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Environmental & Social Consultants

FERN BAY RIFLE RANGE

Preliminary Documentation Report
EPBC Referral 2017/7993

FINAL

February 2021

FERN BAY RIFLE RANGE

Preliminary Documentation Report
EPBC Referral 2017/7993

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Defence Housing Australia

Project Director:	Naomi Buchhorn
Project Manager:	Caitlin Adcock
Report No.	3764/R09
Date:	February 2021

Newcastle

75 York Street
Teralba NSW 2284

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
1	Naomi Buchhorn	8/04/2020	Naomi Buchhorn	8/04/2020
2	Naomi Buchhorn	15/05/2020	Naomi Buchhorn	15/05/2020
3	Naomi Buchhorn	09/02/2021	Naomi Buchhorn	09/02/2020

Cover Letter

Our Ref: 3764F

15 May 2020

Mike Smith
Director Southern NSW & ACT Assessments
Assessments (NSW, ACT) and Fuel Branch,
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601

Dear Mr Smith

Re: Additional Information required for Preliminary Documentation Proposed Redevelopment of the Stockton Rifle Range, Fern Bay, NSW (EPBC Referral No. 2017/7993)

Defence Housing Australia (DHA) submitted a Referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 25 August 2017 for the proposed redevelopment and disposal of the Stockton Rifle Range at Lot 5, DP 233358, Popplewell Road, Fern Bay, NSW.

The Department of the Environment and Energy (DoEE), now the Department of Agriculture, Water and the Environment (DAWE), determined that the proposed action is a Controlled Action due to impacts to threatened species and as a Commonwealth action; and would be assessed on Preliminary Documentation. The Notice of Assessment (dated 2 November 2017) stated that DAWE would require additional information to assess the proposed action. The enclosed Preliminary Documentation Package aims to address DAWE's information requirements regarding EPBC Referral 2017/7993.

The table below outlines the specific information requested by DAWE and the relevant sections of the Preliminary Documentation Package that address these requirements.

The Preliminary Documentation Report (this document) aims to provide DAWE with all of the additional information requested. Where required, the Preliminary Documentation Report is supported by detailed technical studies, which have been included in this Preliminary Documentation Package as appendices to the Preliminary Documentation Report.

Yours sincerely

Caitlin Adcock
Senior Environmental Planner

Additional Information Requested	Relevant Package Section
1. General Information	Section 1.0
2. Description of the Action, including: A. Precise location of all the works to be undertaken, including boundaries and size (in hectares) of the disturbance footprint, any offsite infrastructure and any adjoining areas which may be indirectly impacted by the proposed action B. details of the full scope of the works including permanent and temporary infrastructure, built structures, land or vegetation disturbance, landscaping, fencing, stockpiles of materials (including waste or spoil) and any proposed storm water diversion channels, erosion control measures or rehabilitation works C. a final layout plan (or as near as possible) for the proposed action area, including the location and type of land use, key infrastructure, open space and conservation areas D. details of construction methods, techniques and materials E. description of the operational requirements of the action including vehicle and pedestrian traffic management on site and in the surrounding area and any anticipated maintenance works F. the anticipated timing and duration (including start and completion dates) for both construction and operational components, and G. details on the cumulative impacts from other developments in the immediate vicinity of the proposed development site that impact on the Mahogany-Baloskion Swamp Forest, Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree-Banksia Scrub.	Section 2.0
3. Description of the Existing Environment, including: The Department notes that potential habitat is present on the proposed development site and in the surrounding area for the Koala and Grey-headed Flying-fox (GHFF). To better understand impacts to those, please provide the following details: A. A general description of the environment of the proposed action site, as well as the surrounding areas that could be impacted by the action both in the short and long term. Please provide:	Section 3.0
1. A description of the matters protected by the EPBC Act, which may be affected by the proposed action and their regional context. This section must address (but need not be limited to) threatened species and ecological communities and the environment, which include the Koala and the GHFF, and the native vegetation such as Mahogany-Baloskion Swamp Forest, Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree-Banksia Scrub.	Section 3.1
2. The quality of native vegetation, which is habitat for the Koala and GHFF including Mahogany-Baloskion Swamp Forest, Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree-Banksia Scrub, that contains tree species, including but not limited to, Swamp Mahogany *E. robusta*, Earp's Gum hybrids *E. parramattensis* subsp. *decadens* x *robusta* (two individuals), Blackbutt (*Eucalyptus pilularis*), Smooth-barked Apple (*Angophora costata*), mid-storey Coastal Tea-tree (*Leptospermum laevigatum*) and Coastal Banksia (*Banksia intergrifolia*) within the proposed action site, adjacent, and in the broader local area of the proposed action site. If additional surveys are considered necessary, please provide the details of the scope, timing (survey season), location, effort and methodology, including a discussion on whether surveys were undertaken in accordance with published best practice guidelines.	Section 3.2
3. The ecological value of native vegetation habitat for the Koala and GHF that includes Mahogany-Baloskion Swamp Forest, Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree-Banksia Scrub, to be removed by the proposed action and to be retained in surrounding areas, and on the proposed action site.	Section 3.3
4. Maps displaying the above information (points A2 and A3) overlaid with the proposed Development Footprint and any potential areas to be avoided and/or reserved.	Section 3.4.
5. Further information about the occurrence of the Koala and GHFF and discussion on the likelihood of the site's vegetation as suitable habitat for these species on and within the vicinity of the proposed action site. This must include: i. Reporting on surveys for the Koala consistent with the survey methodology as identified in the Department's *Survey Guidelines for Australia's Threatened mammals* at: http://www.environment.gov.au/resource/survey-guidelines-australias-threatened-mammals-guidelines-detecting-mammals-listed. The general survey design principles detailed in the guidelines are highly relevant to surveying for koalas, although these	Section 3.3, Section 3.5 and Section 4.1 Appendix 1 and 4

