Sydney Swans Headquarters, Moore Park
Microbat Management Plan

Prepared for APP, on behalf of the Sydney Swans

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Abbreviations

Abbreviation	Description
ABLV	Australian Bat Lyssavirus
APP	APP Corporation Pty Limited
BC Act	*Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
CEMP	Construction Environmental Management Plan
ELA	Eco Logical Australia
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environment Planning and Assessment Act 1979*
GPS	Global Positioning System
MMP	Microbat Management Plan
NPWS	National Parks & Wildlife Service
OEH	Office of Environment & Heritage
PPE	Personal Protective Equipment
RHI	Royal Hall of Industries
SEMP	Site Environmental Management Plan
SSD	State Significant Development
SWMS	Safe Work Method Statement

1. Introduction

1.1 Background

Eco Logical Australia (ELA) have been engaged by APP Corporation Pty Limited (APP) on behalf of the Sydney Swans, to prepare a Microbat Management Plan (MMP) for the proposed adaptive reuse of the Royal Hall of Industries (RHI) building at 1 Driver Street in Moore Park, Sydney (the subject site). The existing building infrastructure will be redeveloped for use as a high-performance sport and community facility for the Sydney Swans.

The proposed adaptive reuse of the RHI was assessed as State Significant Development (SSD-9726) in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), with approval determined on 4 June 2020. The SSD application was accompanied by a Biodiversity Development Assessment Report (BDAR; ELA 2020) and Microbat Survey Reports (ELA 2020 and 2021) which identified the potential for the RHI to provide non-breeding roosting habitat for threatened species of microbats.

Microbats use a network of roosts in their foraging range, selecting appropriate roosts based on the daily climatic and environmental circumstances. The Sydney Swans aim to retain roosting habitat within the roof void (~200 mm space in the pitched roof) to avoid long term impacts on microbats. The retention of this space will allow microbats to reinhabit the building following construction, satisfying SSD Development Consent Condition B1b. However, temporary exclusion of microbats from the RHI building during construction will be required to avoid injury or mortality of any roosting microbats, reducing roosting habitat in the short-term. Additionally, the roost site may be reduced in suitability, if noise, light, vibration, and general disturbance from these events, and subsequent increase disturbance of roosting bats. Redevelopment of the RHI building could impact roosting microbats during construction through direct changes to their habitat, and post-construction, through increased noise, light and vibration disturbance associated with increased building use.

A MMP is required to outline microbat impact avoidance measures, including retention of identified or potential microbat roosting habitat, meeting SSD Development Consent Conditions (B1b) and to mitigate direct impacts to microbats prior to and during construction (SSD Condition B1c), prior to the issue of a construction certification. This document is consistent with the above and recommendations by the Environment, Energy and Science Group (EES) of the Department of Planning, Industry and Environment.

1.2 Subject site

The subject site consists of the RHI and associated courtyard area to the immediate south of the building (Figure 1). The site is owned by the Centennial Park and Moore Park Trust and is leased to the Sydney Swans for the development. The RHI is situated within the Entertainment Quarter and is adjacent to the Hordern Pavilion live music venue. The RHI has historically been used intermittently for large music and cultural/arts events. The building is also known to provide non-breeding roosting habitat for microbats throughout the year, as confirmed by surveys in September 2019, February 2020 and May 2021.

1.3 Scope of works

Briefly, the proposed works will include:

- Demolition and removal of all redundant mechanical equipment
- Installation of scaffolding around the perimeter of RHI
- Modification of roof structure for skylights installation
- Reglazing of external windows and restoration of the RHI façade
- Removal or trimming of some vegetation.

The development will largely maintain the structural integrity and façade of the RHI, whilst re-purposing the interior of the building to support several compatible uses and utilise the space more effectively. In addition to the repurposing of the RHI, the south of the building will be extended in the current service and courtyard area and include a pool and other infrastructure such as a netball centre.

A small number of trees (none with hollows suitable for use by microbats) will be removed or trimmed to accommodate construction:

- Four immature, native Spotted Gums (*Corymbia maculata*) will be removed
- The following exotic vegetation will be trimmed: 20% foliage canopy of one Jacaranda (*Jacaranda mimosifolia*) and 13% of one Liquidambar (*Liquidambar styraciflua)*

Approval for the removal and trimming of vegetation will be sought under a separate application to satisfy SSD Condition A25.

The roof of the RHI building is a pitched roof with exposed trusses with no roof cavity/attic space. There is a small void, approximately 200 mm width, between the underside of the roof and the exterior. This space may provide roosting habitat for microbat species. As such, this void will be preserved throughout the construction, minimising the loss of roosting habitat. As such, increase noise and vibration throughout the construction is likely to be the primary cause of disturbance during the RHI redevelopment phase.

A modification to the SSDA was prepared by Urbis in June 2022, detailing design amendments which included:

- A reduction in the extent of rooftop skylights
- Retention of part of the existing roof structure

As the roof void in which microbats may roost was already to be maintained, this is likely to only have minor changes to the impact to microbats, with microbats being excluded during construction and retention of the roof structure resulting in a decrease in roosting habitat modification. As such, roosting habitat will continue be preserved throughout the construction, minimising the loss of roosting habitat

Redevelopment of the building will increase the usage of the building. It is understood that the building has been open to the public on average 50 days per year over the past three years.

1.4 Need for MMP

The proposed adaptive reuse of the RHI could affect microbats in the following ways:

- Disturbance during works – excessive noise (especially high pitched), dust and vibrations above the general background levels will cause bats to arouse more often during daylight when they

would normally be resting, reducing energy reserves and possibly leading to starvation and death.

- Death/injury of individual bats during works – roosting bats can be easily overlooked during the day and will often remain in a roost when threatened during daylight hours rather than risk predation by flying and searching for other roosts during daylight
- Loss of roosting habitat – reduction in the amount of suitable roosting habitat locally available may lead to increased competition/overcrowding of remaining roosting resources
- Reduced suitability of the RHI post-construction – the reuse of the RHI building will increase the usage of the building, increasing noise, light and vibration disturbance, potentially reducing the suitability of the RHI building as a non-breeding roost

1.5 MMP objectives

This MMP aims to reduce these impacts by:

- Providing details of the exclusion procedures and other management measures required to minimise direct (injury or death) and indirect (disturbance during works) impacts to microbats during construction
- Identifying possible risks to construction personnel and outlining procedures for mitigating those risks and dealing with unexpected microbat finds during proposed works.
- Identifying required compensatory habitat to provide microbats with alternative roosts during and post-construction.
- Detailing measures to improve the suitability of the roost post-construction.
- Identifying monitoring and reporting requirements for the actions outlined in this MMP.

