauna species that were identified in the environmental assessment as likely to occur;
- record the details of all trees/other habitat features containing habitat for threatened fauna and threatened flora. Details to be collected (where applicable) include GPS location, tree species, type of habitat feature (e.g. nest, hive, bush rock);
- mark habitat features to be protected during construction. Use suitable methods (e.g. flagging tape and/or spray paint) to mark:
 - all key habitat features;
 - any trees found to contain threatened fauna;
 - the location of any threatened flora;
- make recommendations to reduce impacts on flora and fauna, including staged habitat removal, sequencing, timing or clearing methods.

4.3.2 Final pre-clearing checks

Final pre-clearing checks should be undertaken no more than 24 hours before clearing commences. If multiple days of clearing are required, pre-clearing checks are to be conducted daily, so checks should be done prior to work each day.

The Ecologist should check that:

- exclusion zones are appropriately fenced, and signage is in place;
- habitat trees have been marked for staged clearing;
- any other biodiversity-specific management measures are established as required;
- fauna that has the potential to be disturbed, injured or killed because of clearing activities are captured and/or relocated into pre-determined habitat identified for fauna release;
- any additional recommendations to the Project Environment Manager and Authorised Representative in response to final pre-clearing check findings as required.

The Project Environment Manager should:

- inform clearing contractors of any recommendations made by the pre-clearing report and pre-clearing check, including for staged habitat removal, sequencing, timing or clearing methods;

- clearly communicate to clearing contractors that areas subject to a pre-clearing survey are marked in the field (e.g. exclusion zones).

4.4 Clearance procedure

4.4.1 General requirements for clearing of vegetation

The Project Environment Manager should ensure the following is undertaken:

- the pre-clearing process is completed before any clearing begins;
- a clearing and grubbing plan for this BMP and EPA's waste hierarchy is developed. The requirements of the clearing and grubbing plan are communicated to site staff regularly;
- clearing of vegetation does not go beyond the approved clearing limits for the project, which must be established by a qualified surveyor. Use exclusion zone fencing/delineation techniques to improve the visibility of clearing limits;
- undertake a weed assessment and identify weed control actions to be implemented, from areas of least weeds to areas of more weeds;
- limit the amount of time that cleared vegetation is kept in stockpiles before removal/management to avoid native fauna using stockpiled vegetation as habitat;
- the recommendations of the pre-clearing report prepared by the Ecologist are implemented.

4.4.2 Clearing of woody vegetation

The Project Environment Manager should communicate the following best practice methods to the clearing contractor:

- determine if staged clearing is required based on findings and recommendations of the pre-clearing report. If required, habitat trees and any other habitat features are to be marked during pre-clearing surveys and retained during the first stage of clearing;
- document the selection of suitable work methods in the clearing and grubbing plan;
- carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation;
- where feasible, apply soft fall techniques to the felling of large trees with habitat values;
- an Ecologist should be on-site to supervise the removal of habitat features and inspect felled/cleared habitat immediately for fauna;
- convey where exotic (non-native) vegetation that requires removal and disposal is situated. Where priority weed species are to be cleared, specific management measures may be needed;
- stockpiles of cleared vegetation are kept under two metres high;
- as recommended by the BDAR, native vegetation cleared should be mulched and stockpiled for re-use during any rehabilitation works. Trees and large tree limbs should be retained as logs for placement into rehabilitated areas or retained native vegetation.

4.4.3 Clearing of non-woody vegetation

The Project Environment Manager should communicate the following best-practice methods to the clearing contractor:

- non-woody native vegetation (typically grasses and groundcover species) is to be incorporated into the stripping of topsoil to retain any organic materials and nutrients within the topsoil layer;
- in some circumstances, the soil may need to be treated before re-using on site, e.g. acid sulphate soils.

- topsoil removal is carried out with suitable care such that topsoil is not mixed with subsoils, particularly in areas where topsoil is thin. Topsoil should be stockpiled separately for reuse in site rehabilitation and revegetation.

4.4.4 Staged habitat removal

The staged habitat removal process is to be used when identified habitat (e.g. hollow-bearing trees or habitat trees) is to be removed. Staged habitat removal minimises direct impacts on fauna by allowing them to relocate away from the disturbance. The pre-clearing report will identify habitat that requires staged removal.

The Project Environment Manager should oversee the staged habitat removal process and ensure a post-clearing report is prepared to document its outcomes.

The staged habitat removal process is summarised in Figure 4.1.

4.5 Re-use of woody debris

The Project Environment Manager must ensure the Ecologist advises on re-using woody debris to avoid a negative impact on the receiving environment. In existing areas of high-quality habitat, there may already be enough suitable habitat features such as fallen logs, so adding surplus woody debris may cause a fire hazard or unnecessary disturbance.

Re-use of woody debris off-site must be compliant with NSW EPA Resource Recovery Orders and Exemptions and *NSW Protection of the Environment Operations Act 1997* and is subject to landowner agreement.

The following best practice measures when relocating and re-using woody debris will be implemented:

- removal, stockpiling, transportation and relocation of woody debris is carried out in a manner that minimises disturbance to native vegetation (including the canopy, shrubs, dead trees, fallen timber and groundcover species);
- do not extend the amount of clearing and grubbing to make up for mulch shortfalls;
- the spread of any weeds or pathogens that may be present in the soil is avoided when relocating woody debris from stockpiles. Appropriate weed, disease and pest assessment and management needs to be undertaken prior to clearing;
- all off-site movement of woody debris is undertaken in accordance with the relevant NSW Resource Recovery Orders and Exemptions;
- an Ecologist is engaged to provide advice on positioning woody debris in designated relocation areas;
- topsoil disturbance is kept to a minimum and is not heaped up against woody debris due to the potential to provide habitat for rabbits;
- woody debris is placed evenly across the site.