Additional Information Requested	Relevant Package Section
species are not specifically referred to in the guidelines.	
ii. Further analysis of the suitability of the habitat on proposed action site and in adjacent land against the *EPBC Act Referral Guidelines for the Vulnerable Koala* (*combined populations of Queensland, New South Wales and the Australian Capital Territory*) (2014) at: http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala.	Section 3.4.1 Appendix 1 and 4
i. Reporting on targeted surveys for the GHFF consistent with the survey methodology as identified in the Department's *Survey Guidelines for Australia's Threatened bats* at: http://www.environment.gov.au/resource/survey-guidelines-australias-threatened-bats-guidelines-detecting-bats-listed-threatened.	Section 3.5.2 Appendix 1 and 4
ii. An account of the survey effort and methodology used in the surveys undertaken for the point A6 above, including evidence that the surveys were undertaken for a suitable period of time by a qualified person and used accepted methodology for targeting the species and its habitat.	Section 3.5 Appendix 1 and 4
iii. A description of the distribution and abundance of these species, including, but not limited to, the estimated size, density and location of occurrences on site and in the region.	Section 3.5
iv. Further quantification and description of the extent of suitable habitat on-site and in the region (including whether the habitat is critical to the survival of the species)[1,2].	Section 3.3, Section 3.5 and Section 4.1
v. Maps displaying the above information (points A8v and A8vi) overlaid with the proposed Development Footprint.	Section 3.4
4. Relevant Impacts	Section 4.0
The PD should provide a detailed assessment of any likely impact that this proposed action may have on the following (at the local, regional, state, national and international scale):	Section 4.1.1
i. Listed threatened species and communities (section 18 & section18A): a. Koala (*Phascolarctos cinereus*)(combined populations of Qld, NSW and the ACT) – vulnerable, and	
b. Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable.	Section 4.1.2
ii. The environment because the proposal is a Commonwealth action (section 28): a. Impacts on landscapes and soils	Section 4.2.1
b. Impacts on water resources	Section 4.2.2
c. Impacts on plants	Section 4.2.3
d. Impacts on animals	Section 4.2.4
e. Impacts on Heritage	Section 4.2.5
4.1 Detailed Assessment – Listed threatened species and communities	Section 4.0
A. The total area (in hectares) and quality of habitat that is suitable for the GHFF that will be impacted.	Section 4.1.2
B. The total area (in hectares) and quality of habitat that is suitable for the Koala that will be impacted, against the criteria for habitat critical to the survival of the Koala contained in the *EPBC Act Referral Guidelines for the Vulnerable Koala* (*combined populations of Queensland, New South Wales and the Australian Capital Territory*) (2014) at: http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala. a. Please analyse in detail the quality of the potential koala habitat to be cleared and its relative importance to the species in the context of the local Port Stephens koala population.	Section 3.3.1, Section 3.5.1 and Section 4.1.1
C. The impact assessment should include habitat within all areas to be protected or cleared (quantified in area) and all areas that will be disturbed including, but not limited to, any buffer zones.	Section 4.1
D. A detailed assessment and quantification of the vegetation on site as suitable habitat for the Koala and GHFF. Please provide: a. Analysis of the relative quality of habitat, specifically its value as	Section 3.3 and Section 3.5 Appendix 1 and 4

[1] Significant Impact Guidelines 1.1 – Matters of National Environmental Significance https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

[2] EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (2014) at: http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala

Additional Information Requested	Relevant Package Section
connective habitat, particularly to the north and south of the site.	
b. Discussion of the relative conservation benefit of retaining connective habitat, on the rifle range (particularly for the Koala), with regard to the site's context in the broader region. For example, whether there is good quality habitat to the north, and south and the specific likelihood that habitat to the south (beyond the project boundary) will likely be used by the Koala and GHFF. i. Analysis of habitat to the south of the site's boundary should specifically focus on any possible benefits and/or threats to the Koala and GHFF	Section 3.3, Section 3.5, Section 4.1 Appendix 1 and 4
c. For the Koala and GHFF, analysis and discussion should be focused towards the quantity and quality of habitat for these species which will be impacted by clearing onsite. i. Analysis should be undertaken of the possible benefits and/or impacts to these species from retaining habitat, such as key tree species, onsite.	Section 3.3, Section 3.5, Section 4.1 Appendix 1 and 4
d. Consideration should be given to indirect impacts to the Koala and GHFF during the construction and ongoing occupancy of the development site, including those resulting from: i. edge effects ii. fragmentation iii. disturbance from increased noise, light, dust and sediment generation, introduced predators iv. dog attacks to the Koala to the level that is likely to result in multiple, ongoing mortalities and/or dislodgement from habitat v. vehicle-strikes to the Koala to a level that is likely to result in multiple, ongoing mortalities, and vi. introduction or spread of disease or pathogens, specifically, *Phytophthora cinnamomi* and Myrtle Rust that may further degrade the GHFF foraging and resting habitat on site and the surrounding areas.	Section 4.1 Appendix 1 and 4
E. Should any additional species listed under the EPBC Act be identified as likely impacted from the action (e.g., during additional surveys (if they are undertaken)), or assumed present, they must be described and considered with the already identified listed matters. When addressing relevant impacts, consideration should be given to Recovery Plans, Conservation Advices and Threat Abatement Plans relevant to each species that is 'likely to' or 'may be'	Appendix 1 and 4