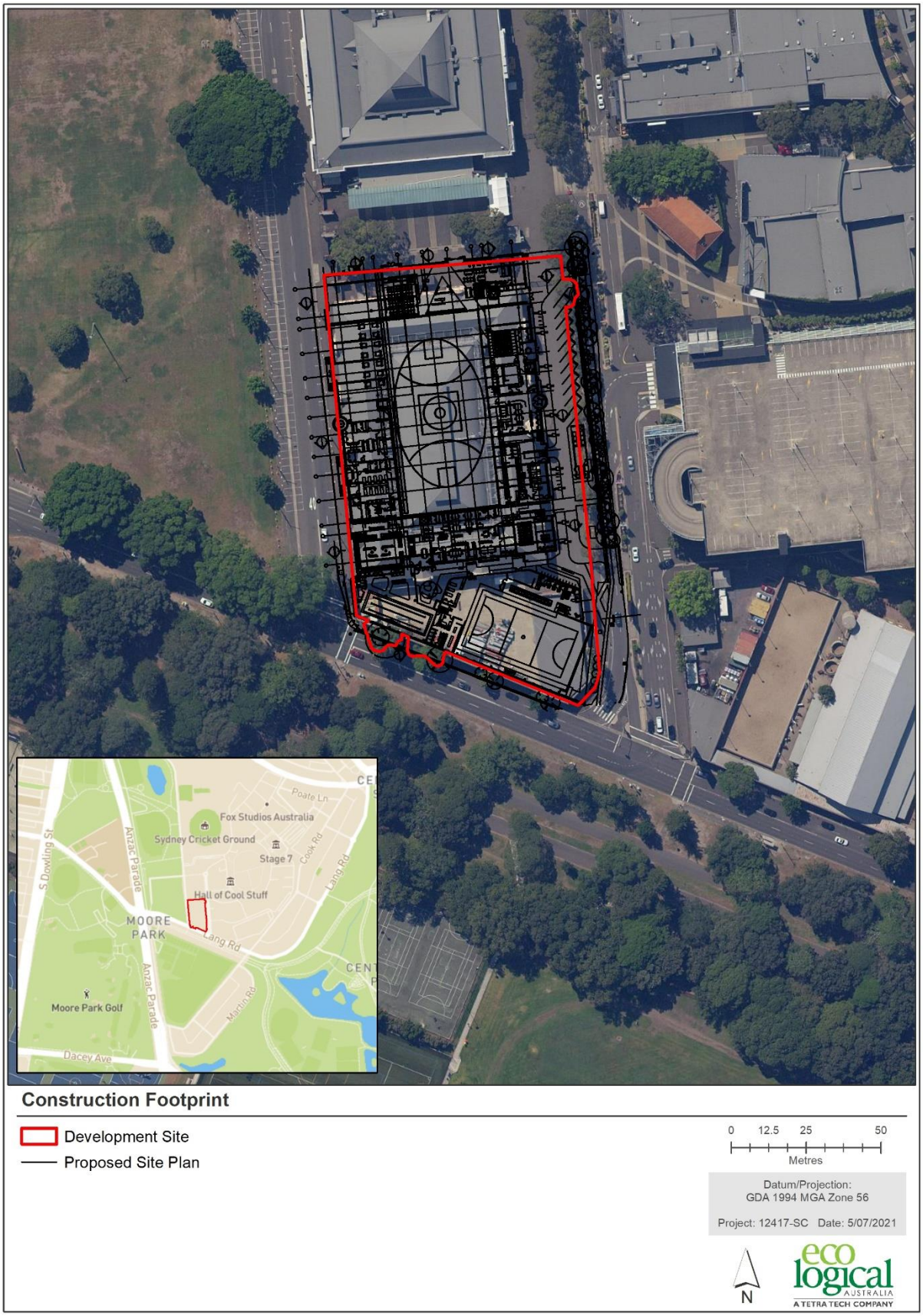

Figure 1: Subject site

2. Summary microbat surveys and roost assessment

2.1 Desktop assessment

A desktop-based survey was undertaken by ELA to establish the potential species likely to occur at the RHI building. Threatened microbat species found to occur within 10 km of the subject site included:

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat)

The life history, ecology and number of records within a 10 km radius of the subject site and an assessment of the likelihood for each of the seven threatened microbats potentially impacted by proposed works are outlined in Table 1.

Of these seven threatened microbat species, only five are considered likely to be affected by proposed works at the RHI, as only these species are known to utilise constructed habitat, such as buildings, as roosts (Churchill 2008). These species are as follows:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle,
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat).

Table 1: Ecology and life history characteristics of seven threatened microbat species known to occur within a 10 km radius of the subject site and likelihood of impacts

Scientific Name	Common Name	BC Act	EPBC Act	Distribution	Habitat requirements	Records within 10 km	Roost preference	Likelihood of impact
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes.	Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country.	1	Subterranean	Unlikely. Not known to roost in buildings and uncommon in the region
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Tall (greater than 20m) moist habitats.	1	Hollows/ Buildings (occasionally)	Potential. Suitable but sub-optimal roosting and foraging habitat present, as the species only occasionally uses buildings to roost and foragings in tall moist habitats
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V		East-coast of NSW from south of Sydney into south-east Qld and east of the Great Dividing Range	Commonly occurs in dry eucalypt forests and woodlands east of the Great Dividing Range. Common on Cumberland Plain. Prefers open spaces in forest and woodland, more active on upper slopes of forested areas.	10	Hollows / Buildings / Telegraph poles / Exfoliating bark. Known to use bat boxes	Potential. Suitable foraging habitat present on site and suitable roosting habitat present within cavities of the RHI.
Miniopterus australis	Little Bent-winged Bat	V		East coast and ranges south to Wollongong in NSW.	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub.	2	Subterranean / Buildings occasionally. Known to use bat boxes placed in subterranean	Potential. Foraging habitat present within study area and the species may use cavities within the RHI for non-breeding roosting habitat.

