Shoalhaven City Council

Peer Review of Conservation Significance Assessment Report

WARRAH ROAD PLANNING PROPOSAL, BANGALEE

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ACRONYMS AND ABBREVIATIONS

DEC	Refer to OEH
DECCW	Refer to OEH
EEC	Endangered Ecological Community – as defined under relevant law applying to the proposal
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cwth)
HCV	High Conservation Value
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water (DECCW) and prior to this, Department of Environment and Conservation (DEC)
SCC	Shoalhaven City Council
SCRCP	South Coast Regional Conservation Plan
sp/spp	Species/multiple species
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

1 INTRODUCTION

1.1 BACKGROUND

Lot 24 DP 714096, Warrah Road, Bangalee (the subject land) (Figure 1-1) is the subject of a planning proposal (rezoning) that is being assessed by Shoalhaven City Council (SCC). There have been a number of biodiversity studies conducted and reports prepared to determine the conservation significance of the vegetation and habitats present to inform the rezoning of the land, since 2008.

1.1.1 Previous assessments

NGH Environmental was engaged by SCC in May 2015 to conduct a peer review of five separate biodiversity assessments that presented conflicting conclusions as to the conservation significance of the subject land. These assessments included:

i. *Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan* (May 2008). Report prepared for Shoalhaven City Council by Allison Hunt and Associates (AHA).
ii. *Flora and Fauna Assessment and Constraints Analysis* (September 2010). Report prepared for the landowner by Biosis Research.
iii. *Lot 24 Warrah Road, North Nowra, Hollow Bearing Tree Survey* (April 2011). Report prepared for the landowner by Biosis Research.
iv. *Review of Hollow Bearing Tree Assessment of Lands at Warrah Road* (May 2011). Report prepared for the landowner by OMVI.
v. *Review of Conservation Significance of Lands at Warrah Road, North Nowra* (October 2011). Report prepared for the landowner by OMVI.

The aim of the review was to provide an independent and objective review of the existing studies and to determine whether or not the subject land contained areas of High Conservation Value (HCV) as defined in the South Coast Regional Conservation Plan (SCRCP) or, if further assessment was required to define HCV areas. The review (NGH Environmental 2015) determined that:

- The existing studies were generally in agreement that the site provided known habitat for a number of threatened species.
- The existing studies differed in their opinion of what constituted 'high constraint' and 'high conservation value' areas.
- In general, survey effort employed was not adequate to accurately determine the current importance of the habitat to these threatened species.
- In the absence of exhaustive multi-seasonal targeted surveys on and surrounding the subject land, that the precautionary principle be employed.

It was the opinion of the review that areas that provide good quality known habitat for threatened species should be included as areas of high conservation value unless it can be adequately demonstrated that the known habitat is no longer important to the relevant threatened species. The review mapped the areas considered to be high conservation value (Figure 1-1) and recommended these areas be considered for Environmental Conservation (E2) zoning to protect the biodiversity values contained in these areas unless it can be adequately demonstrated that loss of these areas would not result in a significant impact, through adequate survey and analysis.

Figure 1-1 High Conservation value areas identified in the NGH Environmental peer review (2015) and those from previous assessments

1.1.2 Current assessment (this review)

The proponent of the planning proposal has submitted to SCC an additional Conservation Significance Report (OMVI 2016) which documents additional studies and assessments conducted on the subject land. The report provides further analysis and mapping of what is considered by OMVI to constitute HCV land (OMVI 2016). SCC have engaged NGH Environmental to conduct a peer review of this study to determine the accuracy and validity of the approach, assumptions and depth of analysis and ascertain whether/or how much of the subject land meets the criteria of HCV, as defined in Chapter 5 of the SCRCP. The conclusion of this peer review will directly inform the eventual Planning Proposal and the future zoning of this land.

1.2 OBJECTIVES AND SCOPE OF THIS REVIEW

The primary objective of this report is to provide an independent and objective review of the OMVI 2016 study. Based on the updated information, this report aims to reassess areas of HCV as defined in the SCRCP and, to determine if further field studies are still required to accurately define HCV areas.

The 2015 review by NGH Environmental, clearly identifies the land subject to review and provides a brief history of key planning decisions affecting the land. It identifies relevant biodiversity legislation and regional planning documents, stating how they apply to the land and provides a detailed analysis of the five past studies. This information is not duplicated in this report and it is recommended that this report be read in conjunction with the 2015 review.

This review:

Provides a summary of the OMVI 2016 study including the objectives, methods and key results.	Section 2
Provides NGH Environmental's assessment of the adequacy of additional survey work conducted on the subject land considering the target species and survey techniques and effort recommended by the draft Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities (DEC 2004), the NSW Guide to Surveying Threatened Plants (OEH 2016) and the BioBanking Assessment Methodology (OEH 2014).	Section 3
Provides NGH Environmental's audit of the findings of the OMVI 2016 study, assessing the accuracy and validity of the approach, assumptions and depth of analysis.	Section 3
Makes an objective assessment of which areas of the subject land meet the criteria of HCV as defined in Chapter 5 of the SCRCP. This assessment considers the results of the previous review conducted by NGH Environmental (2015) and any valid results documented in the Conservation Significance Assessment Report.	Section 4
Provides recommendations regarding the potential for development on the subject land, in consideration of the above evaluation.	Section 5

The scope of this review is limited to the evaluation of areas of HCV as they relate to biodiversity. This review does not consider other key factors such as Aboriginal heritage which may also have a bearing on the conservation value of the subject land.

It is noted that two (2) areas subject to a remedial order are present at the site. These areas are required to be zoned environmental protection at the direction of the NSW Department of Planning and the NSW Office of the Environment and Heritage (OEH) regardless of the conservation values they contain. These areas are identified separately on the mapping of HCV areas in this report.

The review was completed by senior ecology staff (refer to Appendix A, Assessment Personnel) who completed the 2015 review but have not been involved in the previous studies and reports undertaken on the subject site.

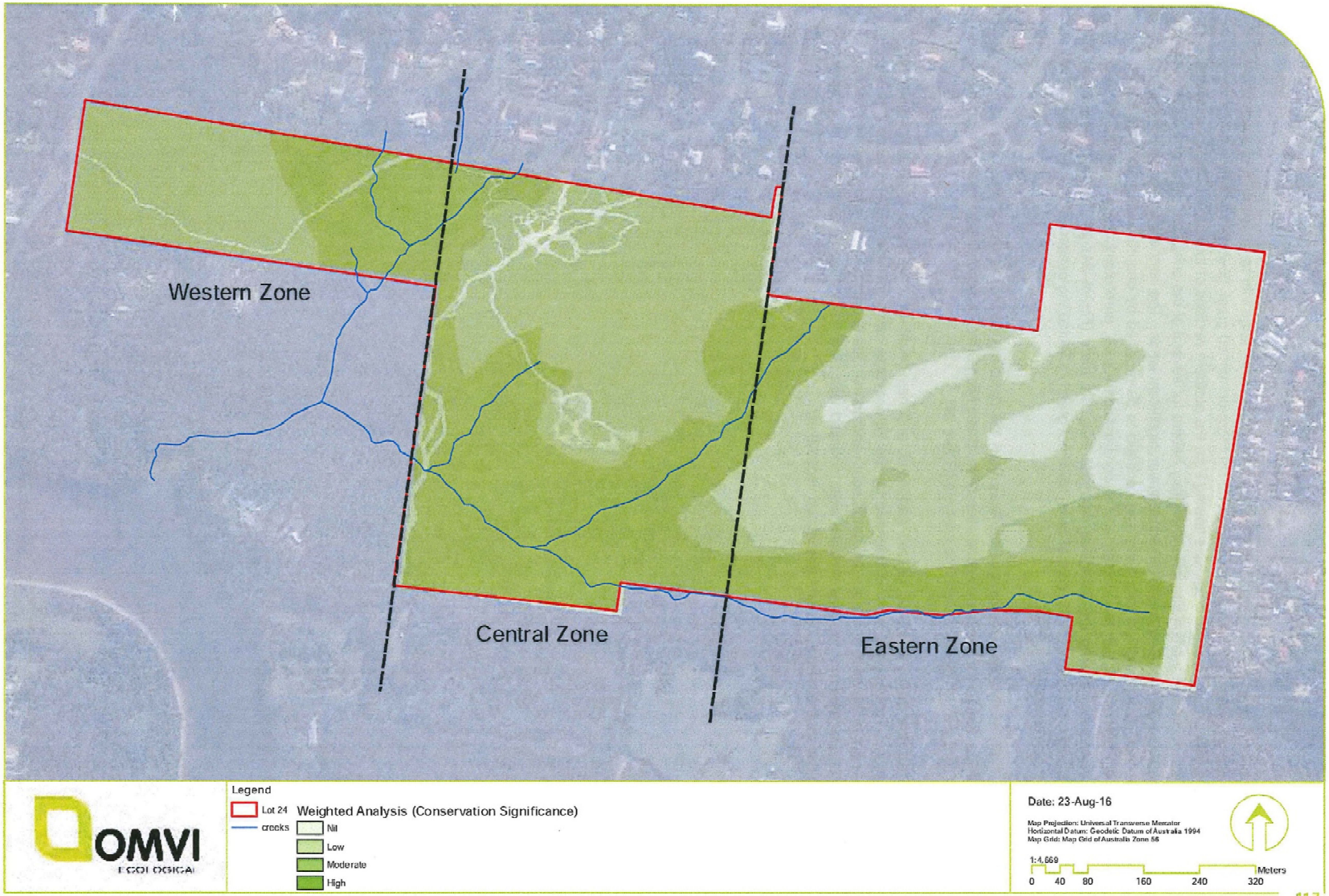

Figure 24: Weighted sum of habitats for conservation dependent species across lot 24

Figure 1-2 HCV areas as defined in the OMVI 2016 report

2 OBJECTIVES, METHODS AND OUTCOMES OF THE OMVI 2016 STUDY

2.1 OBJECTIVES

The primary objective of the OMVI 2016 study as stated in the executive summary is "*to 'fill in the gaps' in data required to determine current occupation, usage and importance of all areas of the lot and surrounding areas by conservation dependant flora and fauna, which have either been described previously in earlier assessments or that have recently been recorded utilising habitat on Lot 24. Therefore giving a relative qualification and quantification to the key matters of conservation significance and deriving an up-to-date map of the 'conservation values' of habitats across Lot 24*". It goes on to state that "*the assessment was conducted for planning purposes and not to assess the likely significance of a development under the administrative guidelines for determining significance under the NSW Environmental Planning and Assessment Act 1979 for those species listed on the Threatened Species Conservation Act 1995 or under the schedules of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Nor was it the aim of the report and analysis to rely on facets of the legislation in the absence of data to derive conservation significance*".

This review considers that the objectives of the OMVI 2016 study are consistent with the above statements, aimed at providing the information required to accurately determine areas of high conservation value.

2.2 METHODS

The OMVI 2016 study references and summarises the results of all the previous assessments and reports to date, providing a good consolidated understanding of the site's biodiversity context.

Subject threatened species were determined by scrutinising the existing reports, performing updated database searches and assessing the habitat type and quality present at the site.

A range of field methodologies were employed for the purposes of accurately defining vegetation types and habitats and targeting subject threatened species. Survey methods employed are summarised in Section 3 below and their suitability and adequacy analysed with reference to relevant guidelines.

For each of the vegetation types and subject species that were considered to be present on site, the conservation value of habitats was mapped and a conservation value rating applied as detailed in Section 6.2 of the OMVI 2016 study:

- *"Primary (i.e. High) – supports core habitat for biota recorded; poorly conserved vegetation or wildlife corridors in accordance with the HCVs of the SCRCP*
- *Secondary (i.e. Moderate) – includes habitat known to be used, possibly used or presents potential habitat for vector movement for species recorded but is not likely to be critical for the species' population viability locally*
- *Marginal (i.e. Low) – incorporates all potential habitat that was recorded with current threatened species use, was not determined to have essential breeding resources, foraging resources and did not provide important connectivity corridors*
- *Nil – did not provide suitable habitat for subject biota"*

A weighted sum analysis was then undertaken within a Geographic Information System (GIS) environment, weighing all subject vegetation types and species evenly to produce a combined conservation value map

for the site (Figure 1-2). This approach combines the conservation values across all species. Where an area may be HCV for one species, if it has no conservation value for several other species, then the overall value would be diminished. In this sense, important habitat for a particular threatened species may not be included in the final HCV analysis. This is discussed further in Section 4.

2.3 RESULTS

The OMVI 2016 study provides a detailed analysis of the vegetation types and habitats present at the site, and includes revised mapping and an assessment of the vegetation types against the HCV criteria. The OMVI 2016 study agrees with the conclusions of the NGH Environmental (2015) review in that vegetation that aligns with the Currambene-Batemans Lowlands Forest community represents a poorly conserved vegetation type and as such is HCV.

Based on the updated vegetation and habitat information, the results of previous studies and updated database searches, the following subject species were identified as requiring further survey and analysis:

Flora

- *Hibbertia stricta* subsp. *furcatula*
- Bomaderry Zieria (*Zieria baeuerlenii*)
- Leafless Tongue Orchid (*Cryptostylis hunteriana*)
- Halbury Rustyhood (*Pterostylis vernalis*)
- Brittle Midge Orchid (*Genoplesium baueri*)

Fauna

- Australian Grayling
- Giant Burrowing Frog
- Square-tailed Kite
- Little Eagle
- Glossy Black Cockatoo
- Gang-gang Cockatoo
- Little Lorikeet
- Powerful Owl
- Masked Owl
- Varied Sittella
- Eastern Pygmy Possum
- Yellow-bellied Glider
- Squirrel Glider
- Grey-headed Flying-fox
- Threatened microchiropteran bats
    - Large-eared Pied Bat
    - Eastern Cave Bat
    - Little Bent-wing Bat
    - Eastern Bent-wing Bat
    - Large-footed Myotis
    - Yellow-bellied Sheathtail-bat
    - East-coast Freetail Bat
    - Eastern False Pipistrelle

  - Greater Broad-nosed Bat
- Migratory species
  - White-bellied Sea Eagle
  - Rufous Fantail
  - Satin Flycatcher
  - Black faced Monarch

The list of subject species accounts for all the species identified in the NGH Environmental (2015) peer review as driving the delineation of HCV areas at the subject site, which included:

- Bauer's Midge Orchid (*Genoplesium baueri*) – referred to in the OMVI 2016 study as the Brittle Midge Orchid
- Yellow-bellied Glider
- Squirrel Glider
- Glossy Black Cockatoo
- Gang-gang Cockatoo
- Varied Sittella
- Grey-headed Flying Fox
- Threatened forest microbats

The OMVI 2016 study considers a number of species additional to those identified in the NGH Environmental (2015) peer review above, and demonstrates a comprehensive approach.