Mulch obtained from woody debris has the potential to contain tannins. Tannins are naturally occurring plant compounds that discolour water and can increase the biological oxygen demand (BOD) in water, decreasing dissolved oxygen.

The Project Environment Manager should consider the potential impacts of tannins leaching from stockpiled mulch and/or mulch used for erosion and sediment control or landscaping.

4.5.1 Reporting

The Project Environment Manager should check that the outcomes of the clearing process are recorded in a post-clearing report undertaken by the Ecologist and should include:

- habitat feature type and location (include unique ID and GPS coordinates);
- number of hours between the first and second stage of habitat removal;
- fauna species present, captured and relocated, including numbers;
- release location and condition/behaviour of animal upon release;
- fauna injured or killed; and
- number of trees/habitat features removed, including the entrance diameter and cavity size of each individual hollow removed.

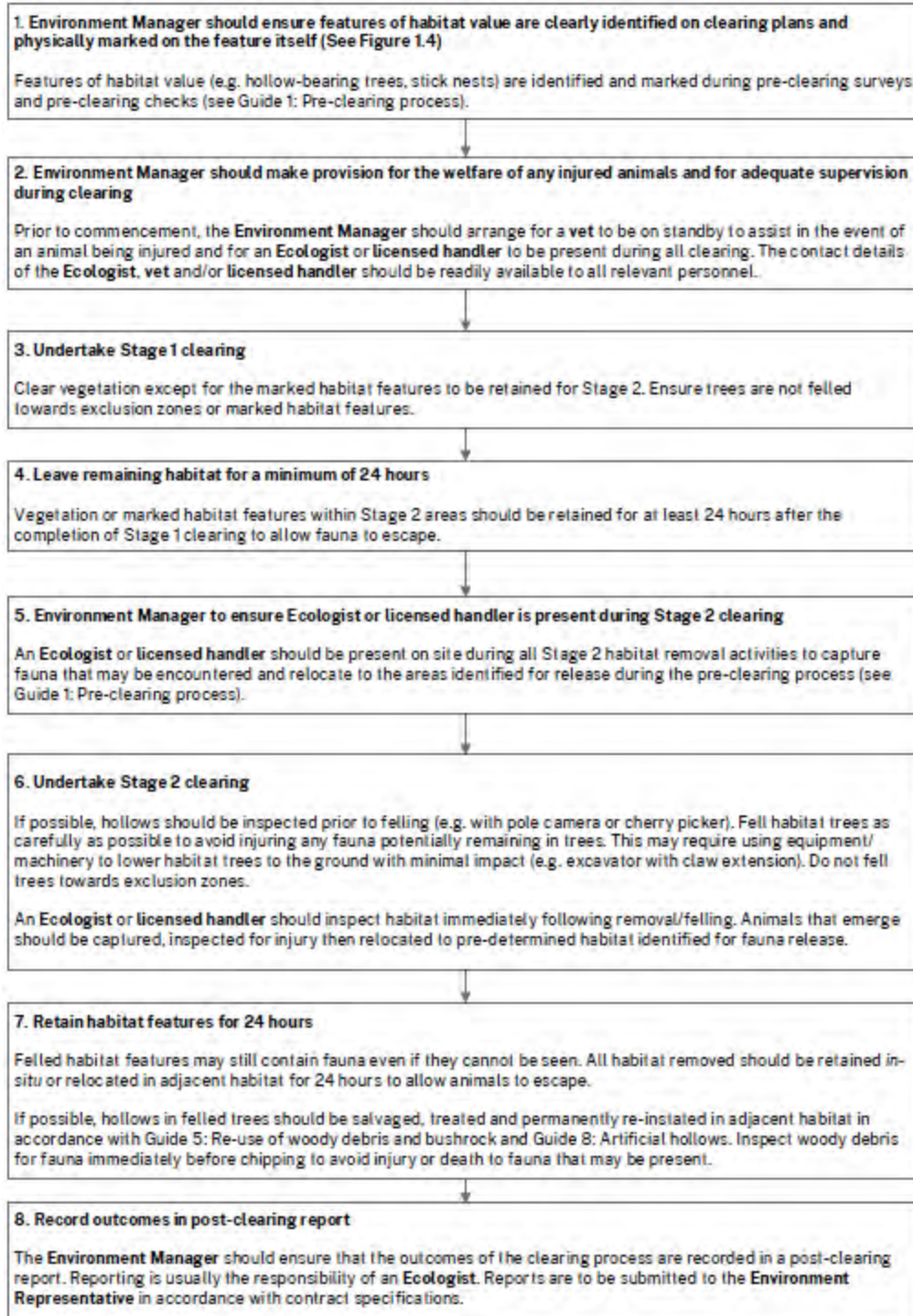


Figure 4.1 Stage habitat removal process (source Transport for NSW Biodiversity Management Guideline March 2024)

4.6 Fauna protocol

4.6.1 Aquatic fauna

The water bodies on site have a low potential for fish, turtles, eels and other aquatic fauna.

Due to the ephemeral water bodies providing potential habitat for the Southern Myotis, dam dewatering will be carried out in accordance with the Sediment Basin Management and Dewatering Procedure outlined in Appendix C of the Erosion and Sediment Control Plan (ESCP). A qualified aquatic ecologist will review the activities the contractor will be implementing prior to the removal of Ponds 1 and 4 and ensure the following mitigation measures are included:

- a suitably qualified aquatic ecologist will be present during the removal of the water from the ponds;
- the water level will be pumped to a level that will allow the safe and effective implementation of capture methods, such as seine nets and/or dip nets;
- a maximum depth of 500 mm is typically required before aquatic fauna salvage (if present) can commence;
- the aquatic ecologist is to establish the presence of native and introduced aquatic fauna;
- captured aquatic fauna will be placed in tubs full of water from the water body for later relocation to pond 3; and
- any exotic fish species will be placed in ice slurry to be euthanised.