Additional Information Requested	Relevant Package Section
impacted by the proposed action. At this stage, these are the Koala and GHFF.	
4.2 Detailed Assessment – the environment because the proposal is a Commonwealth Action	Section 4.2
4.2.1 Impacts on landscapes and soils	
The proposed master plan indicates a maximum disturbance area of approximately 18.3 ha (approximately 16% of the total site area) and requires clearance of vegetation, construction of housing, roads and associated infrastructure, and services. According to the Significant Impact Guidelines 1.2, the proposed action involves medium to large scale excavation of soil. The referral states that earthworks will be minimised through construction of raised buildings instead of using slab designs. Please provide information regarding the potential impacts of the proposed construction and development regarding the following: A. What soils or other substrates are present? a. What is the soil type/structure? b. Are any other substrates present? e.g., sand, gravel and rock. B. Is it likely that the soil/substrate will be directly or indirectly impacted by the action, and if so, to what extent? C. Is the soil/substrate valuable, or does it contain objects that are rare or otherwise valuable, e.g., archaeological items with heritage value? D. Is the soil susceptible to impacts or will disturbance of the soil cause further impacts? a. Are there steep slopes? b. Is there evidence of previous erosion? c. Is the soil/substrate friable (easily eroded)? d. Are acid sulphate soils present?	Section 4.2.1
4.2.2 Impacts on water resources	
Due to the uncertainty of post construction impacts on water resources, please provide a summary of the final Stormwater Management Plan with key outcomes from the MUSIC Model, which reveals the estimated quality of effluent (stormwater) that may or may not be discharged to the Hunter River.	Section 4.2.2
4.2.3 Impacts on plants	
The referral documentation states that 15.3 ha of native vegetation is proposed to be cleared for the proposed development. Five native vegetation community types have been recorded within the proposed action area including Frontal Dune Blackbutt-Apple	Section 4.2.3

Additional Information Requested	Relevant Package Section
Forest, Coastal Tea-tree-Banksia Scrub, Mahogany-Baloskion Swamp Forest, Foredune Spinifex and Beach wetlands. The native vegetation contains Blackbutt (*E. pilularis*), Earp's gum (*E. parramattensis* subsp. *decadens*), Swamp Mahogany (*E. robusta*), Coastal Banksia (*B. intergrifolia*) and Coastal Tea-tree (*Leptospermum laevigatum)* that provide habitat for a range of listed threatened species, which are known or likely to occur within the proposed action area. Please refer to and cross reference with *Section 4.1. Listed threatened species and communities* as appropriate, in addressing this section: A. Please analyse and discuss the potential for the vegetation to regenerate into higher quality habitat, timeframes and proposed management measures to enhance the regeneration.	
4.2.4 Impacts on animals	
The environment of the proposed action area comprises 44.9 ha of native vegetation that provides habitat for native animals. According to the *Significant Impact Guidelines 1.2*, it is likely that the proposed action will substantially reduce or fragment available habitat for native species. Please provide the information as described below: A. Please describe the native animal species present (this should include all native species i.e. not be limited to the Matters of National Environmental Significance described in Section 4.1) and what are their characteristics?	Section 4.2.4
B. Please assess and describe whether the action likely to directly or indirectly impact upon these animal species? a. Will the action result directly or indirectly in animal deaths or injury? b. Can animals be translocated? c. Will the action impact upon habitat, water or other resources utilised by animals?	Section 4.2.4
4.2.5 Impacts on heritage	Section 4.2.5
4.2.5.1 Impact on Historical Value	
According to the referral documentation, historical values and indigenous values are identified on the proposed action site. It is stated in the Heritage Impact Statement (HIS) that no heritage items at the Rifle Range site meet the threshold for the Commonwealth Heritage list. However, the proposed action is likely to have an indirect impact on the Links Battery. Please provide: A. Information in detail about how the Links Battery on the proposed action site will be stabilised, repaired where necessary, and appropriately conserved to promote the heritage values of the site and better allow the Battery to demonstrate the story of WWII on the range.	Section 4.2.5.1
B. There were nine heritage items, which were identified on the proposed action site in 2008 (Heritage Impact Statement, 2016), but only two (the rifle range and Battery) were identified during the 2017 study. Please discuss the other heritage items.	Section 4.2.5.1
C. If additional heritage items of significance are identified, please analyse impacts of the action on these heritage items.	Section 4.2.5.1
4.2.5.2 Impact on Indigenous Values	
To protect Indigenous Values, please provide: A. Details about how the burial sites, located at the south western corner of the proposed action site, will be protected.	Section 4.2.5.2
B. The involvement of Registered Aboriginal Parties (RAP) in the field work survey identified culturally sensitive areas related to the protection of the broader Fern Bay Complex and includes newly identified archaeological sites. As these are on the proposed action site, appropriate consultation should continue to be undertaken with the RAP.	Section 4.2.5.2 Appendix 3
The Department considers the Indigenous consultation process is incomplete until the Department is provided with the final Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) report, with reference to the impacts on Indigenous heritage in the Heritage Impact Statement. To confirm impacts on indigenous heritage matters are appropriately considered (whether there is the potential for either a direct, indirect, short term, long term, temporary or permanent impact on Indigenous heritage values), please ensure the final ACHAA includes any relevant responses and recommendations from RAP. If there are comments, please summarise how/whether the RAPs' comments have been addressed in the PD.	Section 4.2.5.2 Appendix 3
5. Proposed Avoidance, Mitigation and Management Measures	Section 5.0
The PD should provide proposed avoidance, mitigation and management measures for any likely impact that this proposed action may have on the following: • Listed threatened species and communities (section 18 & section18A): a. Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) – vulnerable, and	Section 5.1 Section 5.2 Appendix 1 and 4