A detailed analysis of how the OMVI 2016 study determines whether the site provides HCV areas for the vegetation types and habitat for subject species present is provided in Section 3 below.

3 DETAILED ANALYSIS OF THE ADEQUACY OF THE OMVI 2016 STUDY AND ITS CONCLUSIONS

The table and section below detail an objective analysis of the survey approach and effort and the conclusion regarding HCV areas for each of the subject vegetation types and species considered in the OMVI 2016 study. Where surveys were conducted that did not specifically target a subject species that would affect the determination of HCV areas, it is not investigated in any detail. In assessing the adequacy of survey and the HCV conclusions, the efforts and results of the previous studies are also considered.

3.1 DETAILED ANALYSIS OF SURVEY EFFORT CONDUCTED FOR THE OMVI 2016 STUDY

Table 3-1 Detailed analysis of survey effort conducted for the OMVI 2016 study and previous studies

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
FLORA				
Vegetation communities				
Transect surveys and ground truthing of vegetation boundaries	All vegetation types and Endangered Ecological Communities (EECs)	Not documented within the report	Vegetation previously mapped within the Alison Hunt and Associates report (AHA 2008) and in the Biosis (2011) report.	The OMVI 2016 study considers the vegetation typing of all previous assessments at the site and published up to date broader vegetation mapping (i.e. Tozer *et al.* 2010, AHA 2010). The analysis of vegetation structure and composition and the delineation of various vegetation types and condition is detailed and thorough and considered adequate.
Biometric plots	All vegetation types and EECs	25 plots across all vegetation types	NA	The number of plots conducted across the site is adequate and is consistent with the minimum requirements of the BioBanking Assessment Methodology (OEH 2014).

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
Subject flora species				
Random meanders	• *Hibbertia stricta* subsp. *furcatula* • Bomaderry Zieria (*Zieria baeuerlenii*)	Not documented within the report	No specific targeted searches for these species but would have been detectable during general vegetation surveys	Consistent with the DEC (2004) survey guidelines. Not consistent with the NSW Guide to Surveying Threatened Plants (OEH 2016) but surveys consistent with these guidelines were conducted for more cryptic species below and covered the majority of the site including the most likely habitat for these species. The survey effort and approach is considered adequate for these species.
Parallel Transects	• Leafless Tongue Orchid (*Cryptostylis hunteriana*)	Parallel transects 3-5m apart. 24 person hours on the 15 and 18 December 2015 and confirmation of flowering at nearby reference sites from 7 December 2015 to mid-February 2016.	Targeted orchid surveys (2 ecologists) 5 & 6 December 2007 (AHA 2008)	The survey methodology employed is considered appropriate and adequate for the Leafless Tongue Orchid and the Brittle Midge Orchid.

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
	• Brittle Midge Orchid (*Genoplesium baueri*)	Parallel transects 3-5m apart. 32 person hours over four days (1-3 and 9 March 2016) and confirmation of flowering at nearby reference sites on 1 March 2016.	No suitable timed targeted surveys undertaken	Although identified as a subject species in Section 4.4 of the OMVI 2016 study, the Halbury Rustyhood was not included in the targeted parallel transect surveys. This species flowers in October so the timing of the other targeted surveys was not appropriate for this species. Targeted searches for this species were conducted by Alison Hunt and Associates on 4 and 6 October 2007 within suitable habitat however, the study area for this survey did not cover the entire subject site and given that the surveys were conducted nearly 10 years ago, the results are not considered valid.

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
FAUNA				
Fish and tadpoles				
Tadpole surveys – dip-netting	• Giant Burrowing Frog	Pools across the study area (number not defined) were each surveyed once for 15mins. Survey timing not specified but likely to be during the November 2015 and May 2016 sampling periods.	AHA (2008) conducted diurnal searches of suitable habitat for the Green and Golden Bell Frog and Giant Burrowing Frog during summer (2 person hours) 2.5 person hours was spent on call playback surveys on the subject land. Spotlight searches were also conducted at night along tracks and roads during rain events for the Giant Burrowing Frog. Biosis (2010) conducted a 1-hour combined diurnal reptile and amphibian survey in areas of potential sheltering, foraging, basking, breeding and roosting habitat such as	The survey methods and effort undertaken by the OMVI 2016 study is consistent with the DEC (2004) guidelines for amphibians. The Threatened species survey and assessment guidelines: field survey methods for fauna - Amphibians (DECC 2009) provide specific recommended survey methodologies, effort and timing for the Giant Burrowing Frog. The OMVI 2016 study is generally consistent with these guidelines although it is not clear if the surveys conducted as part of the OMVI 2016 study were timed to coincide with heavy rainfall events as recommended.
Bait traps - light	• Giant Burrowing Frog • Australian Grayling	Five traps deployed over four nights along the southern creekline in November 2015 and May 2016.		
Spotlight stream side surveys	• Giant Burrowing Frog • Australian Grayling	Four streamside surveys conducted on at least two nights each of the November 2015 and May 2016 sampling period.		
Call playback	• Giant Burrowing Frog	Selected sites during streamside surveys incorporating an initial 15min listening period, 5min call broadcast and 10min listening.		

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
General herpetofauna surveys including: Diurnal searches Rock, log and debris rolling Listening for frog calls diurnally and nocturnally Active shelter surveys Nocturnal spotlighting surveys	• Giant Burrowing Frog	November 2015 and May 2016 sampling period. Number of surveys and survey effort not specified	riparian zones and rock outcrops. A 30-minute searching and listening period was conducted in riparian zones for amphibians on one night.	Bait traps and dip-netting are recommended techniques for surveying the Australian Grayling (DSEWPAC 2011). Backpack electrofishing is also recommended. No minimum survey effort is recommended in the Survey Guidelines for Australia's threatened Fish (DSEWPAC 2011). Surveys for the Australian Grayling are considered adequate.
Avifauna				
Diurnal bird surveys	• Square-tailed Kite • Little Eagle • Glossy Black Cockatoo • Gang-gang Cockatoo • Little Lorikeet • Varied Sittella • Powerful Owl • Masked Owl • White-bellied Sea Eagle • Rufous Fantail • Satin Flycatcher • Black faced Monarch	Three morning bird surveys 07:30 – 09:00 were undertaken across the subject site in each of the November 2015 and May 2016 sampling periods. Daytime habitat sampling looking for pellets and white wash also conducted.	Several bird surveys conducted by other studies	The survey methods and effort undertaken by the OMVI 2016 study is consistent with the DEC (2004) guidelines.

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
Glossy Black Cockatoo feed signs – parallel transects	• Glossy Black Cockatoo	5 – 10m transects across the entire subject site during the November 2015 Survey. Cones were identified as foraging or investigative behaviour and classified according to age.	Habitat mapping completed by AHA (2008) and transect surveys by OMVI (2011)	There is no recommended minimum survey effort in the DEC (2004) guidelines. The type and level of survey is considered to be thorough and adequate.
Nocturnal bird surveys Spotlighting and listening Call playback	• Powerful Owl • Masked Owl • Sooty Owl	Three spotlighting surveys 18:00 – 22:00 were undertaken across the subject site in each of the November 2015 and May 2016 sampling periods. Call Playback was conducted on two nights in each of the November 2015 and May 2016 sampling periods. Surveys employed a 5min broadcast and 5min listening for each species and then a final 10min listening period.	Call playback surveys were completed by both AHA (2008) and Biosis (2010) in accordance with the guidelines except for number of site visits required.	The DEC (2004) Guidelines recommend at least 5 visits per site for the Powerful Owl and at least 8 site visits for the Masked Owl. None of the studies past or present have completed this level of survey. However, cumulatively, the level of survey effort is considered adequate to have detected the species if they were to be regularly utilising the subject site.

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
MAMMALS				
Diurnal tracks and signs	• Eastern Pygmy Possum • Yellow-bellied Glider • Squirrel Glider • Grey-headed Flying-fox	Specific searches for tracks, scats, burrows, diggings, scratching or pads. No particular survey effort provided but conducted as part of other surveys which have comprehensive coverage of the subject site	General fauna habitat assessment and completed by all previous studies.	The DEC (2004) guidelines recommend 30min searches in all habitat types. Although not clearly stated in the OMVI 2016 study, it is considered likely that this requirement has been met, based on other documented survey effort during which this survey type would have been incorporated.

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
Elliot trapping	• Eastern Pygmy Possum • Squirrel Glider	Two surveys of four nights each during both the November 2015 and May 2016 sampling periods. 75 traps were placed along four transects both on the ground and on tree mounted platforms. A total of 300 trap nights were employed each survey.	Elliot trapping completed by both the AHA (2008) and Biosis (2010) studies with 40 and 26 trap nights respectively.	The DECC (2002) guidelines recommend 100 trap nights per stratification unit per survey. The OMVI 2016 study almost meets this requirement for each survey period with 60 trap nights in the disturbed areas and 80 trap nights in the other main habitat types. Neither of the previous studies met the recommended minimum number of trap nights either but the current study has employed the greatest survey effort to date. Combined, the studies are considered adequate to determine the presence or absence of the species and the general rates of use.
Spotlighting	• Eastern Pygmy Possum • Yellow-bellied Glider • Squirrel Glider • Grey-headed Flying-fox	Three nights of spotlighting during both the November 2015 and May 2016 sampling periods from sundown to 20:30.	Spotlighting completed by both the AHA (2008) and Biosis (2010) studies. AHA (2008) over at least two nights as required by the guidelines.	Spotlighting survey effort is consistent with the DEC (2004) guidelines.

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
Targeted Yellow-bellied Glider occupation surveys	• Yellow-bellied Glider	Stag watching and active tracking of animals for an entire night in the November 2015 survey and numerous more hours over each survey. 5 – 10m parallel transects searching for evidence of foraging. Types of feed scars and relative age also recorded.	Parallel transect surveys for feed signs conducted by OMVI (2011).	The type and level of survey is considered adequate for determining the core habitat areas for the Yellow-bellied Glider.
Call Playback	• Yellow-bellied Glider • Squirrel Glider	Calls were broadcast for at least two nights each survey season from locations within different habitat types but targeted for the target species. A total of six locations were surveyed.	Call playback completed for the Biosis (2010) study but number of survey locations not documented.	The level of call playback survey conducted for nocturnal arboreal mammals at the subject site is considered to meet the requirements of the DECC (2001) guidelines.

Survey methodology	Target species	Survey effort and timing conducted for the OMVI 2016 study	Relevant survey effort from previous studies	NGH Environmental analysis of adequacy
Microchiropteran bats				
Ultrasonic call detection (Anabat)	• Microchiropteran bats	Two detectors deployed for three full nights during both the November 2015 and May 2016 sampling periods.	Anabat surveys completed by both the AHA (2008) and Biosis (2010) studies. AHA (2008) over at least two nights as required by the guidelines.	The DEC (2004) guidelines recommend that sampling be conducted between October to March when bats are most active. The November 2015 survey was within this window and meets the requirements of the DEC (2004) guidelines. Activity is likely to have been lower during the May 2016 survey. All threatened bats that are likely to occur at the subject site are detectable through call analysis. The call analysis procedures described in the OMVI 2016 study are considered appropriate and adequate.
Harp trapping	• Microchiropteran bats	Two harp traps over four nights each session at six locations during the November 2015 and May 2016 sampling periods.	Harp trapping was not conducted in previous studies	The survey approach and effort is consistent with the DEC (2004) guidelines. This survey technique compliments the Anabat surveys.

3.2 ANALYSIS OF THE CONCLUSIONS REGARDING THE DELINEATION OF HCV AREAS FOR EACH SUBJECT SPECIES

An analysis of HCV area conclusions documented within the OMVI 2016 study is provided below. The results and key conclusions of conservation significance are largely taken directly from the OMVI (2016) study (*italicised text*). It should be noted that in certain instances not all of the text included in the OMVI 2016 study has been duplicated here, particularly where it was not considered important for the determination of HCV areas.

3.2.1 Poorly conserved vegetation types

Study results and conclusion

The OMVI 2016 study agrees with the conclusions of the NGH Environmental (2015) review in that vegetation that most closely aligns with the Currambene-Batemans Lowlands Forest community (Grey Gum Woodland and Spotted Gum Forest) represents a poorly conserved vegetation type and as such is HCV.

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.2 Hibbertia stricta subsp. furcatula

Study results

Despite numerous surveys over the study area and locality, there have been no individuals recorded in the area. It is therefore unlikely that Hibbertia stricta subsp. furcatula is present within the study area.

Study conclusions of conservation significance

Given the absence of the species within the lot, after several appropriately timed targeted surveys for the species, over several years, it unlikely the Hibbertia stricta subsp. furcatula occurs and therefore the lot holds no conservation significance for the species.

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.3 Bomaderry Zieria (Zieria baeuerlenii)

Study results

The targeted threatened species surveys were conducted in all seasons across the study area in 2007 (AHA 2008), 2010 (Biosis 2011) and in the current surveys 2015/2016 and did not record this species. There are numerous records from known population in and around Bomaderry Creek Regional Park. Despite the atlas record in close proximity to the study area as referred to in previous studies, Z. baeuerlenii has not been recorded. It is therefore unlikely that Z. baeuerlenii is present in the study area.

Study conclusions of conservation significance

Given the absence of the species within the lot, after several appropriately timed targeted surveys for the species, over several years, it unlikely the Bomaderry Zieria occurs and therefore the lot holds no conservation significance for the species.

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.4 Leafless Tongue Orchid (Cryptostylis hunteriana)

Study results

Despite 3-10 metre transect surveys for the species over more than 29 hours in the recent 2015 surveys undertaken across all areas of associated vegetation communities during the known flowering period, no individuals were recorded within the study area. Moreover, two previous appropriately timed surveys in 2007 (AHA 2008) and 2010 (Biosis 2011), no individuals were recorded. It is therefore unlikely that C. hunteriana is present within the study area.

Study conclusions of conservation significance

Given the absence of the species within the lot, after several appropriately timed targeted surveys for the species, over several years, it unlikely the Leafless Tongue Orchid occurs and therefore the lot holds no conservation significance for the species.