4.6.2 Terrestrial fauna

Induction requirements

All personnel are to be inducted on the potential threatened biodiversity occurring on site and the unexpected threatened species finds procedure (Figure 4.2).

Threatened species profiles with potential to be encountered onsite are in Appendix A and include:

- Green and Golden Bell Frog - Potential habitat includes Oaky Creek and ponds; and
- Southern myotis - A species of micro-bat known to roost within the culvert on crown land over Oaky Creek, underneath an old eastern access road.

During construction, the following should be implemented:

- install temporary fauna fencing where necessary to prevent animals from entering the construction site;
- conduct daily pre-start checks of excavations and trenches to rescue any trapped fauna; and
- implement protocols for fauna handling and relocation, to be carried out by qualified personnel only.

If **threatened species** are encountered on site, stop work and follow the procedure in Figure 4.2.

If **wildlife** is discovered on site, the following protocol should be followed:

- stop all works in the vicinity of the animal and notify the site supervisor or environmental site representative;
- establish an exclusion zone around the animal;
- control plant and vehicle movements around the area;
- if the animal is mobile, allow the animal to leave the area without handling ensuring the animal has a clear, safe, path to leave the site;

- fauna must only be handled by people who are appropriately licensed under the BC Act unless this cannot be practically avoided, in which case appropriate safety considerations need to be applied. Under no circumstances, however, are unlicensed personnel to handle bats;
- do not handle snakes or bats:
 - contact the Ecologist;
 - maintain an exclusion zone; and
 - supervise until the Ecologist arrives.

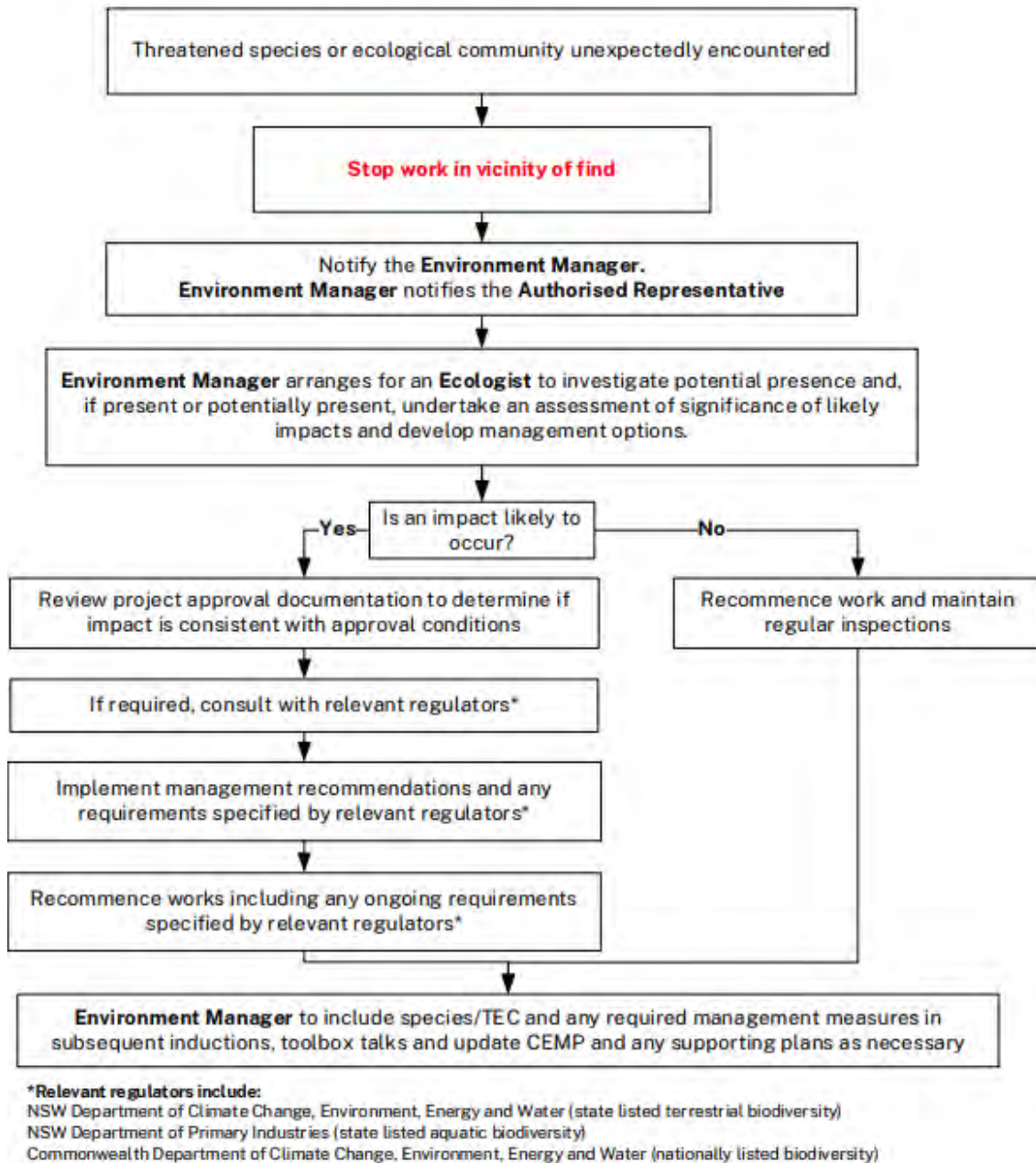


Figure 4.2 Unexpected threatened species find procedure (Source Transport for NSW Biodiversity Management Guidelines March 2024)

4.7 Wildlife attraction minimisation

A new stormwater detention basin will be constructed in the approximate location of the current pond 4. This basin will be netted due to the proximity to WSA but may still become utilised by aquatic fauna once the basin is established.