Scientific Name	Common Name	BC Act	EPBC Act	Distribution	Habitat requirements	Records within 10 km	Roost preference	Likelihood of impact
							structures in small numbers.	
Miniopterus orianae oceanensis	Large Bent-winged Bat	V		In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga.	Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland.	60	Subterranean / artificial structures. Known to use bat boxes placed in subterranean structures in small numbers.	Potential. Foraging habitat present within study area and the species may use cavities within the RHI for non-breeding roosting habitat.
Myotis macropus	Southern Myotis	V		In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers.	Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m. Rarely roosts more than 200 m from water.	35	Subterranean / Hollows	Unlikely. RHI is too far from known foraging habitat on Sydney Harbour and the species is not known to roost in buildings
Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat	V		Wide-ranging species found across northern and eastern Australia	Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	1	Hollows / Buildings	Potential. Suitable foraging habitat present on-site and suitable roosting habitat present within cavities of the RHI.

2.2 Field survey methods

The aim of targeted microbat surveys was to determine if bats were present, identify the species present, quantify the number of roosting bats, and the potential carrying capacity of the roosts within each potential roost. ELA undertook targeted microbat surveys during September 2019, February 2020 and May 2021 to establish the presence of suitable roosting habitat and current usage of roosts by microbats. The survey effort for each period is summarised in Table 2.

Table 2: Survey effort across the three RHI microbat surveys

Survey period	Dates	Number of detectors	Total survey hours	Emergence survey nights	Thermal camera used	Roof void inspected
September 2019	25th – 29th	4	276	4	No	No
February 2020	17th – 18th, 20th – 21st	4	20	2	Yes	No
May 2021	2nd – 11th	5	1,512	2	Yes	Yes

A diurnal survey was conducted in 2019 to identify potential roost entry/exit locations to be targeted in emergence surveys. Potential roosts within the subject site included:

- five cavities in the façade of the building where drainage pipes are attached and run into decorative external features
- degraded timber and plasterboard facia on and under the eaves and guttering
- missing brickwork on the internal turret walls (Appendix A).

The methodology and findings of ELA's 2020 and 2021 surveys, as endorsed by CoS and EES, are summarised as follows:

- Surveys were undertaken at four potential roost entry/exit locations (Figure 2) according to the '*Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Methodology* (OEH 2018), with one cavity excluded as it was observed to be occupied by rodents.
- Each survey involved the deployment of ultrasonic detectors at each entry/exit location for multiple nights and visual observation of roosts by a suitably qualified ecologist during likely emergence (5pm – 9pm) using a hand-held ultrasonic detector, for a minimum of two nights during each survey.
- A thermal camera was used to observe the entry/exit locations and visually capture any emerging microbats during emergence surveys in February 2020 and May 2021.
- A roof cavity search was conducted during May 2021, which involved inspecting the roof void visually and with a handheld detector.