NGH Environmental analysis

NGH Environmental agree that the recent November 2015 survey was appropriately timed with suitable effort. It is noted however, that the AHA (2008) surveys were only conducted over a portion of the site and did not confirm flowering at a reference site during the survey period. The majority of the Biosis flora and fauna surveys were conducted in April 2010 (Biosis 2010) which was not appropriate timing for the Leafless Tongue Orchid. Hollow-bearing tree surveys were conducted by Biosis on 6 and 7 January 2011 (Biosis 2011) employing a structured parallel foot based survey across the subject site, but given that the focus was on identifying hollow-bearing trees and only "focused on areas supporting significant habitat features" (Biosis 2011), it can be hardly considered a targeted survey for the species.

The leafless Tongue Orchid is a cryptic species. Being leafless, flowering is the only indication of the species presence and this is inconsistent from year to year (Bell 2001). As such, repeated surveys are required to conclusively determine the presence or absence of the species. However, given that the species was confirmed to be flowering in the local region (at Tomerong and Manyana) and that a suitable level of survey intensity was applied at the correct time, according to relevant guidelines, the conclusions of the OMVI 2016 study are considered reasonable.

Given that populations of the species may not flower every year, it is recommended that another additional targeted survey for this species be conducted in areas that may developed in the future, to clarify the conclusions of the OMVI 2016 study.

3.2.5 Halbury Rustyhood (Pterostylis vernalis)

Study results

The closest records for this species occur in Triplarina Nature Reserve south of the study area and south of the Shoalhaven River and despite numerous surveys over the study area and locality, there have been no individuals recorded in the Bomaderry North Nowra area. It is therefore unlikely that Pterostylis vernalis is present within the study area.

Study conclusions of conservation significance

Given the absence of the species within the lot, after several appropriately timed targeted surveys for the species, over several years, it unlikely Pterostylis vernalis occurs and therefore the lot holds no conservation significance for the species.

NGH Environmental analysis

Table 6 in Section 3.1 states that habitat for the Halbury Rustyhood (*Pterostylis vernalis*) is absent at the subject site, that the species has not been recorded in the locality and the species is unlikely to occur. This is in contradiction to the AHA (2008) report, where suitable habitat was identified and targeted surveys were conducted for the species, but in agreement with the Biosis (2010) report.

Targeted searches for this species were conducted by AHA on 4 and 6 October 2007 within habitat that was considered suitable by AHA. Random meanders were employed, consistent with the DECC (2004) guidelines however, the study area for this survey did not cover the entire subject site (Figure 1-1). As habitat for this species was specifically mapped in the AHA (2008) report, it is not possible to determine if all the habitat considered suitable by AHA within the subject site was surveyed.

The Biosis (2010) report states that the site provides "*some habitat*" with regards to vegetation types, but concludes the species is unlikely to occur on the basis that "*no observations were made of locations that would support the moisture regime preferred by the species*" and that the species is not recorded in the locality. The absence of the preferred moisture regimes is consistent with observations made by NGH Environmental during the site inspection made for the 2015 peer review. It may have been that the suitable "semi-swampy areas" that AHA identify in their 2008 report were temporary and a result of specific weather events rather than persisting conditions. There are however, four records of the species 2.5km south of the subject site just south of the Shoalhaven River from 2011 – 2015 (as acknowledged in the conclusion of the OMVI 2016 study). These records would not have been present at the time of the Biosis survey and report however, they were picked up in the updated database searches conducted as part of the OMVI 2016 study as they are mapped on Map 26 and the species identified as possibly occurring in Table 23.

Further advice was sought from OMVI to clarify whether the species was considered to have the potential to occur and whether targeted surveys were conducted. OMVI advised that "*the OMVI assessment being reviewed utilised all available information regarding all species. OMVI also discussed the potential occurrence of all conservation significant species with relevant experts, and in relation to orchids including OEH threatened species officers and Alan Stephenson. Pterostylis vernalis (Speculantha vernalis) was determined not likely to occur*" (B. Ryan *pers. comm.* via email to Daniel Hodge 11.05.17). This expert advice is not documented in the OMVI (2016) report. However, it is accepted by NGH Environmental. Combined with the apparent absence of the hydrological conditions preferred by this species during the Biosis 2010 and NGH Environmental 2015 surveys, NGH Environmental agree that the subject site is unlikely to hold conservation value for *Pterostylis vernalis*.

3.2.6 Brittle Midge Orchid (Genoplesium baueri)

Study results

Surveys have been conducted for this species by both AHA and Biosis as part of their respective assessments and the property has been examined in previous years, specifically for this species by local orchids experts, Alan Stephenson and Terry Barrett in 2014 (Alan Stephenson pers. comm.) during the local flowering period. No individuals were found during any of the previous surveys.

There is one record from the Atlas of wildlife for this species from 2006 which is recorded from on site, the location which was closely examined during the recent survey failed to locate an individual. However, seven individuals (seven flowers) were located along a central creek to the east of the atlas records and further north toward Warrah Road.

Being a relatively difficult species to survey for, given the size and colouration it is possible that other individuals may be present in the more dense forest in the west of the lot. It is however, unlikely that the species occurs in east of the individuals recorded given the open grassy habitat, and the detailed surveys undertaken. Moreover, the preferred Scribbly Gum/Red Bloodwood/Stringybark woodland on sandstone occurs mostly in the transition between the Shoalhaven Sandstone woodland and the Grey Gum Gully Forest, which generally follows the creeks and drainage lines across the site (Figure 13), and which also occurs at the reference site near Bomaderry Creek Regional Park.

Study conclusions of conservation significance

The brittle midge orchid is listed as endangered on both the NSW TSC Act and Commonwealth EPBC Act. It is therefore highly conservation dependant.

Flowering usually occurs from December to April (OEH species profile) and was during March 2016 locally. Despite favourable seasonal conditions, some plants do not regularly appear each year.

[The pollinators] *are likely to be able to move large distances and could be cosmopolitan if travelling in the high strata winds. Therefore a relative arbitrary 70 metre buffer around the local population has been considered the primary habitat for the species in lot 24 and all appropriate Scribbly Gum/Grey Gum intergrade as secondary habitat across the site. Open Scribbly gum is unlikely to support this species and the dense understorey with the creek channel is also unlikely to be ideal habitat for the species. The individuals are adjacent to a existing farm trail, which is likely to have been there as long as the existing barbed wire fence +50 years. The opening resulting from the track maybe an important factor in the presence or persistence of the individuals at this location.*

The conservation of vegetated linkages to other known populations may be important, however, given the highly fragmented landscape and that there is no longer linkages to the records north of Illaroo Road nor to those near Bomaderry Creek Regional Park, marinating creek buffers and therefore associated suitable habitat has been hence classified as secondary habitat for the species in the current assessment.

NGH Environmental analysis

Habitat ratings as mapped in the OMVI (2016) report are provided as Figure 3-1.

Given that it was recorded during surveys for the OMVI 2016 study, the fact that several previous surveys (including by experts in the field) failed to locate the species on the site is testimony to the difficulty of its detection. The OMVI 2016 study acknowledges that it is highly conservation dependant.

Primary habitat has been identified by applying an arbitrary buffer of 70m on the plants recorded during the OMVI 2016 study. The location of the previous record is located 370m to the south-west. Although this

location was surveyed and no individuals found, the OMVI 2016 study states "*Despite favourable seasonal conditions, some plants do not regularly appear each year*". As such, it is still possible that the species occurs in this location. Further, the OMVI 2016 study states "*Being a relatively difficult species to survey for, given the size and colouration it is possible that other individuals may be present in the more dense forest in the west of the lot*". It states that "*the preferred Scribbly Gum/Red Bloodwood/Stringybark woodland on sandstone occurs mostly in the transition between the Shoalhaven Sandstone woodland and the Grey Gum Gully Forest, which generally follows the creeks and drainage lines across the site, and which also occurs at the reference site near Bomaderry Creek Regional Park*".

An arbitrary buffer of 70m on the seven individuals found during the recent survey does not seem appropriate given the site provides other known and preferred habitat for the species. The OMVI 2016 study states that "*The conservation of vegetated linkages to other known populations may be important, however, given the highly fragmented landscape and that there is no longer linkages to the records north of lllaroo Road nor to those near Bomaderry Creek Regional Park, marinating creek buffers and therefore associated suitable habitat has been hence classified as secondary habitat*". Although not important for connectivity to populations outside of the subject site, these areas may be important for connectivity between populations that occur on the subject site. Given its sporadic flowering, several surveys over a number of seasons would be required to more accurately determine the distribution of the species across the site. This would include cross-checking with known reference sites to determine the degree of flowering in any given season. For example, if surveys across the site were conducted during a season when most of the known local reference sites were flowering then it could be confidently concluded that majority of the occurrences of the species on the site should have been detected. Conversely, if there were poor rates of flowering at known local reference sites then it is also likely that there would be poor rates of flowering at the subject site and occurrences of the species may be overlooked. Regardless of where the species occurs at the subject site, the areas of suitable habitat represent potential habitat for future dispersal which could contribute to the viability of the local population. It is the opinion of this review that in the absence of surveys that account for the sporadic flowering of the species, that both primary and secondary habitat mapped by the OMVI 2016 study, should be considered HCV.

Figure 15: Habitat for the Brittle Midge Orchid across lot 24

Figure 3-1 Habitat ratings for *Genoplesium baueri* as mapped in the OMVI (2016) report

3.2.7 Australian Grayling

Study results

No Australian Grayling were captured or seen during the site surveys and very few records of the species are available for several years in the Shoalhaven River or tributaries. It is therefore unlikely that the un-named creek along the southern boundary of the study area would serve as habitat for the species.

Study conclusions of conservation significance

Given the absence of the species within the un-named creek, after targeted surveys for the species, and the apparent very low number of possible extinction from the Shoalhaven River catchment, it unlikely the Australian Grayling occurs and therefore the lot holds no conservation significance for the species.

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.8 Giant Burrowing Frog

Study results

While the habitat along the southern creekline may be suitable for the species, it is more limited in size and quality than other known habitat in the Shoalhaven Region (e.g. Vincentia and Booderee National Park). The potential breeding sites observed during the survey were also relatively small and would appear to be rarely inundated, thus providing sub-optimal breeding habitat.

Targeted surveys for the Giant Burrowing Frog were undertaken across suitable habitat within the study area and in immediately adjoining areas that presented potential habitat during and after heavy rainfall during the known local breeding season. No tadpoles or frogs were observed or heard. There is a known population on Cambewarra Range to the north (Daly 2012) and one record from Bomaderry Creek Regional Park to the north east (Figure 27). Given the absence of the species during targeted surveys, particularly tadpoles throughout the range of surveys of the creek from 2007 to 2016, suggest that the Giant Burrowing Frog is unlikely to be present in the study area.

Study conclusions of conservation significance

Given the absence of the species within the un-named creek, after targeted surveys for the species, and the possible local extinction from the North Nowra Bomaderry area, it unlikely the Giant Burrowing Frog occurs and therefore the lot holds no conservation significance for the species.

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.9 Square-tailed Kite

Study results

The Square-tailed Kite is annually recorded in the North Nowra-Bomaderry area (Figure 27). They are recorded regularly near the North Nowra water tower as they make their season migrations (Daly 2012). One individual was recorded during the March terrestrial orchid surveys on Lot 24. The bird was recorded

foraging above the residences north of lot 24 and moved east continuing to forage 1-2 metres from the canopy of trees within the residential matrix through to the water tower and shopping centre of North Nowra. No other individuals have been recorded during spring or summer surveys by other surveyors of lot 24 or locality.

The forested portions of lot 24 are likely to represent foraging for this species, as is the forested habitat along the Shoalhaven River and surrounds. Considering the species' ability to forage in fragmented forest across the locality, all the remnant woodland particularly to the west (where breeding has been recorded) is likely to represent foraging and nesting habitat.

Study conclusions of conservation significance

Square-tailed Kite nest in mature live trees, often near water, such as the nest site recorded in Bangalee Reserve (Daly and Evison 1996). The nest is placed in a fork of a large limb, which is usually horizontal (Marchant and Higgins 1993). There were no raptor nests recorded across lot 24 despite numerous hours of survey over multiple years and only one sighting north of the lot during the current 2016 surveys. Nevertheless the woodland habitat across the lot, or specifically the numerous birds occupying and breeding within this habitat represent foraging habitat for the species on its annual migration. Given the scant observations, and the large areas of similar habitat, including the residential matrix, the habitat provided within lot 24 is unlikely to be critical for the breeding or foraging of this wide ranging and highly mobile species.

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.10 Little Eagle

Study results

The Little Eagle was not recorded during targeted surveys of the study and no raptor nests were observed. The subject site is likely to represent a very small area of potential foraging for this species and it is highly unlikely to represent a significant portion of an individual's home range, if present.

There is one local record at Worrigee to the south east of the study area and one west of Nowra to the south west within 10 kilometres. There are also few other records in the Nowra Bomaderry area. The absence of the species during targeted surveys over several years, suggest that the Little Eagle is unlikely to be resident in the study area, or a regular visitor particularly in the summer breeding season.

Study conclusions of conservation significance

The little eagle has not been recorded near the study area during the site surveys or surveys anywhere in the North Nowra / Bomaderry area (Atlas records). Therefore [the] *study area is likely to represent only a small area of potential foraging for this species, if it occurs transiently, and it is highly unlikely to represent a significant portion of an individual's home range, if present. Therefore, the lot holds little conservation significance for the species.*

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.11 Glossy Black-Cockatoo

Study results

While all the vegetation communities recorded in the study area support a midstorey of She-oaks, the historical disturbance throughout the study area, from past activities such as grazing, under-scrubbing, has reduced the amount of mature She-oaks present. However, one of the greatest impacts to this foraging resource across the lot has been fire. As recorded in the previous assessments in the locality (AHA 2008) bush fires had had a large impact on foraging resources for this species. As a consequence of recent fires, a large percentage of the site now does not support mature She-oaks, suitable or preferred by Glossy Black-Cockatoos. Only areas not affected by the fires, such as the ecotone between the two main vegetation types in the study area appear to support the mature trees with observed foraging. It is also apparent that foraging resources exist on vegetated lands in the surrounding forested and peri-urban landscape, as evidence of foraging as well as sightings of individuals resulted from other local surveys (OMVI 2012, NGH 2012) and from brief targeted surveys of the local street verges in the current surveys (Figure 16).

Despite targeted surveys over successive years within the study area (2007-2016) no individuals have been observed within lot 24. Nevertheless, foraging evidence has been recorded and individuals are using the site for semi-regular foraging expeditions, the lot is therefore a part of a larger home range of some locally occurring individuals.