Management measures to minimise wildlife attraction at the site include:

- No new planting (e.g. for landscaping) will occur on the site that produces fruit or flowers that are likely to attract birds and wildlife. Species selected should generally be species associated with PCT 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion. A review of WSA and Aerotropolis specific guidance material on preferred species will be made before selecting plant species.
- The existing water management dam and decommissioned sediment dam will be netted or have lines across it with moving flags to deter birds before the commencement of WSA operations and will be maintained for the life of the ARRC.
- Structures, fencing and lighting will minimise areas for wildlife, especially birds, to use for breeding, roosting, or perching. This will include no eaves or ensuring no access to the roof cavity through the eaves and using ‘bird-spikes’ on roof edges, fences and lighting.
- Waste bins containing food waste (e.g., from staff lunches) will be stored within the demountable site buildings and made inaccessible to birds and vermin.
- Should birds or other wildlife start using the site in numbers that are concerning, specialists will be engaged to survey/monitor the species utilising the site to remedy the situation.

4.8 Weed control

Weed management will be undertaken in two distinct phases:

1. Weed control during vegetation clearing, which is embedded in the clearing procedure (Section 4.4) to prevent the spread of weeds during construction.
2. Ongoing weed control maintenance ensures that cleared and rehabilitated areas remain free from invasive species over the long term.

Both phases are critical to protecting retained native vegetation, minimising weed infestations in stockpiled soil, and maintaining biodiversity values within the Oaky Creek riparian corridor and rehabilitated areas.

4.8.1 Site entry

To prevent the introduction and spread of weed seeds, soil contaminants, and pathogens, strict site entry procedures will be implemented for all vehicles, machinery, and equipment arriving at the Luddenham ARRC site.

Upon arrival, site personnel must inspect all vehicles and equipment for any remaining soil, plant material, or other contaminants before they are granted entry. A Plant Inspection Register should be maintained to document all inspections, cleaning records, and any identified non-compliances.

Access to the site will be restricted to designated entry points, ensuring all plant and equipment undergo the required onboarding process before entering operational areas. This controlled access will help maintain consistent compliance with weed and biosecurity management requirements.

Random spot inspections will be conducted throughout the project duration to reinforce compliance. If any plant or equipment is found to be non-compliant, it will be immediately directed to a washdown area for cleaning or required to leave the site until it has been properly cleaned.

These measures will ensure that all construction activities are conducted without increasing the risk of weed introduction or spread.

4.8.2 Weed control during vegetation clearing

Weed control measures are integrated into the clearing process to prevent the spread of invasive species. The actions align with the requirements of Section 4.4 – Clearance Procedure and includes:

Pre-clearing weed management

- A pre-clearing weed assessment will map existing infestations and classify weeds based on priority for removal.
- Weed control measures will be included in the clearing and grubbing plan, ensuring that clearing starts in the least-infested areas first (as per Section 4.4.1).
- Exclusion zones will be established around weed-infested areas, preventing disturbance and spread during clearing.

Weed-specific clearing protocols

- Weedy vegetation will be segregated during clearing operations to prevent mixing with reusable mulch or topsoil (refer to Section 4.4.3).
- Exotic (non-native) vegetation requiring removal and disposal will be flagged before clearing (per Section 4.4.2).
- Stockpiled soil from weed-infested areas will be treated separately to prevent contamination of clean topsoil.

Staged habitat removal and weed control

Where staged habitat removal is required (per Section 4.4.4), weed suppression measures (e.g., targeted herbicide application) will be implemented before each clearing stage.

Felled vegetation will be inspected for weed presence before reuse.

Stockpile management and weed hygiene controls

- Woody debris retained for habitat use will be inspected to ensure it does not contain weed propagules (per Section 4.5).
- Vehicles, equipment, and machinery will be cleaned before entering and leaving the site to prevent weed seed spread.

4.8.3 Ongoing weed control maintenance

After clearing vegetation, a weed control maintenance program will be implemented to prevent the re-establishment and spread of weeds in retained native vegetation, rehabilitated areas, and exclusion zones. This program will focus on monitoring and suppression.

Regular weed inspections

- During routine environmental inspection, weed observations will be conducted to assess weed presence and regrowth, with a focus on:
 - Rehabilitated areas and exclusion zones, ensuring native species are establishing successfully.
 - Stockpiled topsoil before reuse, preventing the introduction of weed propagules into revegetation efforts.
 - The Oaky Creek riparian corridor, ensuring that weed species do not invade riparian habitats.

The environmental inspection checklist will document any actions arising from these inspections.

Integrated weed control methods

Depending on the weed species, location, and level of infestation, a combination of control methods can be used.

- Manual removal will be prioritised in sensitive areas (e.g., riparian corridors).
 - Hand pulling and cut-and-paint techniques can be used in environmentally sensitive areas, such as the Oaky Creek riparian corridor and areas where mechanical disturbance is inappropriate.
 - Seed-producing weed species should be removed before flowering to prevent future infestations.
 - All removed weed material will be bagged and disposed of appropriately to prevent reseeding.
- Mechanical slashing/mowing will be used in cleared areas to prevent weed establishment.
 - Slashing or mowing will be conducted in disturbed and cleared areas where grasses and broadleaf weeds establish rapidly.
 - Timings will be aligned with seasonal weed growth patterns, ensuring treatments are done before weeds set seed.
- Selective herbicides will be applied only where required by licensed operators, in compliance with the *Pesticides Act 1999*.
 - Spot spraying with selective herbicides will be used for high-priority invasive species that cannot be controlled manually.
 - Herbicide application will be limited to licensed personnel, ensuring compliance with the *Pesticides Act 1999* and best-practice environmental safety measures.
 - Herbicide use will avoid sensitive areas, including watercourses and revegetation areas unless directly required for weed suppression.
 - Drift-reducing application methods (e.g., wick wiping, stem injection) will be used where possible to minimise non-target impacts.