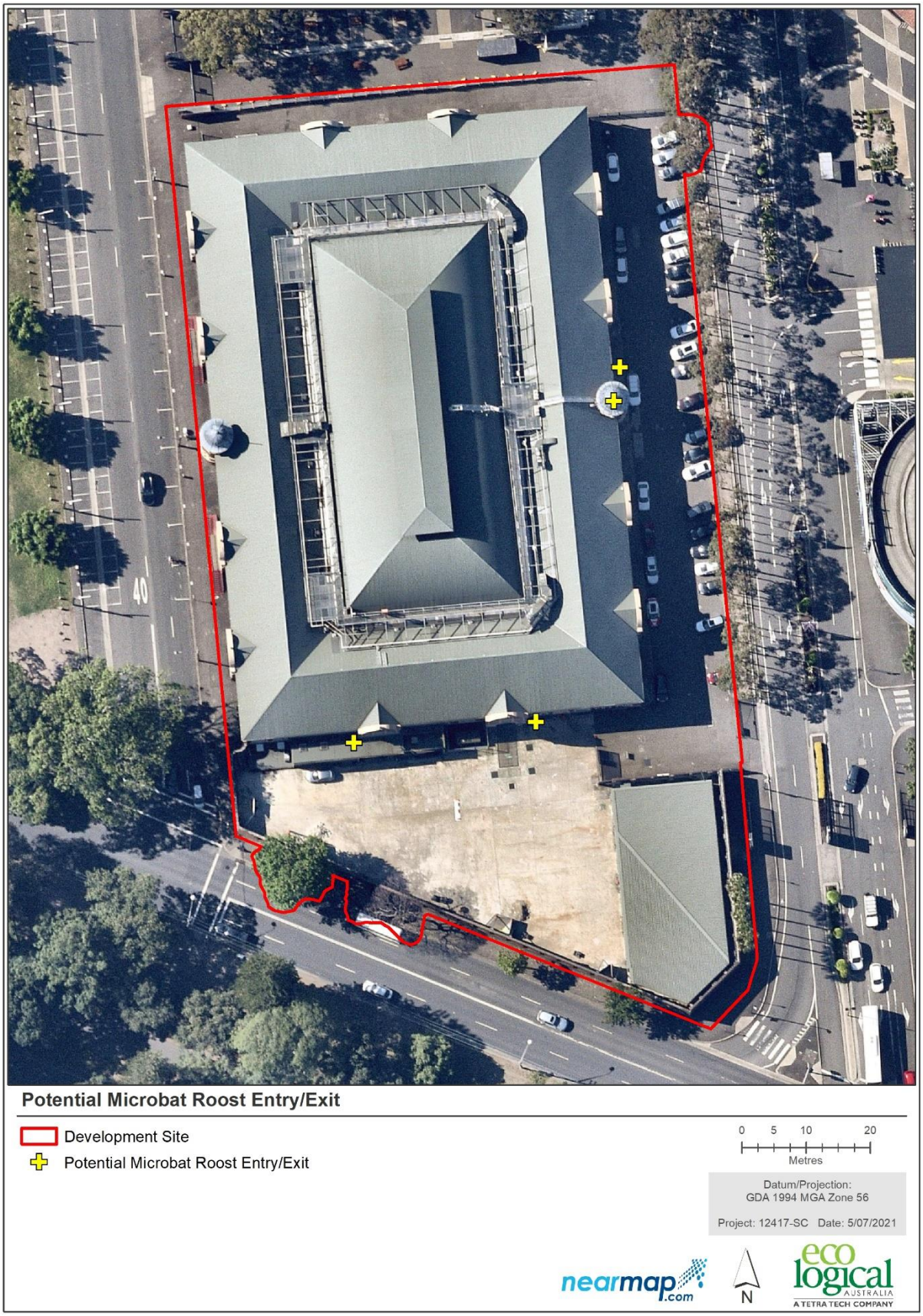

Figure 2: Potential microbat roost entry/exit locations

2.3 Results

Although suitable roosting habitat was identified across the RHI building, including throughout the roof void, only one microbat was identified emerging from a roost entry/exit via thermal imaging and two calls were recorded within the roof void and internal turret. Neither species recorded at the RHI building via calls are listed as threatened, however, the species could not be determined for the visually observed emerging microbat as no calls were recorded during the observation. Six additional species were recorded from the exterior of the building using the ultrasonic detectors, summarised in Table 3, although these numbers should not be directly compared as the survey effort different between surveys.

No evidence was found that the RHI cavities constitute breeding habitat for any threatened, cavity-roosting microbats, including those recorded around the building, i.e. Large and Little Bent-winged Bats. The Large and Little Bent-winged Bats are not known to breed in buildings and no evidence of large aggregations (thousands) required to sustain a maternity roost was found during surveys at the RHI over the spring and summer microbat breeding season.

It is therefore likely that the RHI building is used as an occasional roost for low numbers of microbats year-round, possibly including the threatened Large and Little Bent-winged Bats. These species forage near the RHI and it is therefore likely that individuals or small numbers use the RHI as non-breeding roosting habitat. Given the RHI roof provides protected cavities with good potential long term roosting habitat, but had low activity levels recorded in and around the building, the RHI building is of medium conservation value for microbat roosting habitat, as assigned by the guidelines outlined in Table 4 (adapted from the Woolgoogla to Ballina Microbat Management Plan, prepared by GeoLINK on behalf of the Roads and Maritime Services, 2015).

Table 3: Microbat species recorded at RHI during ultrasonic detection surveys conducted in September 2019, February 2020 and May 2021

Scientific Name	Common Name	BC Act status	EPBC Act status	September 2019		February 2020		May 2021	
				Call	# calls	Call	# calls	Call	# calls
Austronomus australis	White-striped Free-tailed Bat	Not listed	Not listed	Definite	2			No	-
Ozimops ridei	Ride's Free-tail Bat	Not listed	Not listed	Potential	-			Definite	49
Chalinolobus gouldii	Gould's Wattled Bat	Not listed	Not listed	Definite	3	Definite	2	Definite	10
Chalinolobus gouldii / *Ozimops ridei* *	Gould's Wattled Bat/ Ride's Free-tailed Bat	Not listed	Not listed	No	-	Potential	1	Potential	10
Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable	Not listed	Definite	21			Definite	24
Miniopterus australis	Little Bent-winged Bat	Vulnerable	Not listed	No	-			Definite	2
Rhinolophus megaphyllus	Eastern Horse-shoe Bat	Not listed	Not listed	No	-			Definite	1

*Calls overlap with Gould's Wattled Bat and no defining characteristics were present on recorded calls so species cannot be confirmed to be present

Table 4: Conservation habitat value criteria for microbat roosting habitat within cavities of the RHI

Habitat Value	Criteria	RHI
High	• Known to provide breeding habitat for threatened species; or • Known to provide non-breeding roosting habitat for large numbers (ie.>50) of threatened species (e.g. known to support large numbers of Bent-wing Bats over winter); or • Supports one or more of the federally listed threatened species	No. Surveys did not record any breeding habitat for threatened species in cavities of the RHI. There was no evidence that large numbers of bats (>50) use the cavities within the RHI. No federally listed microbat species were recorded during surveys and there is no suitable habitat present for the only federally listed species known to occur within a 10 km radius of the subject site.
Medium	• **Does not satisfy high conservation/ habitat value category;** • **Provides non-breeding roosting habitat for small numbers (ie. <50) of threatened species**; or • Medium to large guano accumulations and/ or stains present indicative of the occurrence of moderate numbers of microbats or medium to long-term usage (threatened/ non-threatened status unknown); or • **Supports protected cavities providing good potential long term roosting habitat; however, no bats or evidence of roosting bats present; and/or** • In proximity to open surface water, however provides mainly exposed roosting opportunities (e.g. cavities <50 mm deep, or rough concrete), offering limited potential for breeding roosting; and/or • Supports a breeding colony of non-threatened microbats.	**Yes.** **Cavities within the RHI can provide non-breeding roosting habitat for small numbers (<50) of microbats including Large Bent-winged Bats. The RHI supports protected cavities providing good potential long-term microbat roosting habitat. Evidence for low activities levels in and around the building and a single observation of an unidentified microbat emerging from one of the cavities**
Low	• Does not satisfy high or medium conservation/ habitat value categories; and • Individual microbats or very small numbers of non-breeding microbats (e.g. <5) present; or • Small guano accumulations and/ or stains present indicative of the occurrence of small numbers of microbats or short-term usage; or • Provides mainly exposed roosting opportunities (e.g. cavities <50 mm deep, or rough concrete) offering limited potential for use as breeding habitat; or • Not in proximity to open water. • Roosting habitat of similar value locally is common.	No. Satisfies medium conservation value category

3. Microbat management

3.1 Overview

Microbat surveys at the RHI building found low activity levels of threatened and non-threatened microbats in and around the building, including two calls recorded within the roof void/turret area and one individual observed exit from a crevice. As such, exclusion of microbats from the subject site is required to prevent injury and death to microbats from works associated with the proposed adaptive reuse of the RHI. Additionally, compensatory habitat is required to replace any roosting habitat lost during redevelopment.

The key actions outlined in the MMP include:

- Compensatory habitat creation: Microbat boxes will be installed prior to construction and the roof void within the RHI building will be retained to allow for suitable habitat for microbats post-construction.
- Exclusion: Exclusion of microbats from the RHI building will be conducted by a suitably qualified ecologist, with monitoring of exclusion devices occurring over multiple nights to ensure any exiting microbats relocate successfully. This will be conducted during non-breeding or maternity seasons or overwinter hibernation and extended torpor seasons for microbats.
- Construction monitoring and reporting: Environmental inductions to advise contractors of the biodiversity values present onsite, risks to human health and safeguards for dealing with unexpected finds.