Moreover, given the absence of foraging evidence on the site during the past surveys (AHA 2008, Biosis 2010, OMVI 2011 and NGH 2015) the suitability of the foraging resources is improving post fire. Given the last major impacting fire was 2003, the subsequent 12 years has seen the extent and maturity of the Allocasuarina increase which has also seemingly resulted in an increase of Glossy Black-Cockatoo activity across lot 24.

During the targeted Glossy Black-Cockatoo foraging surveys conducted over three days in November 2015, more than 55 trees were recorded with evidence of Glossy Black-Cockatoo activity on lot 24 and in adjacent lots and crown land. 21 were recorded with active foraging and 34 were recorded as being investigative sampling of the cones only (Table 9). Three trees were recorded as having been visited more than a single time.

It is therefore evident that the resources for Glossy Black-Cockatoo, while currently are not regularly used, are becoming a part of the foraging resources for locally occurring cockatoos and over time will become more important for certain individuals. However, currently the majority of lot 24 represents nil to marginal foraging habitat, with some Secondary habitat with mature Allocasuarina present, which is irregularly used.

Study conclusions of conservation significance

The largest fruit bearing trees were recorded on the boundary of Lot 24 were in the paper road easement along the northern boundary, in the Powerline easement in the south-east corner of the lot as well as in the neighbouring properties and the road verges in the surrounding residential areas.

It is therefore evident that the resources for Glossy Black-Cockatoo, while currently are not regularly used, are becoming a part of the foraging resources for locally occurring cockatoos and over time will become more important for certain individuals. However, currently the majority of lot 24 represents nil to marginal foraging habitat, with some Secondary habitat with mature Allocasuarina present, which is irregularly used.

Individuals are known to regularly visit foraging, and watering habitat immediately west of Gypsy Point road and other are regularly observed in Bomaderry Creek area, and adjacent residential lands supporting Allocasuarina, such as the North Nowra water tank. Orts were recorded along Crams road in the AHA (2007)

surveys as well as during the current investigations, therefore there is likely to be another family group or pair south of the site. Given the ability of the species [to] *forage widely in any given environment, any of these known groups could be responsible for the orts recorded locally.*

Given the number of re-visits and the sparse scattering across the lot and the general number seen beneath any given tree (Table 9), it appears that the site is not frequently used but is a part of an extended foraging range of one or two birds.

NGH Environmental analysis

The OMVI 2016 study maps the areas where foraging resources have been recorded as secondary habitat for this species (Figure 3-2). No areas are mapped as primary habitat. The definition of HCV areas for threatened species in the SCRCP relies on areas being considered important habitat. In the SCRCP verification rules for identification of HCV; "*Important habitat contributes to the viability of local threatened fauna populations and can include, but is not limited to, essential breeding resources, foraging resources and connectivity corridors*" (refer Appendix B). The subject site does contain specific foraging resources for the Glossy Black-Cockatoo and the fact that there are being used (albeit infrequently), suggests that they may be contributing to the viability of the local population. Further, there is no data provided on the frequency of use of specific foraging resources in the broader locality and it is not possible to determine if this frequency of use is common. A broader study of habitats in the locality and their frequency of use would be required to conclude that the trees on the site are being used less frequently relative to other local resources and therefore, have less importance to the local population. As stated in the OMVI 2016 study, "*It is therefore evident that the resources for Glossy Black-Cockatoo, while currently are not regularly used, are becoming a part of the foraging resources for locally occurring cockatoos and over time will become more important for certain individuals*". This is supported by NGH Environmental, and suggests that these foraging resources constitute important habitat for the species, particularly where there are multiple occurrences of preferred and investigated trees. These areas are also considered important in the context of the potential for clearing of other areas of habitat at the site that may be marginal at the moment, but could provide future foraging resources as the trees mature. As such, the area with the highest density of observed foraging signs is recommended for inclusion as primary habitat and therefore HCV (Yellow circle on Figure 3-2). This differs from the conclusions of the OMVI 2016 study.

The other isolated foraging resources are not proposed as HCV for this species as their isolated nature suggests a much lower density of preferred trees. Further, encompassing these trees in the broader HCV area would require the inclusion of areas that do not necessarily contain important habitat for threatened species to maintain connectivity to these resources. Trees kept in isolation (without connected corridors) may be abandoned by the species as preferred trees given their exposed nature and the proximity of other more sheltered habitats.

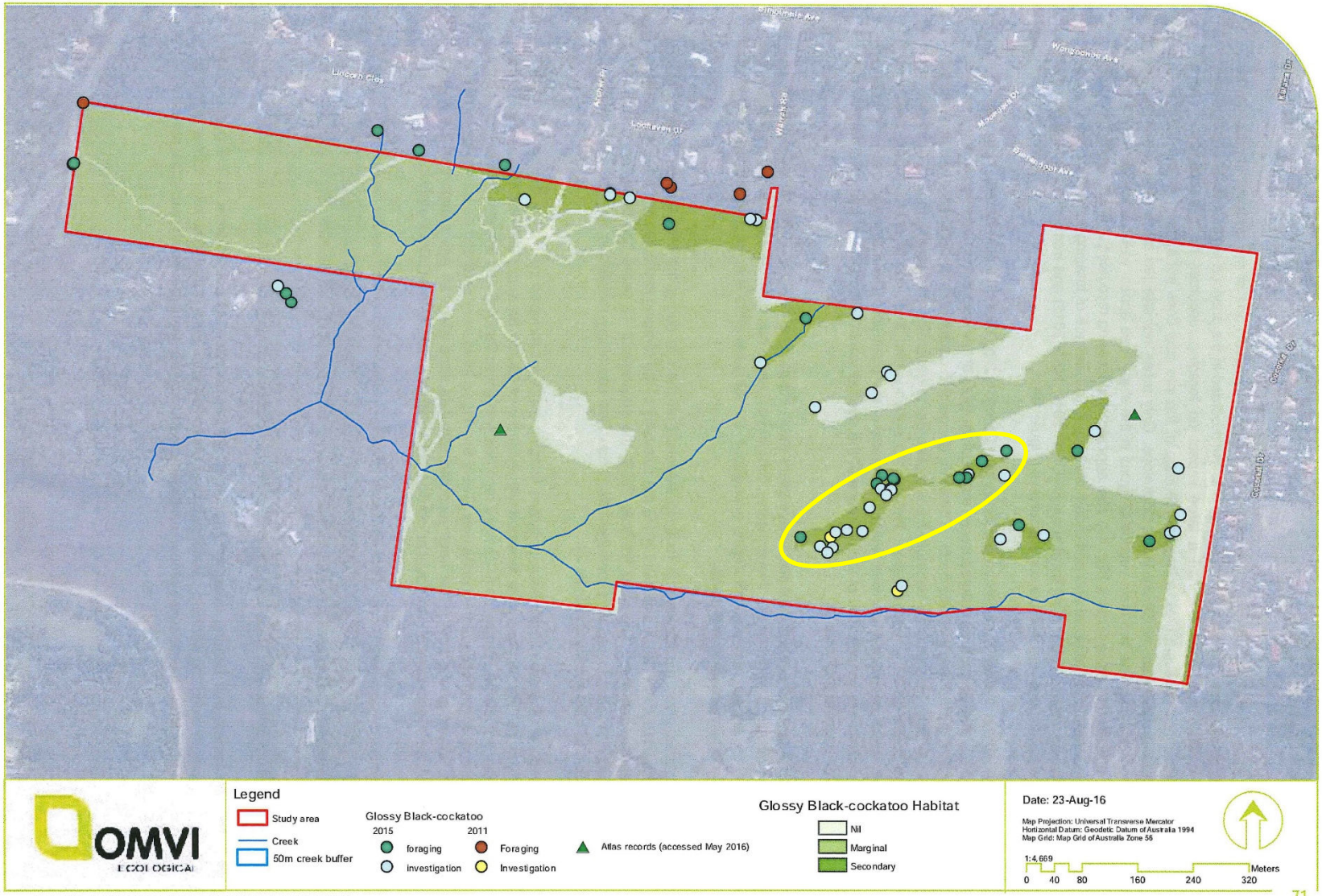

Figure 16: Habitat for the Glossy Black Cockatoo across lot 24

Figure 3-2 Habitat ratings and foraging resource records for the Glossy Black-Cockatoo as mapped in the OMVI (2016) report

(Suggested NGH HCV area identified by yellow circle)

3.2.12 Gang-gang Cockatoo

Study results

The Gang-gang Cockatoo was recorded during the Biosis surveys (2010) along Crams Road but not during the AHA Crams Road IA surveys (2006). There is only one additional record of this species within the Study Area: from 2006 with approximate 1km accuracy.

A pair was recorded flying across the site in November 2015, and again in December 2015. On both occasions, the pair were not recorded forging and were flying west to east during morning surveys.

Despite the scant records there is nevertheless suitable foraging habitat for the species throughout the study area in the form of seeds-capsules of eucalypts, acacia pods and invertebrate within the canopy.

Nesting of C. fimbriatum has been recorded mostly in mountain/highland areas north and east of the study area however, one coastal nesting was recorded in the Jerberra Estate at Tomerong (BES 2007), and Daly (2012) has recorded breeding behaviour from cockatoos in the upper Tapitallee catchment. There has been no nesting recorded within the study area despite targeted surveys between 2007 and 2016.

Suitable foraging and breeding habitat for this species occurs widely within the locality, particularly in Bomaderry Creek Regional Park, along the Shoalhaven River and in private lands with large stands of contiguous forest further to the west, north and south. Similarly, potential foraging habitat is common and widespread in the region, including the coastal national parks to the west, forested agricultural lands and even retained trees in developed urban and semi-urban area, as the species is known to forage within disturbed landscapes.

Study conclusions of conservation significance

There were no nesting cockatoos and only three sightings recorded across lot 24 despite numerous hours of survey over multiple years. Nevertheless, the woodland habitat across the lot, represent foraging habitat for the species on its seasonal migration. Given the scant observations, and the large areas of similar habitat, including the residential matrix, the habitat provided within lot 24 is unlikely to be critical for the breeding or foraging of this wide ranging and highly mobile species.

The study area appears from the survey to represent only temporary and transient foraging habitat. Gang-gang Cockatoos, since they are recorded infrequently in the area. It is highly unlikely that the study area is regular breeding habitat, and may not be regular foraging habitat

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.13 Little Lorikeet

Study results

Habitat suitable for this species is known to occur throughout the Shoalhaven region and recorded habitat does exist within the study area. No known breeding sites have been recorded for Little Lorikeets in the literature, however, in coastal Manyana, the species has been recorded utilising E. sclerophylla for nesting (B. Ryan pers. obs.). The same individuals have been recorded occupying the same area year round for at least the last 3 years. There a few local records of Little Lorikeets, and are known from the broader locality,

such as in Conjola NP, Morton NP and coastal towns such as Manyana, Lake Conjola, Narrawallee and Lake Tabourie (B. Ryan pers obs.).

The Little Lorikeet was not recorded during previous surveys of lot 24 or the locality but was recorded in pairs, or small flocks on numerous occasions through the 2015/2016 surveys (Figure 17) [Figure 3-3]. All records were from the tall vegetation along the southern creekline, and adjacent Scribbly Gum Woodland in the south west. Individuals were recorded foraging in flowering eucalypts during November and December 2015 site surveys as well as during March 2016, where they were also recorded inspecting hollows in a large E. sclerophylla. On this occasion four pairs were recorded in the same area and with the same group of trees, late morning for more than 2 hours.

Study conclusions of conservation significance

It is therefore likely that Little Lorikeets maybe breeding within lot 24, or at the least were inspecting suitable hollows at the beginning of the recognised breeding seasons for the species. The primary and secondary habitat for the species has been assumed as being the tall, mixed species woodland along the creeklines across the study area as well as the woodland knoll where the parrots were inspecting hollows.

The remaining potential habitat is recorded as marginal habitat, given that while the remaining did not support the local individuals during the many hours spent on site woodland may still represent potential habitat (Figure 17) [Figure 3-3].

The habitat across the southern portions of lot 24 are therefore of conservation significance for the Little Lorikeet and as such is assessed as a 'high conservation value' for lands in this assessment.

NGH Environmental analysis

NGH Environmental agree that the site contains land of HCV for the Little Lorikeet. The definition of primary habitat by the OMVI 2016 study has been limited to the extent of the recorded observations. The other areas supporting the tall mixed species woodland along riparian areas preferred by this species have been mapped as secondary habitat (Figure 3-3). These habitats are continuous with that in which the records occurred, contain a number of hollow-bearing trees and as such are also likely to support the species. As such, these 'secondary' habitats defined by the OMVI 2016 study are also considered to provide essential breeding and foraging resources that contribute to the viability of the local population and are considered important habitat. It is recommended that they be included as HCV areas.