Long-term weed suppression

In addition to active weed control, a range of passive suppression techniques will be implemented to reduce weed competition and promote native vegetation establishment:

- Native species will be prioritised in revegetation efforts, ensuring fast-growing and competitive plants establish early.
- Mulching and groundcover plantings will be used to suppress weed growth and retain soil moisture.
- Stockpiled topsoil will be treated before reuse, including turning, solarisation, or selective herbicide treatment where necessary.

Weed hygiene and training

- Contractors and site personnel will be informed on weed identification, hygiene protocols, and control methods.
- All vehicles and machinery must be cleaned before entering and leaving the site to prevent weed spread (per Section 4.4.1).

Annual Review and Adaptive Management

- Weed control measures will be reviewed annually to assess effectiveness and update strategies as needed.
- Weed management records will be maintained and included in the compliance report.

4.8.4 Topsoil management

Topsoil management needs to be planned to minimise the spread of weeds originating from the topsoil while making best use of the native seed bank.

Topsoil recovered from areas of low weed infestation can be re-used onsite with treatment but should be stockpiled separately. Soil disturbance within weed-infested areas should be minimised.

4.8.5 Weed-contaminated material

Weed-contaminated material (including removed vegetation and topsoil) is considered waste and must be managed (i.e. treated and/or disposed of) following the relevant NSW Resource Recovery Order and Exemptions.

Weed-contaminated material can be treated and re-used onsite where the process is covered by an Environment Protection Licence (EPL). Consider the following when planning to re-use weed-contaminated material onsite:

- before mulching any vegetation, test for the presence of weeds. Determine the species of weeds present and document them in the appropriate plan. Where pathogens have the potential to occur, it is also recommended that soil is tested (e.g. *Phytophthora cinnamomi*) before commencing mulching.
- do not use weed material as mulch unless it has been appropriately composted to remove the potential for regrowth/growth. A compost procedure can be developed as part of the weed management plan. After composting and a seed viability test shows no seed growth, the material can be used onsite. If the material is to be beneficially re-used offsite, requirements (including testing) associated with the conditions of the NSW EPA Compost Order and Exemption must be followed.
- topsoil from areas of high weed infestation may be disposed of onsite by burial. Spread uncontaminated topsoil over the burial area and revegetate within seven days.

Dispose of weed-contaminated material offsite at a suitably licenced facility if unable to comply with the NSW Resource Recovery Order and Exemptions. The following general measures apply:

- place waste containing seed and vegetative material in bags or on plastic sheeting during weed removal, where practical;
- remove all weed-contaminated plant material from the site, preferably on the same day;
- unless treated and tested, weeds cannot be disposed to environmentally sensitive areas in accordance with a Mulch Order and Exemption; and
- offsite topsoil disposal should be avoided wherever possible.

4.9 Pathogens

Pathogens can be spread on footwear, infested plant material, vehicles and machinery, particularly during wet weather or in wet conditions. Strict precautions are necessary to prevent the spread of some pathogens. Some pathogens cannot be eradicated from infected sites so controlling their introduction and spread is a high priority.

Several pathogens in NSW have the potential to impact the environment and biodiversity. These may be introduced and spread during the construction of transport infrastructure. Pathogens relevant to the site location are:

- *Phytophthora* (*Phytophthora cinnamomi*) is a soil-borne fungus that causes tree death (dieback) where infestation occurs.

- Chytrid fungus (*Batrachochytrium dendrobatidis*) is an infectious disease that affects amphibians worldwide. Chytrid is a water-borne fungus that may be spread during construction activities as a result of handling frogs or through cross-contamination of water bodies.
- Myrtle rust (*Uredo rangelli*) is a plant disease caused by the introduced fungus *Uredo rangelli*. Myrtle rust is an air-borne fungus that may be spread by moving infected plant material, contaminated clothing (especially hats), equipment and vehicles.

Prior to construction commencing, the Project Environment Manager should consider the potential for pathogens to occur on-site or in the area. This includes considering the potential risk for the project to contribute to the spread of pathogens.

Testing should be undertaken where there is a high risk of pathogens being present. If testing demonstrates that the pathogen is not present, management measures should focus on the potential for introducing pathogens from offsite. The management required will depend on the presence of pathogens and the identification of high-risk areas (e.g., amphibian breeding habitat).

The industry's response to pathogens and quarantine areas is dynamic. The Project Environment Manager should check the DPI website for the most up-to-date hygiene protocols for each pathogen and the most recent locations of contamination.

4.10 Summary of responsibilities

The following table clearly summarises the management and mitigation measures, with a designated responsible party for each item.

Table 4.1 Summary responsibilities for implementing management and mitigation measures

Activity	Management/Mitigation Measure	Responsibility
4.1 Management of the Oaky Creek Riparian Corridor		
	Establish the Oaky Creek riparian zone as a No Go Zone prior to works.	Project Environmental Manager
	Implement sediment and erosion controls to prevent untreated surface water or sediment entering the riparian zone.	Project Environmental Manager
	Monitor the riparian corridor during construction per the CEMP schedule (e.g., daily checks).	Construction Contractor (daily checks), Project Environmental Manager (oversight)
	Conduct annual monitoring of the riparian zone during operation (erosion, plant health, regeneration, weeds).	Ecologist
	Conduct a site weed assessment before long-term works begin and assist in developing a weed management plan.	Ecologist or person trained in weed management
4.2 Management of Biodiversity Outside the Oaky Creek Riparian Zone		
4.2.1 Exclusion Zones	Mark exclusion zones on a suitable plan (with specified details).	Project Environmental Manager
	Implement exclusion zones around areas with native vegetation and fauna habitat (fencing, signage).	Project Environmental Manager
	Set up tree protection zones (TPZs) per AS 4970-2009 around trees to be retained.	AQF Level 5 Arborist (if needed), otherwise Project Environmental Manager