3.2 Compensatory habitat

3.2.1 Bat boxes

Bat boxes will be installed in nearby vegetation to provide potential roosting habitat for any microbat that is displaced and are known to use bat boxes (i.e. Gould's Wattle Bat, Griffiths et al. 2019). A minimum of four bat boxes will be installed near to the site at least one week (but preferably several weeks) prior to commencing the exclusion process. The four bat boxes will comprise a mix of single, double and triple chambered boxes, with a 12 – 15 mm or 16-20 mm wide entrance at the base of the box, constructed from wood or Cyplas (a recycled plastic material that has a longer life than wood). The use of several box types and entrance sizes will cater to the needs of different microbat species that may be displaced by proposed works. Boxes will be placed in vegetation near to the RHI site on healthy trees at heights of no less than 4 m, with a clear flyway to and from the landing pad of the box. Each bat box will be installed under canopy to avoid direct sunlight during the hottest part of the day, but at a direction that they are warmed by late afternoon sun. The location of boxes will be agreed upon in consultation with the City of Sydney Urban Ecology Coordinator.

The following information about each box will be recorded for future monitoring and reporting:

- Date installed
- Unique ID number or code
- Location (GPS coordinates)
- Box type
- Aspect
- Tree species (if relevant)

- Tree health (if relevant)
- DBH of the tree (if relevant)
- Box height above ground.

Boxes will be monitored once during autumn and once during spring, every year for a minimum of five years after installation (details outlined in Section 7.2). A short report is to be sent to the Sydney Swans and the City of Sydney Urban Ecology Co-ordinator following construction and each monitoring season.

3.2.2 Roof void

For species not known to use nest boxes (e.g. Large Bent-winged Bats), it is important that the roosting habitat within the RHI building is preserved during redevelopment to allow for these species to reinhabit the building post-construction. Sydney Swans aims to preserve the roof void during redevelopment, minimising the loss of potential roosting space. Photos of the roof void will be taken throughout the construction to ensure a similar void size and design is maintained post-construction. To ensure roof space remains suitable post-construction with a likely increase in noise, light and general disturbance, construction will aim to create similar or increased insulation within the roof while maintaining a similar void space to lessen the potential impact of disturbance on the suitability of the RHI building for microbat roosting. Entry / exit points to the roof void will be maintained in similar localities and of similar sizes to that which currently exits, allowing microbats to re-enter the roof void post-construction.

The microbat activity levels at the RHI building will be monitored at 6 and 12 months post-construction, to determine whether the potential roosting activity has returned to pre-construction levels. If it has not, further recommendations, such as the installation of alternative compensatory habitat, will be made at this time.

3.3 Roost exclusion

3.3.1 Aims

The following exclusion process will be applied to the four identified microbat roost entry/exit points of the RHI, removing microbat access to these four cavities identified during construction. The objective of controlled roost habitat exclusion is to prevent microbat injury or mortality and avoid impacts to overwintering colonies of microbats.

3.3.2 Timing

The proposed exclusion works can only commence once bat boxes have been installed. Works can be undertaken once the exclusion is in place and the cavities in the RHI have been certified to be bat free. Exclusion should occur at least 2 weeks prior to commencement of construction to ensure microbats are not continuing to try to return to the cavities within the RHI.

3.3.3 Exclusion methodology

Exclusion will occur in a staged approach to minimise the risk of microbats not emerging or attempting to return once exclusion has occurred. This will involve:

1. An emergence survey pre-exclusion to determine the number of microbats emerging
2. Installation of a temporarily one-way valves at entry/exit locations following emergence, allowing microbats to leave but not return to the roost

3. Three nights of dawn and dusk surveys following the installation of valves to collect and relocate any microbats attempting to return
4. Installation of a permanent exclusion device
5. Monitoring of exclusion devices until construction is completed.

An initial emergence survey will be conducted at the four microbat roost entry/exit points at least one hour prior to sunset to attempt to identify if microbats are present (species and numbers) and if so, where they are roosting (exit/entry locations). The number of microbats recorded exiting the RHI will be documented along with the general direction of travel and behaviour upon exiting. This emergence survey will commence 30 minutes prior to sunset and continue until the ecologist is satisfied that all bats have emerged from the roost, or until there has been a period of sustained inactivity (60 – 90 minutes). An ultrasonic detector and thermal camera should be used to aid in identifying any emerging microbats.

Following emergence of all bats (or sustained inactivity) one-way valves (plastic cones) will be installed over each roost entry/exit point. This one-way valve is designed to let microbats exit the roost but not enter back into the roost, forcing bats to find roosts elsewhere before the permanent exclusion devices are installed over the roost entry/exit.

One-way valves will be left in place for three nights, with emergence and pre-dawn surveys undertaken for 1.5 hours at dusk and dawn during for each of these days to record any emerging bats and relocate any bats that are attempting to re-enter the building and are not self-relocating. The integrity of the one-way valves will also be inspected during these surveys. Any microbats roosting in unsafe places and not self-relocating will be captured by hand, held in a calico bag (containing no more than five microbats of the same species) in a cool, dark, quiet place for the day until they can be released at the site after dark. Any breaches of the exclusion devices will be noted and marked for repair later that evening.

A permanent exclusion device will be installed over each entry/exit location on the final morning following the one-way valve being in place for three days and secured in such a manner that will allow it to remain in place until and throughout construction works.

3.3.4 Exclusion device design

Exclusion devices will comprise heavy duty plastic sheeting fixed around the entry/exit point and shaped into a cone with a small opening at the base. Once the ecologist is certain a roost entry / exit point does not contain microbats, a permanent exclusion device will be installed over all entry/exit points on the final morning of the staged exclusion process.

Hold Point 1- completion of exclusion process

The project ecologist will confirm completion of Hold Point 1 to verify the exclusion process is complete, permanent exclusion devices are in place, the four microbat roost entry / exits are free of microbats and works may commence.