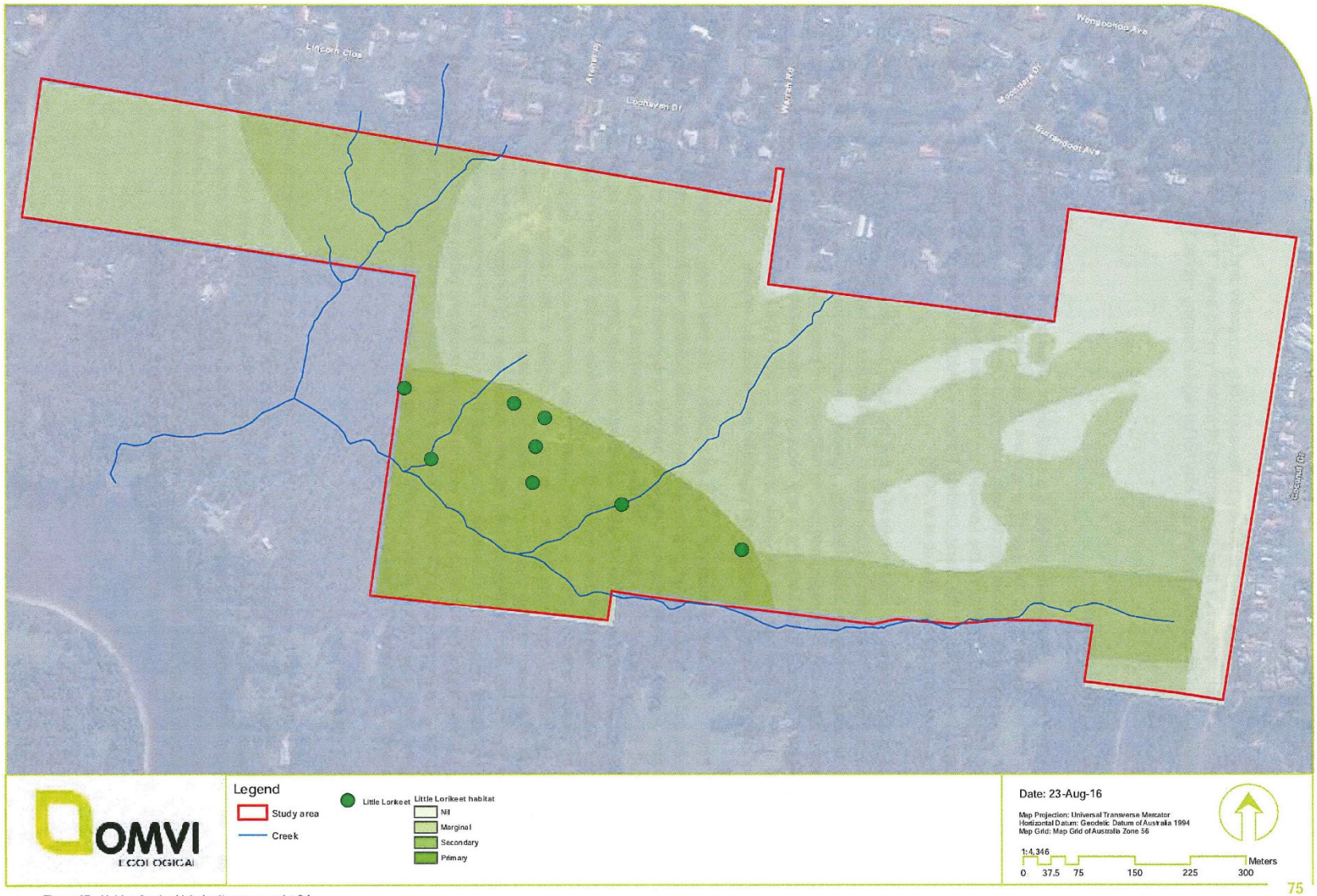

Figure 17: Habitat for the Little Lorikeet across lot 24

Figure 3-3 Habitat ratings and records of the Little Lorikeet as mapped by OMVI (2016)

3.2.14 Powerful Owl

Study results

Since breeding has been recorded in the same tree since 2005 and Powerful Owls are strongly territorial, there is not likely to be other breeding sites within Lot 24 or nearby. Given the proximity of the permanent breeding and roosting site it is strange that Powerful Owls were not recorded during the surveys conducted by both AHA and Biosis nor during the current surveys, which overlapped with the occupancy west of the study area in March 2016.

The study area contains limited suitable foraging habitat for the species, as there is a relatively low density and diversity of preferred prey species (arboreal mammals). Pellet analysis indicated a high proportion of birds in the diet of this owl pair in 2005/08, and only birds remains were found at the roost sites in the 2011/12 survey period, which suggest that birds appear to be the main prey in this part of the owls' breeding range. This may be due to the range of disturbances to the surrounding landscape or prevalence of suitable bird prey species in that modified environment.

Study conclusions of conservation significance

The Powerful Owl has not been recorded during numerous local surveys targeting the species and despite its known presence west of the site. Nevertheless, the woodland habitat across the lot, may represent suitable foraging habitat. However, the habitat provided within lot 24 is unlikely to be critical for the breeding or foraging of this wide ranging and highly mobile species.

NGH Environmental analysis

The OMVI 2016 study comments that "*Given the proximity of the permanent breeding and roosting site it is strange that Powerful Owls were not recorded during the surveys conducted by both AHA and Biosis nor during the current surveys, which overlapped with the occupancy west of the study area in March 2016*". It is noted that none of the surveys on their own have met the minimum recommended five site visits for detection of the Powerful Owl (DEC 2004). This may have been a contributing factor to the lack of detection.

It is however, considered likely by NGH Environmental, that if the subject site supported essential breeding or foraging resources that would define important habitat, that the cumulative level of survey completed by all the studies would have detected the species. NGH Environmental agree that the habitat provided within the subject site is unlikely to be critical for the breeding or foraging of the Powerful Owl and as such, the subject site does not contain land of HCV for this species.

3.2.15 Masked Owl

Study results

The relative few records locally may also be a direct result of completion. Powerful Owls are much more frequently recorded in the Bomaderry area (atlas of wildlife) and the Masked Owl may therefore be forced to forage on differing prey species when sympatric or forced to differing habitats in order to forage sustainably. Nevertheless, given recent records from Bomaderry Creek, indicate that the open forest of Lot 24 may represent potential foraging habitat, if only transiently.

Study conclusions of conservation significance

The masked Owl has not been recorded during numerous local surveys targeting the species. Nevertheless, the woodland habitat across the lot, may represent transient foraging habitat. However, the habitat provided within lot 24 is unlikely to be critical for the breeding or foraging of this wide ranging and highly mobile species.

NGH Environmental analysis

NGH Environmental agree with this conclusion.

3.2.16 Varied Sittella

Study results

Most of the broad fauna habitat types within Lot 24 (other than grasslands) provide potential habitat resources for the Varied Sittella (Figure 9), although the denser components of the Grey Gum Forest, Spotted Gum Forest, Melaleuca Forest and Morton Mallee Heath are less likely to be used. Suitable and widespread foraging resources are present in their preferred habitat (e.g. insects) and the species is likely to use trees for nesting, although none were recorded during the surveys.

Varied Sittellas were recorded during the surveys as a small group of 4 (25 November 2015) in the west Scribbly Gum Wood with a heathy understorey; five birds were recorded again in the same area the following day (25th November 2015) and later the same day six birds were recorded flying west to east to forage in the central (north south) creekline. No birds were recorded during the May 2016 surveys.

Varied Sittella's were not recorded during the 2007 (AHA) surveys and were recorded along the central creekline in a similar location to where they were recorded foraging in 2015, during the Biosis 2010 surveys. There are several records form Spotted Gum forest and the Grey Gum intergrade forest west of the site (OMVI 20012) and Tapitallee Nature reserve, and Bangalee Reserve to the west. Therefore it appears that at least in the locality one possibly two groups occupy the mixed forest (i.e. roughbarked gums) over the western half of the site as well as west of Gypsy Point Road. It is likely that the birds seen on three occasions in November 2015 are the same group and the Grey Gum Woodland, and intergrade, serve as foraging habitat for the group, if only transiently. Similar habitat suitable for this species is known to occur throughout the Shoalhaven region and the habitat that exists within the study area, particularly along the Shoalhaven River and its tributaries.

The species was not recorded east of the central creekline on any of the surveys (2007-2016) and given the presence of Noisy Miners, Starlings and Common Myna in this mostly disturbed woodland, their presence in unlikely. Many studies have shown that Noisy Miners exclude most small insectivorous bird species from their colonial territories (Debus 2008), and a study by Maron et al (2013) shows that the Varied Sittella is a species impacted by the Miners dominant occupation.

Study conclusions of conservation significance

The Woodland interface and Grey Gum Woodland across the western half of the lot appears to be irregularly used, (based on surveys and the numerous hours spent on the site since 2007) by the Varied Sittella. The same family group, or associated group are known to occupy similar habitat west of Gypsy Point road and were regularly seen in open forest along the Shoalhaven River, including at the end of Crams Road (B. Ryan pers. obs.).

The mixed woodland habitat across the western half of the lot therefore represents suitable foraging habitat. However, the habitat provided within lot 24 is unlikely to be critical for the breeding or foraging, given the scant observations of the species in the lot. The remaining open generally smooth barked Scribbly Gum woodland is considered as marginal habitat in this assessment.

The recorded habitat across lot 24 is therefore of marginal conservation significance for the Varied Sittella and as such is not assessed as a 'high conservation value' in this assessment.

NGH Environmental analysis

Although infrequently recorded on the subject site, as acknowledged by the OMVI 2016 study, the western section represents suitable known foraging habitat for the Varied Sittella. Although nesting has not been observed on the site, the habitats in this area provide suitable nesting opportunities and could be utilised in the future. The species is generally sedentary (OEH 2012) and as such, the habitats on the subject site are likely to be contributing to the viability of the local population.

However, it is recognised that there are extensive habitats to the west of Gypsy Point Road which are also known to support the local population. In this context, the small area of habitat on the subject site that appears to be infrequently utilised by the species and does not provide important connectivity, is not considered to be greatly contributing to the viability of the local population. The conclusion by OMVI that the habitats on the subject site are not HCV for the Varied Sittella is supported by NGH Environmental.

3.2.17 Eastern Pygmy Possum

Study results

During the current surveys across Lot 24, Eastern Pygmy Possums were captured on three nights in the western heathy Scribbly Gum. Habitat was similar to the areas where the species has been captured locally (OMVI 2012, NGH 2012). The western Scribbly Gum Woodland, bounded by Gypsy Point road to the west, a council reserve (with the same vegetation) to the north and similar habitat to the south through other lots. This type of woodland is relatively common along the same altitude and topography in the North Nowra Bangalee area. With irregular fire and low human disturbance it forms a low emergent E. sclerophylla woodland with a dense shrub layer including potential food resources such as Banksia spinulosa, B. serrata, B. oblongifolia and B. ericifolia as well as Mountain devil (Lambertia formosa) and Grevillea spp. There is only a shallow skeletal soil over sandstone and a relatively dense ground cover or grasses and sedges.

Due to historical impacts (human and wildfire) within the study area the same community type east of the western finger has lost the dense understorey and therefore apparently habitat quality suitable for the Eastern Pygmy Possum (no captures despite the similar effort). Similarly, the Currambene- Batemans Lowland Forest, Grey Gum intergrade or the Melaleuca Forest was unsuitable habitat for the Eastern Pygmy-possum due to the extent understorey foraging resources. The habitat for this species over most of the study area appears to be sub-optimal due to the disturbance history, which has resulted in spared understorey and lack of shelter and foraging resources.

The current surveys recorded higher capture rates were 3 animals in 160 trap nights over the November and May trapping periods or 1.9 per 100 trap night, again much higher than other published results. Therefore the heathy Shoalhaven Sandstone Forest recorded throughout the Bangalee, North Nowra Bomaderry area is likely to support foraging and shelter habitat for the Eastern Pygmy Possum. Moreover, it has been shown to support the species across the locality from Bangalee Scout Camp to Bomaderry Creek regional Park when targeted with dedicated survey methods (OMVI 2012, NGH 2012, Ecological 2011).

Conversely, the same Vegetation Community, with an absence of the same dense heath has been found not to support the species locally (OMVI 2012 and the current surveys).

Study conclusions of conservation significance

The heathy Scribbly Gum Woodland across the western finger is therefore assumed to be primary habitat for the Eastern Pygmy Possum and the other areas of the same community as secondary or potential habitat. Connectivity, without non-vegetated breaks is also considered important for the conservation of the species locally, therefore the Grey Gum Woodland and other vegetation along the Creeklines of the site has also been included as secondary habitat for the species in the significance modelling. The more disturbed open and grazed woodland, open grassland etc do not represent suitable habitat for the species (Figure 18) [Figure 3-4].

NGH Environmental analysis

NGH Environmental agree that the heathy Scribbly Gum Woodland across the western finger provides primary habitat for the Eastern Pygmy Possum and that this area is HCV for this species. OMVI (2016) have mapped connectivity corridors as Secondary habitat and state that "*connectivity, without non-vegetated breaks is also considered important for the conservation of the species locally, therefore the Grey Gum Woodland and other vegetation along the creeklines of the site has also been included as secondary habitat for the species in the significance modelling*". By the HCV verification rules in the SCRCP (refer Appendix B), areas that provide important connectivity corridors for threatened species are considered HCV. As such, the areas mapped as secondary habitat for the Eastern Pygmy Possum, specifically along the creek lines within the subject site, are also considered to be HCV for this species.

Figure 18: Habitat for the Eastern Pygmy Possum across lot 24

Figure 3-4 Habitat ratings and records of the Eastern Pygmy Possum as mapped by OMVI (2016)

3.2.18 Yellow-bellied Glider

Study results

Surveys of an unknown person or persons in 2005/6 recorded the majority of the records for the Yellow-bellied Glider across lot 24, most records are based on indirect evidence (sap-feeding incisions); there is also a record of a den tree, five records of call recognition and two observations from the same 2005/6 surveys. Both AHA and Biosis recorded indirect evidence (feeding incisions) of the Yellow-bellied Glider when conducting surveys across the lot and Biosis surveys recorded a call (response to call play back) in 2010 which is recorded as another wildlife atlas record for the site (Figure 27).

There are no records from the AHA surveys in 2007, noted in the Atlas data and it is noted from the report that the SCC Threatened Species officer conducted most of the surveys or this species as a part of the Crams Road IA survey effort in 2007.

Given the local records and the vocalisations heard on site or nearby, a series targeted occupation surveys for the species were conducted as part of the current assessment to determine the presence and occupation, habitat usage, of the Yellow-bellied glider in Lot 24 and in surrounding lands. Analysis of all findings from each of the surveys previously conducted along with the current surveys have shown that Yellow-bellied Gliders do utilise the study area for both foraging and denning. The den tree recorded in the 2005/6 surveys (recorder unknown) was shown in the current surveys to also be used by the species several years later. This part of the locality, Tall wet Grey Gum Forest along the southern creekline, with nearby spotted gum and other vegetation type, which is only 300meters from the Shoalhaven River is likely to be supporting at least one family group of gliders. An individual was observed during the November surveys soon after sun-down on the western boundary with 'Elbrevan' (lot 11, 102 Gypsy Pt Road, Bangalee), and several calls heard throughout he nocturnal surveys from the same lot or along the creekline in this corner of the current study area. The AHA studies along with current spotlighting and listening periods recorded Gliders on Crams road to the south, which is a part of the same catchment of the un-named creek entering the Shoalhaven at Gypsy Point (Figure 19) [Figure 3-5].

Despite the absence of observations in the remaining portions of the lot, the north/south creeks in the centre of lot 24 are also likely to represent foraging habitat, as are some of the Red Bloodwoods and Grey Gums, with notches currently being utilised. A large number of records for the species on the lot from atlas of wildlife (as discussed above), are recorded as feed trees or notched trees. Where the species that has created the notches being assumed as YBG.