Activity	Management/Mitigation Measure	Responsibility
	Ensure no clearing of native vegetation outside the approved impact footprint.	Project Environmental Manager, Construction Contractor
	Ensure no stockpiling of material outside the approved impact footprint or within TPZs.	Site Supervisor
	Ensure no vehicular access through or in areas of retained native vegetation.	Site Supervisor
	Apply speed limits (40 km/h on sealed roads, 20 km/h on unsealed roads) to minimize fauna strike risk.	Site Supervisor
	Maintain appropriate sediment and erosion control measures on-site.	Project Environmental Manager
	Use a qualified surveyor to mark out exclusion zones and clearing limits.	Qualified Surveyor
	Seek advice from an AQF Level 5 Arborist for TPZs where standard application is not feasible.	AQF Level 5 Arborist
	Use qualified Ecologists to determine type and location of temporary fauna exclusion measures.	Ecologist
4.3 Pre-clearance Protocol, Removal of Trees and Salvage		
4.3.1 Pre-clearing Survey	Conduct a pre-clearing survey at least one week before clearing (confirm biodiversity features, fauna, weeds, etc.).	Ecologist
4.3.2 Final Pre-clearing Checks	Undertake final pre-clearing checks (fencing, signage, fauna relocation, etc.) no more than 24 hours before clearing.	Ecologist
	Ensure the pre-clearing process is completed before clearing begins.	Project Environment Manager
	Inform clearing contractors of pre-clearing report recommendations and marked areas.	Project Environment Manager
4.4 Clearance Procedure		
4.4.1 General Requirements for Clearing of Vegetation	Develop a clearing and grubbing plan referencing EPA's waste hierarchy and communicate to staff.	Project Environment Manager
	Ensure clearing does not exceed approved limits, established by a qualified surveyor.	Project Environment Manager, Qualified Surveyor
	Undertake a weed assessment and identify weed control actions (least to most infested areas).	Ecologist or Environmental Consultant
	Limit time cleared vegetation is kept in stockpiles to avoid fauna habitat use.	Clearing Contractor, supervised by Environmental Manager
	Implement recommendations from the pre-clearing report.	Project Environment Manager

Activity	Management/Mitigation Measure	Responsibility
4.4.2 Clearing of Woody Vegetation	Communicate best practice methods for clearing woody vegetation to the clearing contractor.	Project Environment Manager
	Supervise removal of habitat features and inspect felled habitat for fauna.	Ecologist
4.4.3 Clearing of Non-woody Vegetation	Communicate best practice methods for clearing non-woody vegetation to the clearing contractor.	Project Environment Manager
4.4.4 Staged Habitat Removal	Oversee the staged habitat removal process and ensure a post-clearing report is prepared.	Project Environment Manager
4.5 Re-use of Woody Debris		
	Ensure the Ecologist provides advice on re-use of woody debris to avoid negative impacts.	Project Environment Manager
	Implement best practice measures for relocating and re-using woody debris.	Construction Contractor, supervised by Project Environmental Manager
	Consider potential impacts of tannins leaching from stockpiled mulch.	Project Environment Manager
4.5.1 Reporting	Check that outcomes of the clearing process are recorded in a post-clearing report.	Project Environment Manager
4.6 Fauna Protocol		
4.6.1 Aquatic Fauna	Review dam dewatering activities and ensure mitigation measures are included.	Construction Contractor, supervised by Environmental Manager
4.6.2 Terrestrial Fauna	Implement induction requirements for personnel on threatened biodiversity and procedures.	Project Environment Manager
	Install temporary fauna fencing to prevent animals entering the construction site.	Project Environment Manager
	Conduct daily pre-start checks of excavations/trenches for trapped fauna.	Site Supervisor or designated personnel
	Implement fauna handling and relocation protocols.	Ecologist
	Follow the unexpected threatened species finds procedure if threatened species are encountered.	All personnel, with Ecologist involvement
4.7 Wildlife Attraction Minimisation		
	Implement measures to minimise wildlife attraction (e.g., netting basins, bird deterrents).	Project Manager, in consultation with Ecologist
4.8 Weed Control		
4.8.1 Site Entry	Implement site entry procedures for weed control (inspections, cleaning, washdown).	Project Environment Manager
4.8.2 Weed Control During	Conduct a pre-clearing weed assessment to map infestations and classify weeds.	Ecologist or Project Environment Manager

Activity	Management/Mitigation Measure	Responsibility
Vegetation Clearing	Include weed control measures in the clearing and grubbing plan (least to most infested areas).	Project Environment Manager
	Establish exclusion zones around weed-infested areas to prevent spread.	Project Environment Manager
	Segregate weedy vegetation during clearing to prevent mixing with reusable materials.	Construction Contractor
	Flag exotic vegetation requiring removal and disposal.	Ecologist or Project Environment Manager
	Treat stockpiled soil from weed-infested areas separately.	Project Environment Manager
	Implement weed suppression measures (e.g., herbicide) before each stage of habitat removal.	Construction Contractor, supervised by Ecologist
	Inspect felled vegetation for weeds before reuse.	Ecologist or Project Environment Manager
	Inspect woody debris for weed propagules before relocation.	Ecologist or Project Environment Manager
	Clean vehicles, equipment, and machinery before entering/leaving the site to prevent weed spread.	All personnel, overseen by Project Environment Manager
4.8.3 Ongoing Weed Control Maintenance	Implement a weed control maintenance program to prevent re-establishment in cleared/rehabilitated areas.	Project Environment Manager
	Conduct regular weed inspections during routine environmental checks.	Project Environment Manager or designated personnel
	Use integrated weed control methods (manual, mechanical, chemical) based on infestation levels.	Project Environment Manager, with input from Ecologist
	Implement long-term weed suppression techniques (e.g., mulching, native plantings).	Project Environment Manager
	Provide weed hygiene and training to contractors and site personnel.	Project Environment Manager
	Review weed control measures annually to assess effectiveness and update strategies.	Project Environment Manager
4.8.4 Topsoil Management	Manage topsoil to minimize weed spread (separate stockpiling, treatment).	Project Environment Manager
4.8.5 Weed-contaminated Material	Manage weed-contaminated material per NSW Resource Recovery Orders and Exemptions.	Project Environment Manager
4.9 Pathogens		
	Consider the potential for pathogens (e.g., Phytophthora, Chytrid fungus) on site.	Project Environment Manager
	Test for pathogens if there is a high risk of presence.	Project Environment Manager