3.3.5 Inspection and maintenance of exclusion devices

Exclusion devices would need to be monitored before and during construction. These exclusion devices should be checked regularly to ensure they are adequately attached and remain effective in excluding microbats, especially following any high rainfall or high wind events. Prior to construction commencing, an ecologist should check the devices at 1 week and 1-month post-installation, and if any breach is observed, the device will be repaired by the client and microbat activity observed by ELA for a single night before construction can re-commence. If construction commences more than one month after

installation of the exclusion devices, then either the ecologist or the client will need to continue monthly checks until construction starts.

Notification is to be sent to the project engineer/site supervisor following completion of the exclusion process confirming that the exclusion is complete and providing photos and descriptions of the exclusion devices that have been installed.

An action log (Table 5) will be kept during the exclusion process and for any monitoring inspections conducted between the exclusion and commencement of works. This log will be submitted to the project engineer/site supervisor upon completion of the project as part of the reporting requirements. The exclusion log will contain the following information:

- Action undertaken
- Date
- Personnel involved
- Results/outcomes against performance measures
- Effort/time on site
- Adaptive / alternative procedures required / recommended.

3.4 Actions during construction

3.4.1 Site induction

All staff and contractors undertaking work at the subject site should be made aware of the environmental sensitivity of the site and the potential presence of threatened microbat species before commencing work through an environmental induction. A picture of the four potentially affected threatened microbat species should be made available and the location of potential microbat roosts marked on site maps/design drawings displayed on site. Staff should be briefed on what to do in the event of unexpected finds of microbats. Some microbats carry diseases that can be lethal to humans if untreated, and inexperienced/unvaccinated people should never handle bats.

3.4.2 Daily Inspection

A daily check of the exclusion devices at the RHI is to be undertaken before commencement of works and records kept of each check. If the exclusion devices are no longer secure the site supervisor must contact the project engineer and the project ecologist immediately so that the breach can be inspected and repaired as soon as possible. No works are to commence at a roost entry/exit point if the exclusion device at the location is not secure. Works at the roost entry/exit point can only recommence once the ecologist provides advice that the site is secure.

If a breach of the exclusion devices has occurred, the exclusion methodology outlined in Section 3.3 will be followed by the project ecologist over a single night. The breach will be repaired following conclusion of evening emergence and a dawn inspection of the repaired exclusion device(s) will be undertaken. A pre-works inspection of each roost entry / exit would be undertaken by the site ecologist prior to works commencing at that location.

Details of how to identify microbats or evidence of their presence should be provided to staff to ensure they can correctly identify potentially roosting microbats, including:

- Visual (diurnal) observations of singles or clusters of roosting microbats hanging from the obvert (ceiling or roof) or walls or lying within horizontal crevices within the RHI structure.

- Visual (nocturnal) observations of bats flying from or returning to a structure at dusk and dawn, respectively.
- Audible sounds made by roosting bats include a chattering clicking type noise often heard around dusk and dawn or if bats are disturbed in a roost. Any suspicion of unusual noises within the culvert will be investigated further with a handheld ultrasonic call recorder.
- Guano (bat dung/scats) will be present if bats are utilising a roost, even just for a couple of days. Often guano collects immediately under the roost site or sticks to the structure walls under the roost or around the entrances to a roost.
- Staining (urine) may be present where bats frequently access a roost.
- Bat bugs (ectoparasites) or their casings are frequently observed throughout microbat roosts and take the form of tiny tick like or spider-like invertebrates.
- Any Welcome Swallow or Fairy Martin nests – mud and earth constructed bird nests - should be investigated as some bat species will utilise disused nests as roost sites.

All works should cease if roosting bats are found or heard within a work area or bats are observed flying from a roost or around the works site during daylight. Unexpected finds of microbats should be reported immediately to onsite environmental staff, project engineer/site supervisor and the supervising ecologist who will advise the best course of action. In the first instance, photographs should be taken and then sent to the project ecologist to identify the microbats and to determine what actions are required.

4. Contingency measures

4.1 Adaptive procedures

Microbats are wild animals and do not always behave in the ways we expect or predict. Management plans need to be adaptable enough to respond to situations as they arise and deal with a range of possible outcomes, within the confines of the applicable Biodiversity Licences and Animal Care and Ethics Committee approvals. The MMP aims to outline the best practices in microbat exclusion and management during construction. However, the procedures of this plan may be adapted in response to factors such as microbats remaining in cavities within the RHI and not emerging to forage (affecting the length of time it takes to exclude microbats). Modifications to the procedures outlined in this plan may be undertaken given adequate consultation between the project engineer/site supervisor and the project ecologist.

4.2 Capturing and releasing healthy microbats

If healthy microbats are discovered during works or observed flying from a roost site or around the works site during daylight, works should be stopped immediately and the site supervisor and supervising ecologist informed. This is the responsibility of all site personnel. Works that are disruptive to microbats include those which create excessive noise (particularly high-pitched), vibration or light and heat sources or give off smoke or other potentially noxious gases. As such, all works should cease until the individual(s) can be relocated.

The supervising ecologist may elect to retrieve isolated bats (if possible) that are alive and healthy from the work area, hold them in a calico bag (no more than 5 microbats of the same species to be held in a single bag) during the day in a cool, quiet, dark, well-ventilated place and release them at the point of capture once the work area is secured. This should only be undertaken if microbats can be safely released on the night after they were captured. Bats should not be held for more than 12 hours.

If it is not possible to capture and remove the bats, a suitable exclusion zone will be set up by the supervising ecologist and no works will be undertaken within that zone until specifically directed by the supervising ecologist. The exclusion zone will remain in force until the cavity can be confirmed to be bat free.

Some microbats carry diseases that can be lethal to humans if untreated (Australian Bat Lyssavirus, ABLV). Bats should not be handled by unvaccinated and inexperienced persons to minimise any potential of serious disease transmission. The outlined risks and mitigation measures for avoiding ABLV are detailed in section 5.2.

Any evidence of a roosting microbat should be documented, photographed and actions recorded with onsite works staff and directed to the project ecologist for further action. Photos are the first and the best course of action to help identify microbats and should be supplied to the project ecologist.

4.3 Injured or dead microbats

If microbats are found injured or dead in a works area, all works in the immediate area should cease and the site supervisor and supervising ecologist must be informed. Any evidence of injured or dead microbats should be documented, photographed and actions recorded with onsite works staff and directed to the project ecologist for further action. A suitable exclusion zone will be set up by the supervising ecologist and no works will be undertaken within that zone until specifically directed by the

supervising ecologist. The supervising ecologist will inspect the work area and once it has been determined to be bat free, will provide approval for works to recommence.