A parallel transect survey of the entire lot and adjacent lands was undertaken in November 2015, by two experienced surveyors, to determine current usage and the species most likely to have created any notches recorded. All trees across the entire lot were inspected during these surveys 17 trees were recorded with some form of glider notching; from either YBG or Sugar Gliders. The surveyors were very care not to include tree scarred by insect damage (e.g. Longicorn beetles, Wood moth) or fungal disease, the damage caused on the trunks of many Eucalypts which can look superficially similar, particularly when callused or grown over. The number of trees recorded with notches was considerably less than the number of Atlas records.

Of the 18 notched trees recorded, 15 were within lot 24 and only 4 were currently used by a glider for sap (scars bleeding and/or recent chewing evident); 9 were old notches, not used or some time and the remainder 5 were recorded as very old notches, that were completely callused over and had not been used for many years (Table 10). Of these notches nine were recorded as most likely as being created by YBGs, including 1 current use site in the south west corner. Another current use sap site recorded in the east was a large Red Bloodwood with very old YBG notches and recent smaller, (mostly likely Sugar Glider) notches.

There were several small Red Bloodwoods (>30cm dbh) recorded in the south west corner of Lot 24 with old YBG notches. Three additional Red Bloodwoods with distinctive YBG notches were recorded outside in adjacent lots or the Council road reserve (Figure 19) [Figure 3-5]*. There were no Acacia recorded across the site with characteristic glider notching. One Black Wattle on Crams road was recorded with numerous incisions, with flowing exudates, which may have been from TBG or sugar gliders.*

It should be noted that most (83%) of the trees recorded with notches were Red Bloodwood, however the most characteristic y and v notching was recorded on Grey Gums across the locality.

Study conclusions of conservation significance

Given the location of all observations recorded during surveys of the current study area and those of surveys conducted locality; the calls heard or elicited; the distribution of recent and used notches in Red Bloodwood and Grey Gum, the southern creeklines, particularly in the western corner of the lot (as well as the adjoining lot 11) appear to the current primary habitat for the local group of gliders. The Grey Gum Woodland and other vegetation along the Creeklines of the site have also been included as secondary habitat for the species in the significance modelling and all other forested habitat remaining a potential habitat but modelled as marginal for this assessment.

The more disturbed open and grazed woodland, open grassland etc do not represent suitable current habitat for the species (Figure 19) [Figure 3-5].

NGH Environmental analysis

In their initial analysis of the ecology of the local YBG population OMVI (2026) state "*As the Yellow-bellied Glider maintains a large home range, none of which appear to overlap with the subject site (i.e. absence of records, and suitable foraging or nesting habitat), it is unlikely that any portion of a home range will be impacted by the proposal and therefore is unlikely to significantly impact on this species*". This is a contradiction to the results presented above which clearly show the subject site provides primary and secondary habitat for this species.

NGH Environmental agree that the south-west corner of the subject site represents the most important habitat for the species and should be included as HCV. However, as discussed above for the Eastern Pygmy Possum, the southern creeklines are also likely to provide important connectivity for this species. The OMVI 2016 study does not provide any justification as to why areas have been mapped as secondary habitat aside from stating that "*the southern creeklines, particularly in the western corner of the lot (as well as the adjoining lot 11) appear to the current primary habitat for the local group of gliders. The Grey Gum Woodland and other vegetation along the Creeklines of the site have also been included as secondary habitat*". As the southern creeklines have been identified as primary habitat for this species by the OMVI 2016 study, it is the opinion of NGH Environmental that areas mapped as secondary habitat along these creeklines, should also be included as HCV for this species.

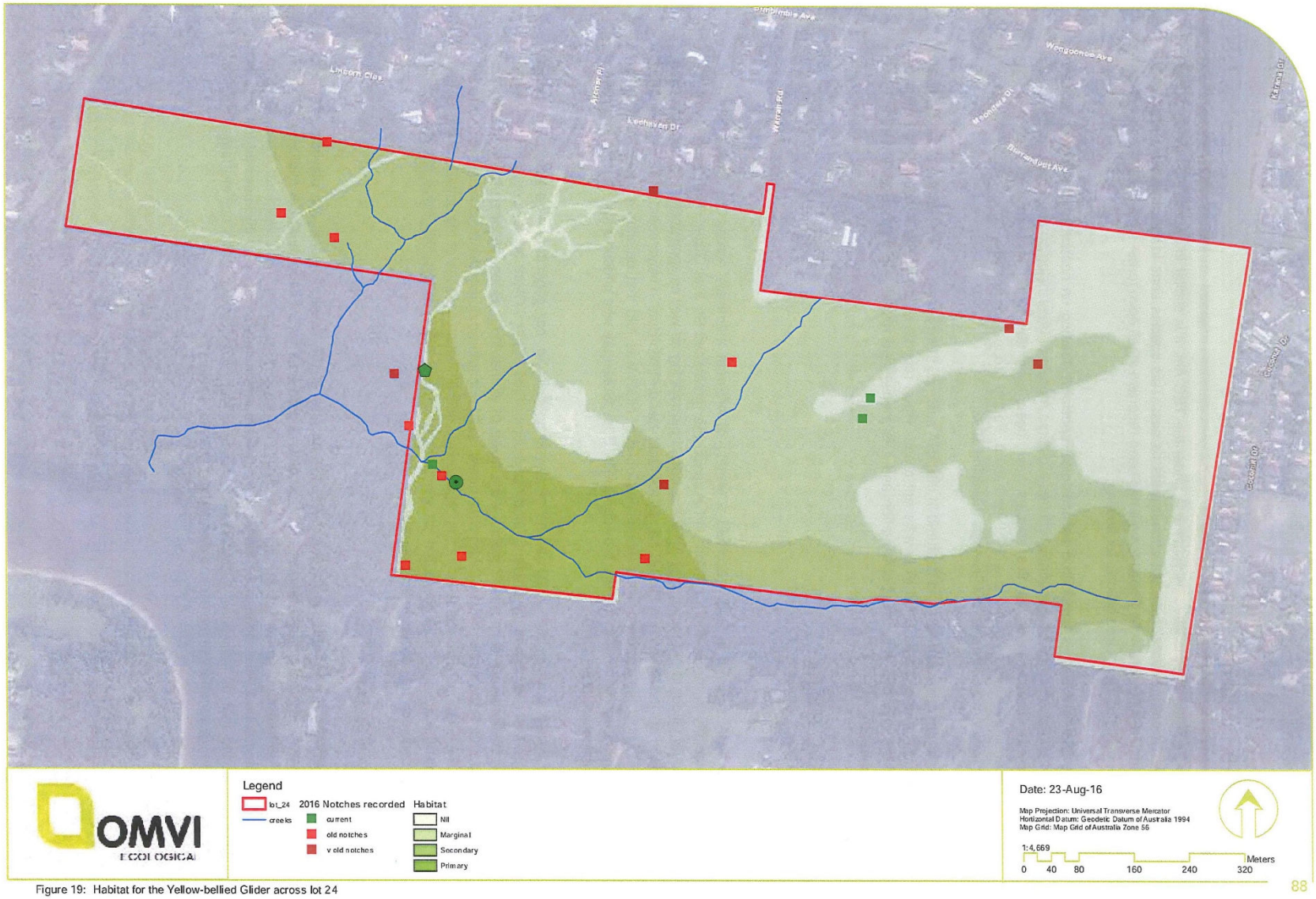

Figure 19: Habitat for the Yellow-bellied Glider across lot 24

Figure 3-5 Habitat ratings and records of the Eastern Pygmy Possum as mapped by OMVI (2016)

3.2.19 Squirrel Glider

Study results

During the current surveys (November 2015 and May 2016), which included: call playback, camera surveys, arboreal trapping and spotlighting; only Sugar Gliders were seen, heard or captured. Each of the 38 individual Sugar gliders captured during the trapping program, were weighed, measured and photographed. All relevant descriptors, including colouration, head shape, tail thickness (of the pelage) showed that all individuals captured were Sugar Gliders (P. breviceps) and not the larger Squirrel Glider.

Study conclusions of conservation significance

It appears given the data collected from the site and from the locality over recent years, including the apparent absence within the locality despite numerous targeted surveys; the large number of Sugar Gliders occupying the woodland and wet forest of the study area; that the Squirrel Glider is no longer present in the woodland across the study area. Therefore the woodland and forest of the study area does not hold conservation significance for the Squirrel Glider.

NGH Environmental analysis

The Squirrel Glider was trapped on the subject site during the AHA surveys in 2007 within Elliot B traps with a survey effort of 40 trap nights. The Biosis survey in 2010 employed 26 trap nights using arboreal Elliot A traps and did not trap the species. Spotlighting by Biosis also did not detect the species. The current study employed two surveys of 300 trap nights each using Elliot A traps combined with spotlighting.

It is noted that only the AHA (2007) study used the larger style Elliot B traps. The use of the smaller Elliot A traps is generally not recommended for larger animals such as a Squirrel Glider as they can get their tails stuck in the door (DEH 2010). It is also likely that the larger Squirrel Glider would also be more apprehensive to enter a smaller trap. It is the experience of the author and evidenced in a number of targeted surveys for the Squirrel Glider (ARCUE 2016, ARCUE 2013, NGH Environmental 2009, van der Ree 2003), that cage and camera trapping are the most common methods employed.

Although not optimal in terms of methodology, it is considered likely that if a population of the Squirrel Glider occurred on the subject land, that the species would have been detected during the Biosis (2010) and OMVI (2016) studies through other techniques such as spotlighting. Combined with the paucity of records in the locality, it is the opinion of NGH Environmental that the survey effort to date of all techniques (such as spotlighting), would have likely identified a resident population of the Squirrel Glider if present. NGH Environmental agree with the conclusions of the OMVI 2016 study that the subject site does not contain areas of conservation significance for the Squirrel Glider.

3.2.20 Grey-headed Flying-fox

Study results

The study area is known to contain suitable habitat for the Grey-headed Flying-fox and this species is likely to forage widely within the study area when the canopy species are in flower the animals have migrated from northern permanent camps. There are neither camps nor suitable diurnal roosts within the study.

The Grey-headed Flying-fox was recorded flying over the study area during the field surveys during the AHA surveys in 2007 and in the recent November site surveys. Individuals are mostly likely moving from the nearby Bomaderry Creek summer roost camp. The mature forest in locality, the proximity of the seasonally

occupied camp site in Bomaderry Creek and presence of suitable foraging throughout the Nowra Bomaderry area as well as the relatively contiguous remnant vegetation throughout the locality, which includes gardens and residential areas, the study area would provide some foraging habitat for the species.

Study conclusions of conservation significance

The Grey-headed Flying-fox is a highly mobile and wide ranging species, readily adaptable to novel habitat, as evidenced in the recent Batemans Bay camp, within a water control pondage engineered to control storm water from the CBD. The forested habitat across lot 24 nevertheless represents suitable forging habitat in close proximity to a known breeding colony and therefore has conservation significance. While unlikely to represent significant habitat for this species, the conservation values for the species have been incorporated into the habitat modelling for this assessment.

NGH Environmental analysis

It is not clear how the conservations values for the Grey-headed Flying Fox have been incorporated into the habitat modelling. No map of habitat values for the species is included in the OMVI 2016 study. Nevertheless, it is the opinion of NGH Environmental that the subject site does not contain primary habitat for this species. The site would contain secondary habitat where woodland is present given the foraging resources it contains but these foraging resources are abundant within the home range of the local population and would not be contributing greatly to the viability of the local population. The subject site is not considered to contain areas of HCV for the Grey-headed Flying-fox.

3.2.21 Threatened microchiropteran bats

Study results

Surveys for microbats were conducted in summer along with an autumn, during the AHA survey in 2007 (12-19 Feb 2007), the Biosis surveys in 2010 (12-14 April 2010) and the current 2015/16 surveys (23-27 Nov 2015; 2-6 May 2016) which covers high activity periods for all microbats, including the small climate and temperature sensitive species such as the Little Forest Bat (Vespadelus vulturnus). In recent years, however, most species including the small forest bats have been recorded year round in the Nowra area (B. Ryan pers obs.).

A relatively diverse group of microbats were recorded, including a number of small bats which are unlikely to be roosting on site (e.g. Eastern Horseshoe Bat, Eastern Cave Bat and Eastern Bentwing Bat (Table 2). The presence of this range species highlights that the climate including the temperature was suitable for the detection of a full suite of small to large microbats. All locally occurring threatened microbats have been detected during the surveys with varying degrees of certainty and all are assessed all as species of conservation significance in this assessment.

No bats were recorded roosting within the study area during any of the surveys.

The Large-eared Pied Bat, Eastern Cave Bat, Little Bent-wing Bat, Eastern Bent-wing Bat and Large- footed Myotis are predominantly cave roosting species that also utilise man-made structures, including drains, bridges, tunnels and mines (Dwyer, 1995). The remaining species roost in tree hollows.

There were no caves, mine adits or built structures that could serve as roosting habitat for the cave roosting species, however the steep sandstone banks within the monolith sandstone cliffs and gorges of Morton National Park to the west and the rocky cliff lines of the Shoalhaven River to the south would provide numerous caves, and rock pile for these species. These species are highly unlikely to roost within the study area.

Yellow-bellied Sheathtail Bat

The Yellow-bellied Sheathtail Bat was not recorded during the 2010 or 2015/16 field investigations but was recorded as possible call, via Anabat recording in 2007 (AHA 2008). There are five local records, all from Anabat recordings (Figure 27) and could potentially occur on site given the habitats present. Despite being a large bat with an low-frequency audible part of their call, which can be seen spotlighting, none were recorded in recent surveys.

The assumption for this assessment was that this species, while unlikely to be regular visitor to the study area, individuals are likely to utilise the forest and woodland across the lot for foraging transiently. Considering this and the availability of foraging resources within the wider locality, the woodland and forest vegetation in the lot 24 is unlikely to represent a significant portion of the foraging habitat for the species locally, should it occur.

East-coast Freetail Bat

The East-coast Freetail Bat was recorded during the 2007, 2010 and 2015/16 field investigations and is known from the region (Figure 27). Lot 24 does represent suitable foraging and roosting habitat across the forested areas and margins. Given the preference to riparian areas in the Hunter, it is likely that the species is present in the forests of the study area, due to the proximity of the Shoalhaven River and that the urban areas to the east, and north are unlikely to provide resources for the species.

All of the Wet Sclerophyll vegetation associated with the creeklines is considered better quality foraging habitat for this species, and the drier woodlands as marginal. However, considering this and the availability of foraging resources within the wider locality, including the Shoalhaven River, the small and mostly densely overgrown creeklines on lot 24 are unlikely to represent a significant portion of the foraging habitat for the species locally, and it not likely to provide suitable maternity roosting which would be critical for the species locally.