Additional Information Requested	Relevant Package Section
b. Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable. • The environment because the proposal is a Commonwealth action (section 28): a. Impacts on landscapes and soils b. Impacts on water resources c. Impacts on plants d. Impacts on animals, and e. Impacts on Heritage. • Any other matters likely to be impacted, which are protected by the EPBC Act, identified as a result of further investigations under this PD. Please provide a consolidated list of avoidance and mitigation measures for each protected matter that is 'likely to' or 'may be' impacted by the proposed action. A. The avoidance and mitigation measures should include actions that will be undertaken to prevent or minimise potential direct and indirect impacts to the protected matters. Please describe the relevant plans that avoidance and mitigation measures will be discussed. These may include: a. a Construction Environmental Management Plan (CEMP) b. a site specific Development Conservation Plan (DCP) c. a Koala Plan of Management, or d. a Stormwater Management Plan.	
B. Please include the following measures in the Koala Plan of Management: i. options for protective covenants on un-impacted areas, in particular, areas which are better quality habitat for koalas ii. an analysis of the quality of habitat, which will be avoided, and discussion of its effectiveness in achieving conservation outcomes for these species. iii. mitigation measures to prevent the Koala to travel to the proposed action site iv. mitigation measures to prevent the impacts of proposed action (including but not limited to direct mortality, indirect mortality and injury from dog attack and vehicle strike, habitat loss from edge effect and fragmentation) on the Koala v. plans for koala habitat retention, and The Koala Plan of Management should be aligned with the broader Port Stephens Council Koala Plan of Management.	Appendix 1, Attachment E
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Acronyms and Abbreviations

Acronym / Abbreviations	Definition
ACHAA	Aboriginal Cultural Heritage Archaeological Assessment
ADF	Australian Defence Force
AEP	Annual Exceedance Probability
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
APZ	Asset Protection Zone
ARI	Average Recurrence Interval
BAL	Bushfire Attack Level
BAM	Biodiversity Assessment Methodology (NSW)
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BDAR	Biodiversity Development Assessment Report (NSW)
BOS	Biodiversity Offset Scheme (NSW)
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CMP	Construction Management Plan
DAWE	Department of Agriculture, Water and Environment (Cth), previously DoEE
DCP	Development Control Plan
DHA	Defence Housing Australia
DoD	Department of Defence
DoEE	Commonwealth Department of the Environment and Energy, now known as the Department of Agriculture, Water and the Environment
DPIE	Department of Planning, Industry and Environment (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
ESCP	Erosion and Sedimentation Control Plan
ESD	Ecologically sustainable development
GPT	Gross Pollutant Traps
HIS	Heritage Impact Statement
LEP	Local Environmental Plan
LGA	Local Government Area
MNES	Matter of National Environmental Significance
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
OEH	Office of Environment and Heritage (NSW)

Acronym / Abbreviations	Definition
PCT	Plant Community Types
PSC	Port Stephens Council
PD	Preliminary Documentation
RAAF	Royal Australian Air Force
RAI	DAWE's Request for Additional Information
SEED	Sharing and Enabling Environmental Data (NSW)
SEPP	State Environmental Planning Policy
Umwelt	Umwelt (Australia) Pty Ltd
VIS	Vegetation Information Service
VZ	Vegetation Zone
WSUD	Water Sensitive Urban Design

1.0 General Information

1.1 Title of the action

The title of the proposed action is 'Rifle Range Residential Development and Disposal'. Reference number: EPBC 2017/7993.

1.2 Full Name and Postal Address of Proponent

The proponent for the proposed action is:

Defence Housing Australia (DHA)
Level 2, 287 Elizabeth Street,
SYDNEY NSW 2000

1.3 Objective of the action

The proposed action seeks to rezone part of the former Rifle Range site from E2 Environmental Conservation to R3 Medium Density Residential under the Port Stephens Local Environmental Plan (LEP) 2013 to enable the future master planned residential development and partial divestment of the land. The objective of the proposed action is to provide suitable housing for both the Australian Defence Force (ADF) personnel and the private market.

1.4 Location of the action

The proposed action is located at the former 'Rifle Range' site, Lot 5, DP 233358, 14 Popplewell Road, Fern Bay in the Port Stephens local government area (LGA) at the boundary with City of Newcastle LGA (refer to **Figure 1.1**).

The former Rifle Range site covers about 111 hectares (ha) extending from Popplewell Road in the west to the mean high water mark of Stockton Beach in the east. The Rifle Range is located at the northern end of the Stockton peninsula within the suburb of Fern Bay, approximately four kilometres (km) north of Stockton town centre, six kilometres from Newcastle and 11 km south of the Royal Australian Air Force (RAAF) Base at Williamtown (refer to **Figure 1.1** and **Figure 1.2**).

The Rifle Range adjoins the Worimi Regional Park to the north, Stockton Beach to the east, the residential suburbs of Fern Bay to the west and the Stockton Centre and Stockton Cemetery to the south (refer to **Figure 1.1** and **Figure 1.2**).

Fern Bay is a small community comprising low density residential, over 50s community living (Bayway Village, the Cove Village and Seaside) and the Newcastle Golf Course. Stockton accommodates low to medium density residential land uses with a small-town centre. Newcastle city centre can be accessed from Stockton by ferry across the Hunter River, or by road via Kooragang Island.