Activity	Management/Mitigation Measure	Responsibility
	Check the DPI website for up-to-date hygiene protocols for pathogens.	Project Environment Manager

5 REVIEW AND EVALUATION

5.1 Review of Biodiversity Management Plan

Mitigation measures proposed in this BMP will be regularly reviewed and monitored as part of the construction CEMP and site audits. The following elements specific to biodiversity should include:

- Any complaints, incidents or audit actions relating to biodiversity over the reporting period.
- Any monitoring results collected over the reporting period.
- An evaluation of any trends in monitoring results.
- Any non-compliance recorded during the reporting period and the actions taken to ensure compliance.
- Identification of any discrepancies between the predicted and actual impacts and analysis of the potential cause of any significant discrepancies.
- Summary of management actions to be implemented to improve environmental performance on site.

The BMP is formally reviewed annually (as a minimum) and whenever the plan, risk, and/ or activities change from the scope/ content.

The review is conducted by a review team comprising the Project Manager (or delegate) and the Project Environmental Manager (or Safety Manager) and considers performance against the BMP with respect to incident trends and findings from internal and external audits.

The Project Manager (or delegate) ensures that personnel are informed of any changes to the BMP resulting from the review/ change.

5.2 Monitoring and reporting

The proposed monitoring and reporting program relevant to biodiversity is provided within Table 5-1. The monitoring and reporting program detailed within this BMP will commence upon the commencement of construction. Monitoring will continue during construction and at the timing or frequency detailed within Table 5-1 for each of the monitoring items.

Table 5.1 Monitoring and reporting program

Item	Scope	Project Phase	Frequency	Responsibility	Records/ reporting
1 Weekly inspections	Inspection of the exclusion/no-go zones, retained vegetation, riparian zone corridor, water quality of Oaky Creek	Construction	Weekly	Environmental Manager Supervisors	Weekly Environmental Inspection Checklist
2 Pre-clearing inspection	Inspecting work areas before clearing per Section 4.3	Construction	At least one week prior to clearing Final pre-clearing checks completed no more than 24 hours prior to clearing.	Environmental Manager Ecologist	Pre-clearing Report

Item	Scope	Project Phase	Frequency	Responsibility	Records/ reporting
3 During clearing supervision	Ecological supervision of clearing operations and removal of habitat trees during two-stage clearing approach per Section 4.4.	Construction	During clearing	Environmental Manager Ecologist	Post-clearing Report
4 Dam dewatering monitoring	Ecological supervision of dam dewatering works per dam dewatering protocol	Construction	As required when dewatering dams	Environmental Manager Ecologist	Dam Dewatering Report
5 Fauna handling and rescue	Handling and rescue of fauna per Section 4.6	Construction	As discovered	Environmental Manager Ecologist	Fauna Handling Record Sheet
6 Weed monitoring	Presence of weeds within project area and riparian zone per Section 4.8.	Construction Operation	Pre-clearing commencement Annually	Environmental Manager Ecologist	Weed Monitoring Report
7 Wildlife usage monitoring	Monitoring of levels of wildlife using site	Operation	Weekly	Environmental representative	Wildlife Usage Checklist

5.3 Adaptive management

Biodiversity on site will be managed in accordance with this BMP to ensure that the performance indicators outlined are met.

Where performance indicators are not met, all reasonable and feasible steps are to be implemented including adaptive management measures. Adjustments to management strategies will be based on flexibility and responsiveness and be practical and measurable. Any changes are to be made in consultation with qualified ecologists, environmental representatives and site managers.

Any adaptive management measures (if required) will be detailed in line with the CEMP scheduled performance reporting.

5.4 Access to information

For the duration of the project, up-to-date information will be made available on the project website including:

- environmental impact statement/environmental assessment and modification reports;
- current statutory approvals for the development;
- approved strategies, plans and programs required under the conditions of the consent;

- a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs;
- complaints register, which is to be updated monthly;
- any independent environmental audit of the development, and response to the recommendations in any audit; and
- any other matter required by the Secretary.

5.5 Contingency Plan

The table below lists the actions to be implemented if inspections, monitoring and/or auditing indicate that the mitigation measures are ineffective in managing environmental impacts.

All Condition Amber and Condition Red occurrences will be recorded and discussed during the toolbox talks.