Eastern False Pipistrelle

Possibly recorded during the 2007 surveys (AHA 2008) and as an 'either' in the 2015/16 surveys foraging along the edge of the existing forest, the potential habitat for the Eastern False Pipistrelle is assumed to be the forested areas and adjacent vegetation within the study area and in the wider locality, as well as the hollow-bearing trees. However, considering this and the availability of foraging resources within the wider locality, including the Shoalhaven River, and the adjacent ranges and National Parks, the vegetation across lot 24 is unlikely to represent a significant portion of the foraging habitat for this widely ranging species locally, and it not likely to provide suitable maternity roosting which would be critical for the species locally.

Greater Broad-nosed Bat

This species was potentially recorded with varying degrees of confidence in all surveys conducted across the study area. The Greater Broad-nosed Bat is likely to use the more open foraging habitat that occurs along gaps in woodland/forest along streets and the edges of the fragmented vegetation occurring. Tree hollows across the site are likely to provide potential roosting habitat for this species.

The Greater-broad-nosed Bat does use the forested areas and adjacent vegetation within the study area and in the wider locality, as well as the hollow-bearing trees. However, considering this and the availability of foraging resources within the wider locality, including the Shoalhaven River, and the adjacent ranges and National Parks, the vegetation across lot 24 is unlikely to represent a significant portion of the foraging habitat for this widely ranging species locally, and it not likely to provide suitable maternity roosting which would be critical for the species locally.

Study conclusions of conservation significance

All the threatened microbat recorded or that are likely to use habitats within lot 24 are highly mobile and ranging widely during nightly foraging, and many migrate very large distances to maternity colonies during the breeding season. All recorded species, are able to tolerate some disturbance as is evidenced by their use of the fragmented vegetation across lot 24 and the surrounding urban matrix. The forested habitat across lot 24 nevertheless represents suitable forging habitat for all the species described above and may represent suitable roosting habitat for the tree-roosting species. The wetter riparian gallery forest appears to represent the most preferred habitat for most species given the records and habitat preferences recorded elsewhere in any species' range. However, the remaining woodland, heathland and other shrublands would also represent habitat for these species.

Notwithstanding this, given the past disturbances, the fragmentation and proximity to open residential areas, most habitats across the site are unlikely to represent critical habitat for any species. All forest and woodland habitat for all bats has been incorporated into the habitat modelling for this assessment.

NGH Environmental analysis

The OMVI 2016 study states that "*most habitats across the site are unlikely to represent critical habitat for any species*" which implies that some of the habitats may be more important. Prior to this the OMVI 2016 study states that "*the wetter riparian gallery forest appears to represent the most preferred habitat for most species given the records and habitat preferences recorded elsewhere in any species' range*".

The OMVI 2016 study concludes for all threatened microbat species that "*the vegetation across lot 24 is unlikely to represent a significant portion of the foraging habitat for* [these] *widely ranging species locally, and it*['s] *not likely to provide suitable maternity roosting which would be critical for the species locally*". As a result, the OMVI 2016 study has mapped the majority of the subject site as secondary habitat (Figure 3-6).

NGH Environmental agree that the foraging resource that the subject site provides is widespread in the locality but also note that the site appears to contain preferred foraging habitat for a number of species along the creek lines. The OMVI 2016 study also acknowledges that the site "*may represent suitable roosting habitat for the tree-roosting species*" which would be provided for by the hollow-bearing trees. The site contains known foraging habitat for threatened microbat species that are known to frequently occur on the site. As such, the more preferred habitats are considered to be contributing to the viability of local populations and should be regarded as important habitat as defined in the SCRCP (refer Appendix B). It is recommended by NGH Environmental that the preferred riparian habitats within the subject site be considered as HCV for threatened microbat species.

Figure 22: Habitat for the Microchiropteran Bats across lot 24

Figure 3-6 Habitat ratings for threatened microbats as mapped by OMVI (2016)

3.2.22 Migratory species

Study results

A large number of bird species listed under the migratory species provisions of the Commonwealth EPBC Act have been recorded within 10km of the subject site (Appendix C). Those species listed pursuant to the Act comprise migratory species protected by International Agreements with other countries including between, Australia and China (CAMBA), Australia and Japan (JAMBA), Australia and the Republic of Korea (Rokamba) and the Bonn Convention or the convention on the conservation of migratory species of wild animals, as well as additional species which belong to a number of bird families nominated by Federal Environment Department.

Of the listed migratory species; the White-bellied Sea Eagle (Haliaeetus leucogasta); Rufous Fantail (Rhipidura rufifrons); Satin Flycatcher (Myiagra cyanoleuca) or Black-faced Monarch (Monarcha melanopsis) have been recorded on or near lot 24.

Study conclusions of conservation significance

White-bellied Sea Eagle

The White-bellied Sea Eagle occurs along the coastline of Australia and also range inland over large rivers and wetlands, favouring forested coasts and forested margins of inland waterways. Nests are usually near water, in tall live or dead trees or on remote coastal cliffs. River Red Gum (Eucalyptus camaldulensis), Forest Red Gum (E. tereticornis) and Bangalay (E. botryoides) are commonly used as nest trees (Emison & Bilney 1982). On islands free of predators, nests may be close to the ground in shrubs or rocky platforms (Marchant & Higgins 1993). Given that there is no wetland and open water habitats within the study area; no raptor nest have been recorded on or nearby the study area, the lot does not hold any conservation significance for the White-bellied Sea Eagle.

Rufous Fantail

The Rufous Fantail occurs throughout the coastal areas of north and eastern Australia but is also found on some of the surrounding islands, especially in the Solomon Islands where it is also resident. This species forages for insects in the lower undergrowth gleaning prey from leaves, branches and logs. Rufous Fantails can be found in a range of habitats, including undergrowth of rainforests, monsoon forests, paperbark swamps, coastal scrubs, parks and gardens. The Rufous Fantail is a breeding migrant to south-eastern Australia where breeding occurs between October and February. Pairs nest in a small cup woven from roots, grasses and spider webs, usually built in a shaded fork about 5 metres above the ground. This species regularly migrates in autumn and winter to Papua New Guinea but does not migrate in flocks tending to be nomadic. Woodland and forest across lot 24 is likely to represent seasonal habitat for the species, however, considering this and the availability of foraging resources within the wider locality, including the Shoalhaven River, and the adjacent ranges and National Parks, the vegetation across lot 24 is unlikely to represent a significant portion of the foraging habitat for this widely ranging species locally, therefore it is unlikely to be of high conservation significance for the Rufous Fantail.

Satin Flycatcher

Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests than the Leaden Flycatcher (Myiagra rebecula), often occurring in gullies (Blakers et al. 1984; Emison et al. 1987; Officer 1969). They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest (Emison et al. 1987; Officer

1969). Satin Flycatchers are migratory, moving north in autumn to spend winter in northern Australia and New Guinea. They return south in spring to spend summer in south-eastern Australia (Blakers et al. 1984). Woodland and forest across lot 24 is likely to represent seasonal habitat for the species, however, considering this and the availability of foraging resources within the wider locality, including the Shoalhaven River, and the adjacent ranges and National Parks, the vegetation across lot 24 is unlikely to represent a significant portion of the foraging habitat for this widely ranging species locally, therefore it is unlikely to be of high conservation significance for the Stain Flycatcher.

Black-faced Monarch

The Black-faced Monarch occurs along the eastern coast of Australia, from Cape York to Victoria, although it is considered more common in the northern coastal areas. This species forages for insects in foliage and can be found in a variety of habitats from rainforests, eucalypt woodlands, and coastal scrubs. When migrating, they have been recorded in more open woodland. Breeding occurs between October and January and Black-faced Monarchs are breeding migrants to coastal south-eastern Australia from August to September and March to April. Pairs nest in a deep cup woven from bark strips, rootlets and green moss, which is often built in the fork of a slender sapling. Many migrate to Papua New Guinea in autumn and winter. Woodland and forest across lot 24 is likely to represent seasonal habitat for the species, however, considering this and the availability of foraging resources within the wider locality, including the Shoalhaven River, and the adjacent ranges and National Parks, the vegetation across lot 24 is unlikely to represent a significant portion of the foraging habitat for this widely ranging species locally, therefore it is unlikely to be of high conservation significance for the Black-faced Monarch.

White-throated Needletail

White-throated Needletail This species of migratory bird migrates from Siberia, the Himalayas, and Japan to Australia in Summer, arriving mid-October and departing mid-April. It is known to inhabit a variety of habitats including forests, woodlands, farmlands, plains, lakes, costs and towns (Pizzey and Knight 1999). The White-throated Needletail nests in tree hollows and feeds on insects during flight, chiefly ahead of weather changes. In Australia this species is nomadic, responding to local weather changes and is often seen foraging high in the sky on the south coast immediately before a rain storm (B. Ryan pers. obs.)

While the woodland, forest and other habitats across lot 24 is likely to represent habitat for the prey species of the White-throated Needletail, the entire locality represents foraging habitat for this high and fast flying species, which is uncommonly recorded perching/landing in trees. In the context of the availability of foraging resources within the wider locality, including the Shoalhaven River, and the adjacent ranges and National Parks, the vegetation across lot 24 is unlikely to represent a significant portion of the foraging habitat for this widely ranging species locally, therefore it is unlikely to be of high conservation significance for the White-throated Needletail.

NGH Environmental analysis

NGH Environmental agree with the conclusions of the OMVI 2016 study with regard to migratory species.

3.3 ANALYSIS SUMMARY

3.3.1 Survey effort

The survey types, timing and effort are generally appropriate and in accordance with the NSW Threatened Biodiversity Survey and Assessment Guidelines (DECC 2004). Where surveys have not met the

requirements of the guidelines this was taken into account when considering the conclusion of HCV areas. Two exceptions are noted:

- No appropriately timed targeted surveys (identified as October in the OEH threatened species profile database) were conducted for the Halbury Rustyhood despite it being included as a subject species and contradicting statements of its likelihood of occurrence appearing within the OMVI (2016) report. However, it is acknowledged that further advice from OMVI (B. Ryan *pers. comm.* via email to Daniel Hodge 11.05.17) is that orchid experts were contacted and advised that this species is unlikely to occur on the subject site. As such, no further surveys are considered to be warranted.
- Elliot A traps are generally not recommended for trapping Squirrel Gliders and other larger arboreal mammals as they can get their tails trapped in the traps (DEH 2010). No cage trapping or arboreal camera trapping was conducted as part of the OMVI 2016 study however, it is the opinion of NGH Environmental that the survey effort to date of all techniques (such as spotlighting), would have likely identified a resident population of the Squirrel Glider if present.

3.3.2 Assessment of conservation significance

There have been a number of revision to areas defined as 'high constraint' or HCV at the subject site. These included areas defined by AHA (2008) and Biosis (2010) and then, the initial definition of HCV areas according to the SCRCP by NGH Environmental (2015) (refer to mapping in Appendix C). The NGH Environmental 2015 peer review identified a lack of survey effort to conclusively determine HCV areas and, in the absence of this information, took a precautionary approach. This lack of survey effort has been addressed by the OMVI 2016 study which has allowed for a more accurate delineation of important habitat and HCV areas based on the definitions in the SCRCP.

In general, NGH Environmental agree with the delineation of primary and secondary habitat provided by the OMVI 2016 study and the justifications provided regarding areas of little to no conservation significance. There are however, a few instances where NGH Environmental consider that a higher degree of importance should be given to habitats to be considered as HCV areas. These include:

- Previously recorded locations of the Brittle Midge Orchid and all suitable habitat on the subject site
- Areas with a higher density of Glossy Black-Cockatoo foraging resources
- Secondary habitat areas supporting the tall mixed species woodland along riparian areas preferred by the Little Lorikeet
- Connectivity corridors for the Eastern Pygmy Possum and Yellow-bellied Glider
- Preferred foraging habitat (wetter riparian gallery forest) and potential roost sites contained in this area for threatened microbats.

This is included in the final assessment of HCV areas in Section 4 below.

4 FINAL ASSESSMENT OF HCV AREAS

The verification rules for ground-truthing HCV areas are stated in Appendix B. For threatened fauna, the verification rules require that

> "*until an appropriate survey (DEC 2004) demonstrates otherwise, the mapped habitat should be regarded as important habitat. Important habitat contributes to the viability of local threatened fauna populations and can include, but is not limited to, essential breeding resources, foraging resources and connectivity corridors*".

This definition has formed the basis of the analysis of conservation value in Section 3 above and as such, the delineation of HCV areas in this review.

It was the opinion of the 2015 NGH Environmental review that "*areas that provide good quality known habitat for threatened species should be included as areas of HCV unless it can be adequately demonstrated that the known habitat is no longer being utilised*". The additional work conducted by the OMVI (2016) study has further clarified which areas of the subject site are being utilised by threatened species, the frequency of use and the relative importance of the habitats being utilised.

The OMVI 2016 review identified HCV areas for the following vegetation types and threatened species:

- Currambene-Batemans Lowlands Forest community (Grey Gum Woodland and Spotted Gum Forest) – poorly conserved vegetation type
- Brittle Midge Orchid – occupied habitat and an arbitrary 70m buffer
- Known habitat of the Little Lorikeet
- Known habitat of the Eastern Pygmy Possum
- Core habitat of the Yellow-bellied Glider

As a result of this review, as stated in Section 3.3.2 above, NGH Environmental also consider that the following areas of threatened species habitat be included as HCV areas:

- Previously recorded locations of the Brittle Midge Orchid and all suitable habitat on the subject site
- Areas with a higher density of Glossy Black-Cockatoo foraging resources
- Secondary habitat areas supporting the tall mixed species woodland along riparian areas preferred by this Little Lorikeet
- Connectivity corridors for the Eastern Pygmy Possum and Yellow-bellied Glider
- Preferred foraging habitat and potential roost sites along riparian areas for threatened microbats

Many of these areas overlap or are already defined as HCV in the OMVI 2016 report for other threatened species or poorly conserved vegetation types.

As discussed in Section 2.2, the weighted analysis approach of OMVI (2016) used to determine the final HCV areas in their report combines the conservation values across all species. Where an area may be HCV for one species, if it has no conservation value for several other species, then the overall value is diminished. In this sense, important habitat for a particular threatened species may not be included as HCV in the final analysis. This appears to be the case in two instances. In Section 4.12.2 the OMVI 2016 study states that "*the habitat across the southern portions of lot 24 are therefore of conservation significance for the Little Lorikeet and as such is assessed as a 'high conservation value' for lands in this assessment*" (refer Figure 3-3). However, following the weighted analysis, a portion of this area has been defined as only

moderate conservation significance. Similarly, the area mapped as primary habitat for the Eastern Pygmy Possum is also defined as only being of moderate conservation significance (refer Figure 1-2).