Image Source: Nearmap (May2016)
Data Source: LPI NSW (2009), Commonwealth of Australia (2018)

0 1 2 4 km
1:75 000

Legend

- Referral Area
- National Park
- State Conservation Area
- Regional Park
- Hunter Estuary Wetlands Ramsar Site
- Worimi Conservation Land

FIGURE 1.1

Locality Plan

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20200221 12.43

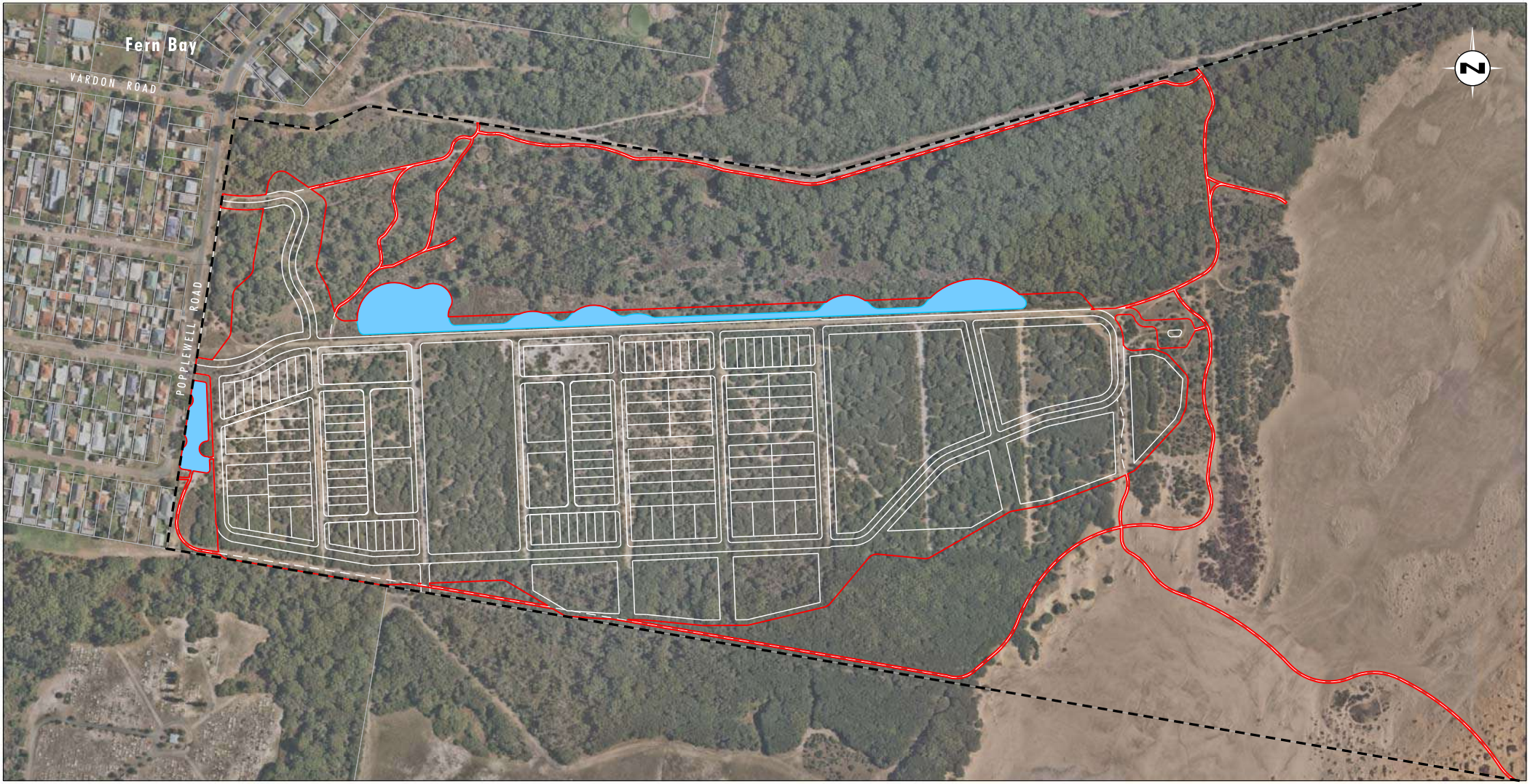

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Architectus (2019)

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1:5 000

Legend

- Referral Area
- Development Footprint
- Stormwater Detention Basin

FIGURE 1.2

Proposed Development Footprint

1.5 Background to the development of the action

From the early 1900s until 1940, rifle shooting in the Newcastle area was undertaken at the Adamstown Rifle Range. In 1939-1940, construction of the Rifle Range at Fern Bay began to meet extra local demand from the Adamstown facility. The Rifle Range was officially opened for use on 28 January 1941, although the government did not formally acquire the site until 1942.

The range was constructed as a classification range of 50 targets in a concrete gallery with firing mound at 900 yards. An anti-aircraft battery, known as the Links Battery, was established on the site to the north of the classification range. From 1953 the site was a training facility for all shooting in the region and was utilised by the police force, military, school cadets and civilian rifle clubs. The range was closed in December 1997.

The Rifle Range was zoned 7(a) Environmental Protection under the Port Stephens LEP 2000. The objective of the zone was to encourage the conservation and proper management of environmentally sensitive land. Development for the purposes of dwelling houses, dual occupancy housing, tourist facilities, recreation facilities, and clearing native vegetation were permissible with consent.

The Port Stephens LEP 2000 was revised in 2012 in accordance with the Standard Instrument LEP. The draft Port Stephens LEP 2012 zoned the Rifle Range as an E2 Environmental Conservation zone. During exhibition of the draft LEP (on the 12th of December 2012), the Department of Defence (DoD), owners of the Rifle Range at the time, made a submission that requested all Defence owned lands be zoned SP2 Infrastructure in accordance with the directions of the Standard Instrument. This reflects Defence land not being subject to planning instruments under NSW legislation and clearly distinguish the planning and management of the land. Relevant sites were mapped and listed in an attachment to the submission. The Rifle Range was identified as one such piece of land (Lot 5 DP233358).