Injured bats will be removed and taken to a local veterinarian or wildlife carer experienced in the care and handling of microbats by the project ecologist. Options for treatment and future release would be decided and then documented by the supervising ecologist. Costs for treatment would be the responsibility of the contractor. Dead microbats will be collected by the project ecologist (using gloves and a plastic bag) and, as an option, retained for lodgement with the Australian Museum.

5. Risks

5.1 Safe work method statement

Some of the procedures detailed within the plan pose various risks to human safety. The key risks include:

- contact with microbats
- working at night
- working at heights.

These risks are to be addressed by the project ecologist through the preparation of a Safe Work Method Statement (SWMS) that outlines control measures required to eliminate or reduce the risks to acceptable levels.

5.2 Exposure to diseases such as Australian Bat Lyssavirus

No unvaccinated or untrained person will handle microbats. The following actions will be undertaken if any personnel, unvaccinated or vaccinated, is bitten or scratched by a bat:

- Immediately wash the wound thoroughly with soap and water for at least five minutes - proper cleansing of the wound reduces the risk of infection
- Apply an antiseptic with anti-virus action such as povidone-iodine, iodine tincture, aqueous iodine solution or alcohol (ethanol) after washing
- Seek medical attention as soon as possible to care for the wound and to assess whether you are at risk of infection.

If bitten or scratched, a combination of rabies immunoglobulin and rabies vaccine may be required, at the advice of the medical professional. If not vaccinated previously, an injection of rabies immunoglobulin is required as soon as possible and a series of either four or five rabies vaccine injections over one month. If vaccinated previously with a full course of vaccination, two further doses of vaccine will be required. In NSW, Public Health Units will work with general practitioners to assess your risk and where indicated, will arrange for rabies vaccines and immunoglobulin to be delivered to your general practitioner or hospital.

The project ecologist and any other ecologists working on site must be vaccinated against ABLV and wear gloves when handling microbats. The equipment and procedures for dealing with potentially infected persons outlined above must be detailed within the SWMS. Appropriate bat rescue equipment / Personal Protective Equipment (PPE) must be available on-site before works commence (cotton bags, gloves, soap and water to wash hands).

Controls to eliminate or reduce the remaining key risks identified above are commonly encountered on construction projects and should be adequately addressed in the Safe Work Method Statement (SWMS).

6. Roles and responsibilities

The project engineer/site supervisor is responsible for:

- Notifying the project ecologist if there are any changes to the scope of works or works schedule
- Including the actions outlined in the MMP in the Construction Environmental Management Plan (CEMP) or Site Environmental Management Plan (SEMP)
- Notifying the project ecologist of the proposed date for commencement of works
- Notifying the project ecologist of the proposed date for conclusion of works
- Immediately notifying the project ecologist (within the same day) in the event of any unexpected finds of microbats during works (alive and healthy, injured or dead)
- Covering the costs associated with rehabilitation and release of any microbat injured during the course of works
- Ensuring monitoring of any new microbat habitat is undertaken (if required) and reported on with any recommendations for future improvement provided to the Sydney Swans.

The project ecologist is responsible for:

- Providing basic information and pictures of microbats to be included in the environmental induction and to be kept in the crib room and available to all site personnel
- Preparing a SWMS and undertaking daily Toolbox Talks for the implementation of the MMP
- Procuring bat boxes and exclusion material
- Maintaining an action log concerning activities related to the implementation of the MMP
- Monitoring and installing bat boxes and exclusion devices (may require assistance from construction personnel or subcontractors to conduct the exclusion)
- Conducting a pre-works inspection of each roost entry/exit point
- Providing regular updates to the project manager and site supervisor on the progress of works
- Dealing with any unexpected finds of microbats on-site, including the provision of advice, attendance at the site at short notice, rescue, handling, and release of healthy bats, transfer of injured bats to an appropriate wildlife carer and lodgement of dead microbats with the Australian Museum
- Reporting on the outcomes of the MMP within one month of completion of works
- Undertaking and reporting on monitoring of the bat boxes.

The project ecologist is to guide the project manager such that the aims of the MMP are achieved and impact to microbats are minimised. Any decision relating to statutory obligations would be discussed or referred to the project manager and environmental officer.

The site supervisor is responsible for:

- Conducting environmental inductions for all personnel working on site
- Providing the relevant materials on-site to deal with the immediate care of bites and scratches from microbats
- Conducting daily checks of the exclusion device during the works period
- Notifying the project ecologist if the exclusion device is not secure
- Notifying the project manager of the proposed date for commencement of works
- Notifying the project manager of the dates for conclusion of works

- Stopping works on-site in the event of any unexpected finds of microbats during works (alive and healthy, injured or dead)
- Notifying the project manager of any unexpected finds of microbats during works (alive and healthy, injured or dead)
- Maintaining a suitable exclusion zone around any unexpected finds on the advice of the project ecologist.

Construction staff and contractors are responsible for:

- Undertaking site inductions including the environmental induction
- Assisting the project ecologist with the installation of a permanent exclusion device (if required)
- Stopping works immediately and notifying the site supervisor, project manager and environmental officer in the event of any unexpected finds of microbats during works (alive and healthy, injured or dead).

7. Monitoring

The objectives of monitoring are to:

- Ensure no microbats are harmed by the construction works
- Identify the need to adjust the exclusion methodology to minimise impacts to microbats
- Identify whether the microbat management actions have been implemented and gauge their success
- Provide further recommendations for consideration on future projects with similar impacts on threatened microbats.

Monitoring of the exclusion devices would be undertaken by the project ecologist:

- Daily during the exclusion process
- One week following the completion of the exclusion process
- Once per month until construction occurs
- One day before construction at each roost entry/exit point.
- Following removal of exclusion device (compensatory habitat)

7.1 Monitoring methodology

Monitoring during exclusion involves diurnal and nocturnal visual inspections of the roost entry/exit points. Evidence of microbats, the number and species of microbat present, indications of breeding activity, occurrence of any pest species, date and time of inspection and record of the rainfall and weather during inspections will be recorded during each monitoring event.

Details of all monitoring inspections would be recorded in the log of actions and provided to the project manager following each monitoring inspection. The action log (Table 5) would be appended to the final report compiled by the project ecologist and provided to the project manager within one month upon completion of the project.