The SCRCP states important habitat "*contributes to the viability of local threatened fauna populations*". While OMVIs ranked analysis prioritise areas that contribute numerous threatened fauna, NGH Environmental have taken a more conservative and inclusive approach and suggest that even areas that support important habitat for only one species should be considered to have potential to be categorised as having HCV. For this reason, we have recommended some additional areas that the data supports as being important for single species.

A revised HCV area map is provided in Appendix C based on the weighted sum analysis map produced by OMVI (2016) and incorporating the items detailed above. A comparison map is also provided comparing the previous HCV areas (defined as high constraint areas in some reports) of AHA (2008), Biosis (2010), NGH Environmental (2015) and OMVI (2016). Largely, the revised HCV map produced in this report aligns with the areas identified as high and a portion of those identified as moderate conservation significance on the OMVI (2016) weighted sum analysis map, and includes the additional areas identified considered to be HCV by NGH Environmental above.

5 CONCLUSION AND RECOMMENDATIONS

This review has independently and objectively assessed the Conservation Significance Report prepared by OMVI (2016) to address knowledge gaps in the conservation value of habitats on Lot 24 DP 714096, Warrah Road, Bangalee (the subject land). It has critically analysed the survey effort and methods, analysis and recommendations of the study for the purposes of making a final independent assessment of the conservation value of the subject land, with specific reference to high conservation value (HCV) land in accordance with the South Coast Regional Conservation Plan 2010.

This review has identified that:

- The methodologies employed to survey the subject land were generally consistent with applicable guidelines and that sufficient survey effort has been employed at the subject site by the present and past studies to adequately assess HCV areas
- The OMVI (2016) report makes an objective and informed analysis of habitat values at the subject site specific to the vegetation types and threatened species habitats that occur
- In general, NGH Environmental agree with the conclusions of HCV lands with regard to the following entities identified in the OMVI (2016) report:
    - Currambene-Batemans Lowlands Forest community (Grey Gum Woodland and Spotted Gum Forest) – poorly conserved vegetation type
    - Brittle Midge Orchid – occupied habitat and an arbitrary 70m buffer
    - Known habitat of the Little Lorikeet
    - Known habitat of the Eastern Pygmy Possum
    - Core habitat of the Yellow-bellied Glider

  However, NGH Environmental also recommended the inclusion of the following:
    - Previously recorded locations of the Brittle Midge Orchid and all suitable habitat on the subject site
    - Areas with a higher density of Glossy Black-Cockatoo foraging resources
    - Secondary habitat areas supporting the tall mixed species woodland along riparian areas preferred by this Little Lorikeet
    - Connectivity corridors for the Eastern Pygmy Possum and Yellow-bellied Glider
    - Preferred foraging habitat and potential roost sites contained in this area for threatened microbats
- That the weighted sum analysis approach of OMVI (2016) to determining the final areas of HCV is allows for important habitat for individual threatened species to be given a lesser conservation value rating. It gives a higher rating where multiple threatened species may use areas of habitat. It is the recommendation of this review in mapping the final HCV areas, that **all** important threatened species habitat be included as HCV land.

It is concluded by this review that adequate survey has been undertaken to determine HCV lands at the subject site. However, given that populations of the Leafless Tongue Orchid may not flower every year, and only one comprehensive survey for this species has been undertaken, it is recommended that another additional targeted survey be conducted for this species in areas that may developed in the future, to clarify the conclusions of the study that the species is absent.

As recommended in the NGH Environmental (2015) review, this review further recommends that the areas mapped by NGH Environmental in this review as high conservation value in Appendix C, should be considered for Environmental Conservation (E2) zoning to protect the biodiversity values contained in these areas.

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APPENDIX A ASSESSMENT PERSONNEL

Role, staff member	Qualifications and experience
Senior Ecologist (Botany) **Dave Maynard** **Author and field survey**	Dave holds qualifications in science and engineering. He completed his Honours in plant systematics in conjunction with UNSW and the Botanic Gardens Trust, Sydney in 2004. Dave specialises in biodiversity assessment, particularly field based flora surveys and vegetation community mapping. He has experience as Lead Botanist in small and large scale projects for vegetation community mapping including identification and demarcation of endangered ecological communities. He has also led targeted threatened species surveys, such as Leafless Tongue Orchid (*Cryptostylis hunteriana*), East Lynne Midge Orchid (*Genoplesium vernale*) and Crimson Spider Orchid (*Caladenia concolor*). Dave is regularly involved in fauna habitat assessment and survey for projects he is working on. He has been involved in numerous diurnal and nocturnal mammal, reptile and bird surveys particularly targeting threatened fauna species. Dave is based on the NSW far south coast and has extensive experience in this region. Dave is an accredited Biobanking Assessor.
Manager – NSW SE & ACT **Brooke Marshall (CEnvP)** **Senior review**	Brooke has an honours degree in Natural Resources from the University of New England (UNE) where she specialised in wildlife management and ecosystem rehabilitation. Brooke prepares and reviews environmental impact assessment, biodiversity assessment, and environmental management documentation undertaken in the South Coast and ACT regions. Brooke has worked on large scale infrastructure projects including subdivision and land use planning projects. Brooke is an accredited Biobanking Assessor and Certified Environmental Practitioner.
Director – NGH Environmental **Nick Graham-Higgs (CEnvP, FEIANZ)** **Senior technical input and Certification**	Nick has worked as an environmental planning consultant since 1992, specialising in natural resource management. His work demands an in-depth knowledge of current planning and environmental legislation coupled with a comprehensive understanding of development-related impacts. Nick has acquired his knowledge in this field for over 20 years, during which he has worked with a number of land management organisations within and outside Australia. Work undertaken includes the preparation of varied and complex environmental planning, environmental impact assessments, natural resource surveys (biodiversity surveys and assessments) and the preparation of environmental management plans. Nick is a Certified Environmental Practitioner and a Fellow of the Environment Institute of Australia and New Zealand.

APPENDIX B VERIFICATION RULES FOR IDENTIFICATION OF HIGH CONSERVATION VALUE AREAS

The following are the recommended verification procedures for ground-truthing of mapped high conservation value areas on the South Coast. It is taken directly from Section 8.1.1 of the South Coast Regional Conservation Plan (DECCW 2010)

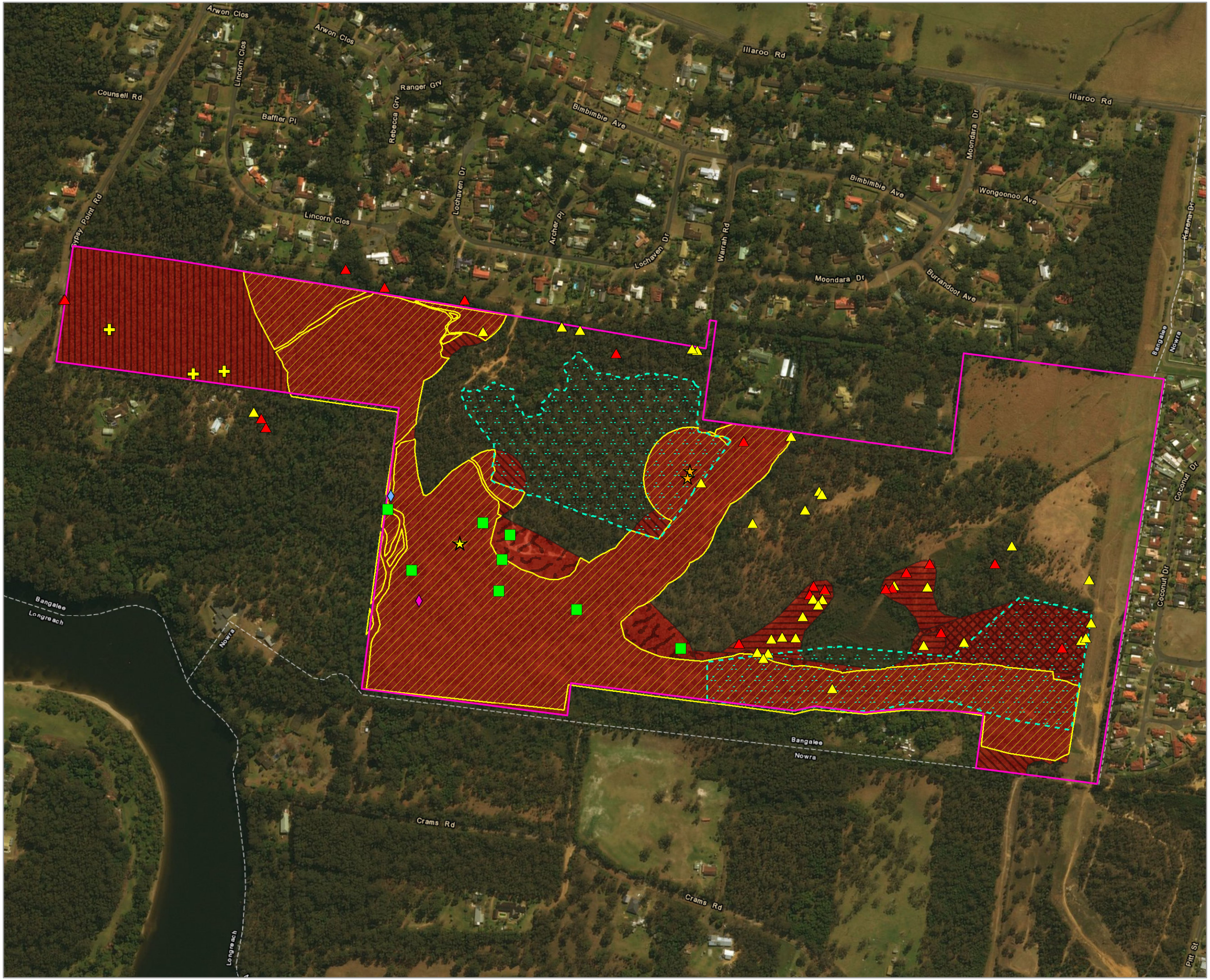
Value	Verification rules
Vegetation-related values • **EECs** • **rare vegetation types** • **overcleared vegetation types** • **vegetation in overcleared landscapes.**	Vegetation is not of high conservation value if it is in poor condition, as defined in section 5.3. The vegetation community descriptions and listing of diagnostic species and associated environmental parameters in Tozer et al. (2006) should be consulted for on-ground verification of vegetation type. The final determinations for EECs under the TSC Act and EPBC Act are the key documents in deciding whether a patch of vegetation is an EEC.
Old-growth vegetation	Old growth is largely defined by the current canopy structure, which should largely consist of senescing or mature trees. Regrowth should be less than 30% of the canopy. There should also be negligible evidence of disturbances such as logging or catastrophic fires. The old-growth layer in this RCP is probably the least accurate of all information provided. Thus it is suggested the occurrence of mapped old-growth features should be confirmed or checked on the ground.
Threatened fauna	The data provided by the RCP ties verified records to mapped vegetation polygons. The Atlas of NSW Wildlife can be consulted to determine what threatened fauna records are involved. Until an appropriate survey (DEC 2004) demonstrates otherwise, the mapped habitat should be regarded as important habitat. Important habitat contributes to the viability of local threatened fauna populations and can include, but is not limited to, essential breeding resources, foraging resources and connectivity corridors. The Threatened Species Web Tool will provide further assistance in habitat identification and advises what other fauna species should be considered.
Threatened flora	The data provided by the RCP ties verified records to mapped vegetation polygons. The Atlas of NSW Wildlife can be consulted to determine what threatened plant records are involved. Targeted surveys for the identified plant species should occur within the proposed development or planning area. The Threatened Species Web Tool advises what other plant species should be considered.

Value	Verification rules
Significant aquatic habitats • **nationally important wetlands** • **catchments of** • **significant lakes and estuaries** • **habitat of migratory wetland species**	The key question is whether a planning or development decision is within, or affects, the catchment of these environmental assets identified in the RCP, and (as required by the SCRS) whether this impact will have a neutral or beneficial effect.
Statutory conservation protection • **conservation and property agreements** • **declared wilderness** • **SEPP 14 wetlands** • **SEPP 26 rainforest**	These assets have surveyed or described tenure boundaries. Verification is a matter of determining whether the planning or development decision occurs within a defined area

APPENDIX C HCV AREA MAPS

HIGH CONSERVATION VALUE AREAS AND RELEVANT SURVEY RESULTS

Warrah Road Peer Review



Subject land
Remediation area

High Conservation Value (HCV) areas
- OMVI HCV areas 2016
- NGH HCV areas 2017

NGH HCV areas additional to OMVI 2016
- Brittle Midge Orchid
- Brittle Midge Orchid - Yellow-bellied Glider
- Eastern Pygmy Possum
- Glossy Black-Cockatoo
- Little Lorikeet

OMVI 2016 survey results

Yellow-bellied Glider
- Possible den tree
- Yellow-bellied Glider

Glossy Black-Cockatoo feed signs
- foraging
- investigation

Eastern Pygmy Possum captures

Little lorikeet observations

Brittle Midge Orchid

NSW Wildlife Atlas records
- Brittle Midge Orchid

Notes:
- Subject land boundary digitised by NGH Environmental based on cadastral data
- HCV areas digitised by NGH Environmental based on HCV and threatened species habitat mapping by OMVI 2016
- Base map Copyright © ESRI and its data suppliers 2017

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HIGH CONSERVATION VALUE AREAS COMPARISON WITH PREVIOUS STUDIES AND REPORTS

Warrah Road Peer Review

Subject land
Remediation area
High Conservation Value (HCV) areas
OMVI HCV areas 2016
NGH HCV areas 2017
Previous constraint/environmental areas
AHA 2008 - High constraint area
Biosis 2011 - proposed conservation area
NGH 2015 HCV areas

Notes:
- Alignment discrepancies of previous constraint and HCV areas due to utilisation of different site boundaries
- Subject land boundary digitised by NGH Environmental based on cadastral data
- HCV areas digitised by NGH Environmental based on HCV and threatened species habitat mapping by OMVI 2016
- AHA 2008 high constraint area provided by SCC
- Biosis proposed conservation area digitised by NGH Environmental based on Biosis 2011 mapping
- Base map Copyright © ESRI and its data suppliers 2017

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