Council's response to DoD's submission recommended 'amend[ing] Draft LEP to reflect all DoD lands as SP2 Infrastructure' and notes that 'the request to rezone all DoD land has been complied with'. A Planning Proposal (PP_2015-PORTS_005_00) implemented by Council in 2016 provided for an administrative amendment to rezone a number of Defence sites at Williamtown RAAF Base as SP2 as they were mistakenly zoned rural due to administrative anomalies during the changeover from the LEP 2000 to LEP 2013. The Planning Proposal referenced Defence's submission and the intention of Council in its response. However, when the Port Stephens LEP was gazetted in 2013, land zone mapping identified the Rifle Range as E2 Environmental Conservation. The Rifle Range is still zoned E2 Environmental Conservation.

In 2015, DHA purchased the Rifle Range land holding from DoD. The site is currently vacant, non-operational, and secured.

A Planning Proposal (Architectus Group, 2018) has been submitted by DHA in June 2017 to Port Stephens Council (PSC) for the rezoning of part of the land to R3 Medium Density Residential to allow for the concept masterplan medium density residential development while retaining the existing E2 Environmental Conservation on the remainder.

The Master Plan was amended in December 2018 and an updated Planning Proposal (Architectus Group, 2019) lodged with PSC in March 2019. DHA is working with PSC to progress the rezoning application through the gateway process. The Planning Proposal (PP_2019_PORTS_002_00) was determined by the Department of Planning, Industry and Environment (DPIE) on 25 November 2019 to proceed, subject to conditions, to amend the LEP to *rezone the land and enable the development of the site for medium-density residential development and to protect and conserve areas of ecological value*.

1.6 How the action relates to other actions

The proposed action is not part of a larger or staged action. With approval construction would occur in a staged manner, however, the proposed action would be constructed in its entirety within the timeframes specified and as part of the one project. No other development than what is described in this Preliminary Documentation is proposed.

1.7 Current status of the action

An EPBC Referral (EPBC 2017/7993) was submitted to the Department of Environment and Energy, now known as the Department of Agriculture, Water and the Environment (henceforth referred to as the Department), in July 2017. The Referral and the attachments provided to the Department at the time are provided in **Appendix 1**.

The proposed action was determined to be a controlled action under the EPBC Act on 5 September 2017, due to the likelihood of significant impacts to threatened species and being a Commonwealth action. As such, the proposed action is to be assessed through Preliminary Documentation (PD). This document, including its appendices comprises the PD and is to be submitted to the Department to assist in the assessment of the controlled action.

The PD includes information updated since the Referral was submitted, in response to the Department's request for additional information (**Appendix 2**). This PD provides detailed assessment, as requested by the Department, for the following matters of national environmental significance (MNES):

- Vulnerable koala (*Phascolarctos cinereus*) combined populations of Queensland, NSW and the ACT, particularly further information on the occurrence of the koala and analysis of suitability of habitat on the proposed action site and adjacent land in accordance with the *EPBC Act Referral Guidelines for the Vulnerable Koala* (Commonwealth of Australia 2014) in the context of the local Port Stephens koala population.
- Vulnerable grey-headed flying-fox (*Pteropus poliocephalus*), particularly further information on the occurrence of the grey-headed flying-fox and habitat on the proposed action site and adjacent land.
- the 'whole of environment' particularly landscape and soils, plants and animals because the proposal is a Commonwealth action, that is undertaken by a Commonwealth agency. This is to also consider fi the proposed action is likely to have a significant impact on water resources and heritage (historical and indigenous values).

For all of the MNES, the PD should provide an assessment of the impact of the proposed action on the MNES, identify appropriate avoidance, mitigation and management measures for any likely impact and the need for any offset of residual significant impacts.

At a local and state level, the proposed action is pending finalisation of the rezoning application and subsequent development approval of the Master Plan.

Since the EPBC referral, the disturbance footprint for the Master Plan residential development has been amended in consultation with PSC. A description of how the proposed action has changed since the referral is provided in **Section 2.2**.

Subject to rezoning of the land, future development of the Master Plan will be subject to assessment and approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and its regulations with PSC being the relevant planning authority.

Subject to the issue of relevant planning approvals, Stage 1 civil early works are proposed to commence in early 2022, with housing targeted for delivery from early 2023.

1.8 Consequences of not proceeding with the action

DHA has an ongoing requirement to provide additional housing for Australian Defence Force (ADF) members posted at RAAF Base Williamtown and to replace existing DHA housing stock that does not meet current housing standards. DHA is seeking to provide housing that is:

- within close proximity to RAAF Base Williamtown
- not affected by Australian Noise Exposure Forecast contours or other environmental constraints that would affect quality of life and
- within close proximity to services and community infrastructure.

There is considerable demand for suitable housing in the Newcastle and Port Stephens area for the ADF. If the Proposed Action does not proceed, DHA would need to seek provisioning of additional housing in direct competition with the local rental market, reducing availability in a limited supply market and driving up accommodation costs.

1.9 Preparation of the PD

Table 1.1 identifies the staff from Umwelt (Australia) Pty Limited (Umwelt), DHA, and other supporting organisations who prepared and/or were relied upon to inform this PD. **Table 1.1** lists the tasks they undertook.