7.2 Compensatory habitat monitoring

Compensatory habitat within the new roof cavity and nest boxes, should be monitored post-installation, to determine usage by microbats. Bat boxes should be inspected for presence of roosting microbats, signs of microbat usage (e.g., staining or guano) or signs of lack of usage (cobwebs throughout nest boxes). Roof cavity usage should be determined through deployment of ultrasonic detectors at a minimum of four entry/exit locations around the perimeter of the building and one night of emergence survey.

Monitoring of compensatory habitat (bat boxes and the new roof cavity) should be carried out once during autumn and once during spring, every year for a minimum of five years after installation

7.3 Performance measures

The project would be considered successful if there are no microbats injured or harmed as a result of the exclusion process and construction works.

7.4 Monitoring report

A short letter style report will be provided post-exclusion and each year following the spring compensatory habitat monitoring. All reports will be provided to the client, DPIE Planning and Assessment Group, DPIE Environment, Energy and Science and the City of Sydney Council. This report will detail the background to the project, the objectives, methodology, and results of monitoring events and recommendations for future improvements to MMPs. These reports should be made available for public inspection by the applicant, along with the MMP (this report) and Microbat Survey Report (ELA 2021a). The applicant will advise DPIE Planning and Assessment Group, DPIE Environment, Energy and Science and the City of Sydney Council where this information can be publicly accessed.

8. Reporting and communication

The project engineer and site supervisor will be kept informed via regular email and phone updates of progress at key milestones throughout the implementation of the MMP by the project ecologist, as listed in Table 5. An action log summarising all site works undertaken will be maintained by the project ecologist. The action log will be a record of the actions taken, personnel responsible, timing, results as measured against performance measures and decisions made regarding adaptive measures if required during the installation and monitoring of exclusion devices. The action log will be included in final project report.

A final project report outlining the actions taken in implementing the MMP and the success or otherwise of the MMP in mitigating impacts to microbats including recommendations for improvements to the process that could be employed on future projects will be submitted one month following project completion.

Table 5 below outlines the main actions required in implementing the MMP and this will form the basis of the action log.

Table 5: Action log summary table to be included in the final report

Management Measures	Details	Timing	Performance Indicators	Responsibility
Site inspection	Project inception	Commencement of project	Undertaken at correct timing; the inspection report	Project ecologist, site supervisor, project engineer
Environmental induction	Discussion of risks involved and safety procedures	Commencement of project	Staff induction records	Project ecologist, site supervisor, project engineer, contractors and all site personnel
Action log	Commence logging actions	Commencement of project	Action log completed from project commencement	Project ecologist
Procure bat boxes and exclusion materials	Purchase suitable materials	At least two weeks before exclusion	Materials obtained at the correct timing	Project ecologist
Install bat boxes	Installation of bat boxes	At least one week before exclusion	Installed at the correct timing	Project ecologist or contractors
Exclusion – Day 1	First diurnal inspection	Winter	Record	Project ecologist
	Emergence survey	After diurnal inspection	Undertaken at the correct timing	Project ecologist
	Inspection following emergence survey	After emergence survey	Undertaken at the correct timing, record	Project ecologist
	Installation of one-way exclusion devices	After nocturnal inspection	Undertaken at the correct timing, record.	Project ecologist
	Dawn inspection	Morning of Day 2	Undertaken at the correct timing	Project ecologist
Exclusion – Day 2	Second diurnal inspection	Winter	Record	Project ecologist

Management Measures	Details	Timing	Performance Indicators	Responsibility
	Emergence survey	After diurnal inspection	Undertaken at correct timing	Project ecologist
	Inspection following emergence survey	After emergence survey	Undertaken at correct timing	Project ecologist
	Dawn inspection	Morning of Day 3	Undertaken at correct timing	Project ecologist
Exclusion – Day 3	Third diurnal inspection	Winter	Record	Project ecologist
	Emergence survey	After diurnal inspection	Undertaken at correct timing	Project ecologist
	Inspection following emergence survey	After emergence survey	Undertaken at correct timing	Project ecologist
	Dawn inspection	Morning of Day 4	Undertaken at correct timing	Project ecologist
Permanent exclusion	Install permanent exclusion device	Moring of Day 4	Undertaken at correct timing	Project ecologist
Notification	Email to PM to confirm exclusion complete	Day that exclusion is completed	Undertaken at correct timing, record kept	Project ecologist
Exclusion monitoring	Inspect exclusion device and email results to project manager	One week following install of permanent exclusion device	Exclusion device secure	Project ecologist
Exclusion monitoring	Inspect exclusion device and email results to project manager	Monthly following install of permanent exclusion device and up to commencement of works	Exclusion device secure	Project ecologist
Roof void inspection	Photos and descriptions taken of roof void to ensure minimal alteration throughout construction	Prior to disturbance of roof void	The final roof void is similar in void size and design and the location and number of entry/exit locations	Site supervisor
Daily works inspection	Inspect exclusion device and inform project ecologist if action required	Daily during works on Subject site	Exclusion device secure	Site supervisor
Pre-works inspection	Inspect exclusion devices and email results to project manager	Day prior to works at each entry / exit point	Exclusion device secure	Project ecologist
Advice and on-site unexpected finds	Provide advice when requested and remain on-call to attend site during construction	Throughout project as required	Timely responses, attend site as requested	Project ecologist

Management Measures	Details	Timing	Performance Indicators	Responsibility
Reporting	Prepare a report outlining actions undertaken	Within one month following completion of works	Report, at the correct timing	Project ecologist
Bat box monitoring reporting	Conduct checks of bat boxes during autumn and spring each year for two years. Prepare a report outlining monitoring actions and results	Autumn and spring. Reporting completed following each monitoring event	Boxes functional and showing evidence of use. Report delivered within a month following box checks	Project ecologist

9. Reference List

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Appendix A Potential microbat roost entry/exit location photos

Site	Photo
1: Near Door 7	
2: Near Door 8	

Site	Photo
3: Eastern turret and facade	
4: Inside eastern turret	

Appendix B Microbat photos

Figure 3: *Miniopterus orianae oceanensis* Large Bent-winged Bats

Figure 4: *Miniopterus australis* Little Bent-winged Bats

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