Table 5.2 Contingency Management Plan

Item	Trigger/ response	Condition		
		Green	Amber	Red
Biodiversity - vegetation	Trigger	No disturbance in retained vegetation or riparian corridor	Minor disturbance in retained vegetation or riparian corridor. Evidence of ground cover impacts e.g. traffic, personnel access, stockpiling, erosion of sediment deposition.	Significant disturbance of retained vegetation or riparian corridor. Evidence of clearing within no-go areas, significant erosion, contaminated material, or sediment-laden water.
	Response	Continue CEMP and BMP implementation.	A suitably qualified ecologist to inspect the site. Review of site management and erosion and sediment control. Remediate as appropriate. Revise BMP if required.	Stop work in vicinity of the impact. A suitably qualified ecologist to inspect the site. Review of impacts. Remediate as soon as practical. Revise BMP if required.
Biodiversity – threatened fauna	Trigger	No threatened or native fauna present in the impact area of the site.	Inspections find threatened fauna present in the impact area of the site.	Injury or death of threatened species or native fauna on site or caused by site works.
	Response	Continue CEMP and BMP implementation.	Stop work. Implement fauna protocol as per BMP section 4.6 and figure 4.2.	Stop work. Implement fauna protocol as per BMP section 4.6 and figure 4.2.
Biodiversity – wildlife attraction	Trigger	No change in birds in and around the site.	Minor or temporary increase in bird numbers on or adjacent to site.	Significant increase in bird numbers on or adjacent to site.
	Response	Continue CEMP and BMP implementation.	Review the efficacy of site controls as per section 4.7.	Suitably qualified ecologist to be engaged to survey/monitor the species utilising the site and implement/modify existing control measures.

6 REFERENCES

Bionet species profile (viewed July 2024), Green and Golden Bell Frog *Litoria aurea* [Green and Golden Bell Frog - profile | NSW Environment, Energy and Science](#)

Bionet species profile (viewed July 2024), Southern Myotis *Myotis macropus* [Southern Myotis - profile | NSW Environment, Energy and Science](#)

Eco Logical Australia 2017, Green and Golden Bell Frog Plan of Management - Arncliffe. Prepared for NSW Roads and Maritime Service.

EMM 2021a, Biodiversity Development Assessment Report for Luddenham Advance Resource Recovery Centre, report prepared for Coombes Property Group and KLF Holding Pty Ltd.

EMM 2021b, Biodiversity Management Plan for Luddenham Quarry, report prepared for Luddenham Operations Pty Ltd.

EMM 2021c, Submissions Report for Luddenham Advanced Resource Recovery Centre, report prepared for Coombes Property Group and KLF Holding Pty Ltd.

Transport for NSW (TNSW) 2024, Biodiversity Management Guideline: Protecting and Managing Biodiversity on Transport for NSW projects.



APPENDIX A

THREATENED SPECIES
PROFILES FOR SITE
INDUCTIONS

GREEN AND GOLDEN BELL FROG

Scientific name: *Litoria aurea*

Conservation status in NSW: Endangered

Commonwealth status: Vulnerable

Online profile: [Green and Golden Bell Frog - profile | NSW Environment, Energy and Science](#)

Description

A relatively large, stout frog, ranging in size from approximately 45 mm to approximately 100 mm snout to vent length. Diagnostic features are a gold or creamish white stripe running along the side, extending from the upper eyelids almost to the groin, with a narrow dark brown stripe beneath it, from nostril to eye. It also has blue or bluish-green colour on the inside of the thighs. The colour of the body varies. Usually a vivid pea-green, splotched with an almost metallic brassy brown or gold. The backs of some individuals may be almost entirely green; in others golden-brown markings may dominate.

It is active by day and usually breeds in summer when conditions are warm. However, the breeding has been recorded from September to February, with a peak breeding period following heavy rains in the warmer January to February months.

The species is known to be highly mobile and may move among breeding sites with large distances travelled in a single day/night or up to 1-1.5 kilometres. Male frogs call while floating in water and amongst fringing vegetation and females produce a raft of eggs that initially float before settling to the bottom of the water body.

Habitat and ecology

- Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha spp.*) or spikerushes (*Eleocharis spp.*).
- Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.
- Some sites, particularly in the Greater Sydney region occur in **highly disturbed areas** and constructed water bodies such as storm water detention basins, farm dams, bunded areas, drains and ditches.
- **The species is active by day** and usually breeds in summer when conditions are warm and wet.
- Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation.
- Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs.
- Preyed upon by various wading birds and snakes.

Images



PREV



Green and golden bell frog, Broughton Island, NSW
Copyright © Dean Portelli/DPIE



Photo: S. Marks

Figure 1: Green and golden bell frogs often bask in the sun



The green and golden bell frog has an electric blue splash on the groin and back of the thighs

Photo: Sharron Marks

SOUTHERN MYOTIS

Scientific name: *Myotis macropus*

Conservation status in NSW: Vulnerable

Commonwealth status: Not listed

Online profile: [Southern Myotis - profile | NSW Environment, Energy and Science](#)

Description

The Southern Myotis (*Myotis macropus*) is also known as the Large-footed Myotis. A species of vesper bat it is one of only two Australian 'fishing' bats that is known for its disproportionately large feet that it uses to catch its prey.

The bat's appearance is mouse-like with small, rounded ears and dark-grey to reddish brown fur. They usually weigh up to 15 grams and have a wingspan of about 28 cm. Their feet are more than 8 mm long with widely-spaced, hairy toes and long, curved claws.

The Southern Myotis feeds on aquatic insects and small fish. They fly close to the surface of streams, reservoirs or other large bodies of water, trawling their claws to scoop up prey and bring it to their mouth, mid-flight.

Habitat and Ecology

The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.

Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, wharves, bridges and in dense foliage.

Forage over streams and pools catching insects and small fish by raking their feet across the water surface.

In NSW females have one young each year usually in November or December.

KNOWN to be roosting underneath the bridge over Oaky Creek.



Photograph 5.8 **Roosting Southern Myotis underneath the bridge**

Source – BDAR v4



Southern Myotis



Image: Allan Young
© Australian Museum



Southern Myotis or Large-footed Myotis, *Myotis macropus*.

Image: R & A Williams© Australian Museum



Large-footed Myotis Copyright © Australian Museum

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