Table 1.1 Project Team Roles

Name	Job Title, Company	Tasks Undertaken
Naomi Buchhorn	Principal Ecologist/Environmental Scientist, Umwelt	Oversight and review of the PD.
Caitlin Adcock	Environmental Planner, Umwelt	Primary author of the PD report.
Gabrielle Allan	Senior Environmental Scientist, Umwelt	Project Director for the EPBC Referral and Umwelt supporting reports for the Planning Proposal application to PSC.
Kate Connolly	Senior Ecologist, Umwelt	Primary author of the EPBC Referral and Ecological Assessment for the Planning Proposal (Umwelt 2018)
Bill Wallach	Senior Ecologist, Umwelt	Ecological surveys and primary author of the Biodiversity Development Assessment Report (BDAR) (Umwelt 2019) that informed the PD. Accredited Biodiversity Assessment Methodology (BAM) assessor under the NSW *Biodiversity Conservation Act 2016* (BC Act) responsible for calculation of offset requirements for the proposed action under the BC Act Biodiversity Offset Scheme (BOS).
James Garnham	Senior Ecologist, Umwelt	Assistance with ecological surveys and ecological report preparation.

Name	Job Title, Company	Tasks Undertaken
Emily Gardiner	Ecologist, Umwelt	Assistance with ecological surveys and ecological report preparation.
Nicola Roche	Principal Archaeologist, Umwelt	Oversight and review of the Aboriginal Cultural Heritage and Archaeological Assessment Report
Alison Lamond	Archaeologist, Umwelt	Primary author of the Aboriginal Cultural Heritage and Archaeological Assessment Report
Rachel Nesbitt	Associate, Architectus	Primary author of the Planning Proposal for the Former Rifle Range, Popplewell Road, Fern Bay, March 2019.
Jane Freeman	Principal, Urban Planner Architectus	Reviewed Planning Proposal for the Former Rifle Range, Popplewell Road, Fern Bay, March 2019.
Michael Gawn	Douglas Partners	Primary Author of the Geotechnical investigation
Scott McFarlane	Douglas Partners	Reviewed Geotechnical Investigation
Alexandria Barnier	Senior Consultant Heritage, Urbis	Heritage Impact Statement for the Planning Proposal
Stephen Davies	Heritage Director, Urbis	Heritage Impact Statement for the Planning Proposal
Mark Waugh	Better Transport Futures	Transport Report for the Planning Proposal

2.0 Description of the Action

2.1 Location of all Works

The Rifle Range site occurs to the east of Fern Bay residential area between the Worimi Regional Park and the Stockton Centre and the mobile dunes of Stockton Beach/Newcastle Bight.

The total size of the Referral Area is approximately 110 ha, accounting for the entirety of the Rifle Range. However, the proposed disturbance footprint only covers approximately 22.5 ha (refer to **Figure 2.1**). Construction of residential development is proposed to occur towards the western boundary of the former Rifle Range. As such, only a portion of the Rifle Range would be rezoned and disturbed as a result of the proposed action. The proposed master plan and Development Footprint are shown in **Figure 2.1**.

2.1.1 Site Boundaries

The coordinates for the Rifle Range site boundaries are provided in **Table 2.1**.

Table 2.1 Site Boundary Coordinates

Location Point	Longitude			Latitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	151	49	23	-32	52	10
2	151	49	19	-32	52	13
3	151	49	15	-32	52	16
4	151	49	14	-32	52	17
5	151	49	11	-32	52	19
6	151	49	09	-32	52	20
7	151	49	03	-32	52	24
8	151	48	57	-32	52	27
9	151	48	49	-32	52	32
10	151	48	39	-32	52	38
11	151	48	35	-32	52	41
12	151	47	48	-32	52	34
13	151	47	50	-32	52	21
14	151	47	53	-32	52	22
15	151	47	55	-32	52	21
16	151	48	10	-32	52	23
17	151	49	02	-32	52	11

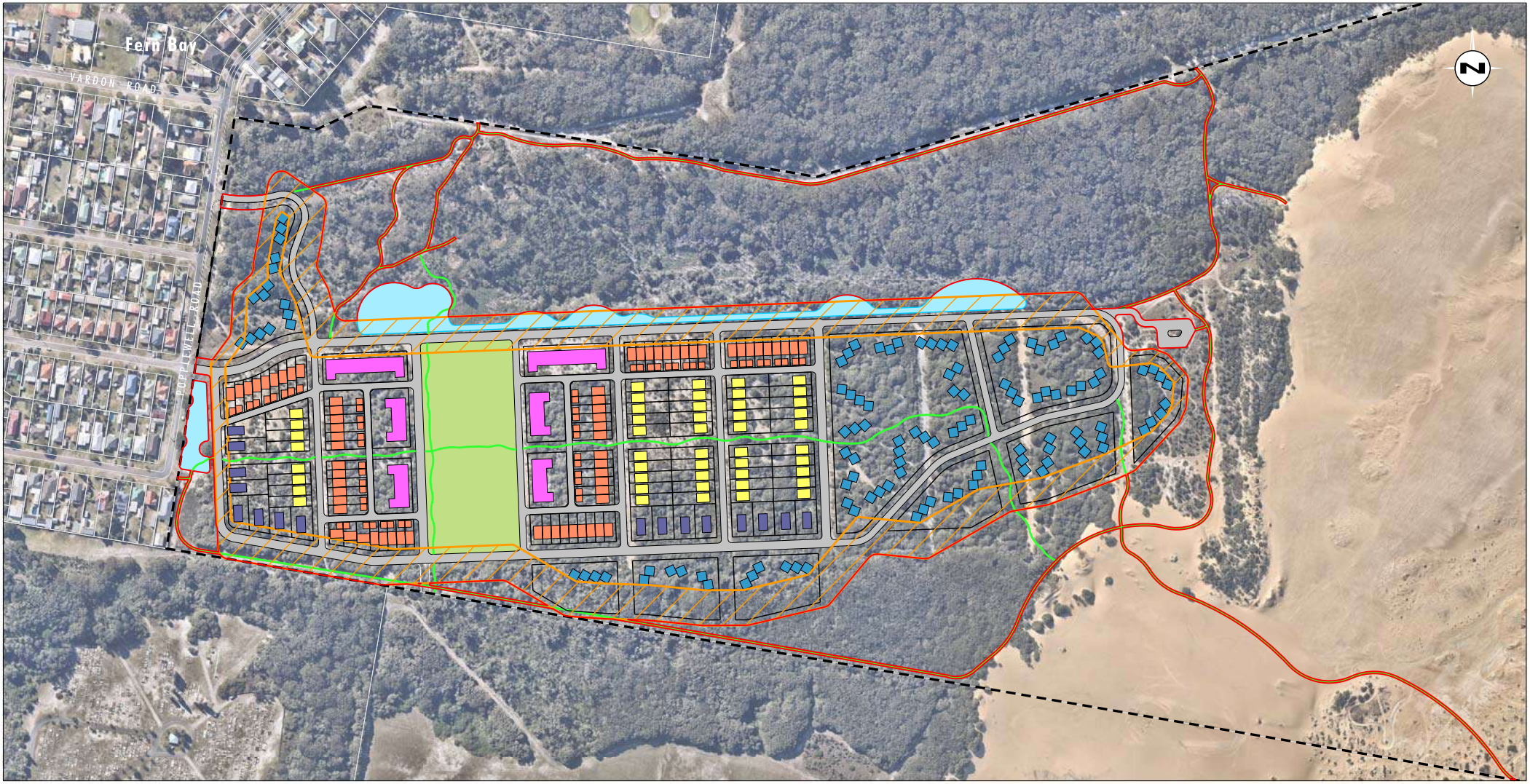

Image Source: Nearmap (Aug 2019)
Data Source: Architectus (2019)

0 100 200 250m
1:5 000

Legend

- Proposed Action Area
- Development Footprint
- Asset Protection Zone
- Dune Apartment
- Townhouse
- Courtyard Home
- Cluster Home
- Single Eco Home
- Park Area
- Tracks
- Stormwater Detention Basin

FIGURE 2.1

Proposed Master Plan and Development Footprint

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The proposed action is directly surrounded by the following land uses:

- To the north is The Newcastle Golf Course and the Worimi National Park, with the developments 'Bayway Village', 'The Cove Village' and 'Seaside' residential development (refer to **Figure 2.2**).
- To the east, the land holding extends to the high tide mark of Stockton Bight (refer to **Figure 1.1**). The beach is a popular fishing and recreational area.
- To the south is a narrow strip of remnant vegetation, the Stockton Cemetery and the Stockton Centre. Beyond the Stockton Centre is the DHA owned Fort Wallace and a redundant Hunter Water wastewater treatment works further south (refer to **Figure 1.1**).
- To the west is residential suburb of Fern Bay, comprising of six streets of low-density residential development perpendicular to the Rifle Range western boundary. Within proximity to the western boundary of the Rifle Range site is the Fern Bay Store, and social infrastructure such as the Fern Bay Public School and Fern Bay Reserve (see **Figure 1.1**). Further west is estuarine wetlands either side of the north channel of the Hunter River. These wetlands are protected as Hunter Wetlands National Park and are also identified as the Hunter Estuary Wetlands Ramsar Site of international significance for migratory shorebirds.

2.1.2 Offsite Infrastructure

The proposed action would allow for a development yield of 318 dwellings (Architectus, 2019). The proposed action would be adequately serviced by the surrounding infrastructure, with no constraints relating to the provision of necessary utility services (ADW Johnson, 2018). Connections to existing utility infrastructure would be required as part of the proposed action, as described within the *Servicing Report* (ADW Johnson, 2018) included in the Planning Proposal Gateway submission, included in **Appendix 3**, and summarised in **Table 2.2.**

Table 2.2 Summary of available utility services

Utility	Availability to Proposed Action
Water	Area surrounding the Rifle Range site is well serviced with 100 millimetre (mm) diameter cast iron concrete lined water mains in all of the adjacent neighbouring streets of Fern Bay. Hunter Water Corporation have identified that there is currently sufficient capacity available in the surrounding water mains.
Sewer	The Fern Bay residential area is serviced by 150 mm diameter UPVC sewer mains which drain by gravity to Fern Bay 1 Waste Water Pump Station on Vardon Road. Hunter Water Corporation have identified that there is currently sufficient capacity at the Fern Bay 1 Waste Water Pump Station for the proposed action.
Electricity	There is an overhead High Voltage transfer main along Popplewell Road on the western boundary of the Rifle Range site. It is envisaged that a high voltage connection will be made from the transfer main to service the proposed development.
Telecommunications	It is envisaged that in consultation with NBN that an NBN fibre option connection will be provided to the site.
Gas	The nearest supply is a 150 mm gas transfer main along the western side of Nelson Bay Road. There is no domestic gas services in the neighbouring streets of Fern Bay and no proposal to extend infrastructure to the Rifle Range site.

Construction and operation of the proposed action would generate traffic. Traffic access to the site would be through the local Fern Bay road network off Nelson Bay Road (B63). Nelson Bay Road is the main road connection from Newcastle, via Kooragang Island to the RAAF Base and Port Stephens.

A transport study for the Planning Proposal for the proposed action has identified that:

- there would be two entrances to the proposed action site on Popplewell Road (this work is occurring onsite)
- upgrade of at least one local road would be required from the Rifle Range site to Nelson Bay Road
- an upgrade at the intersection of Vardon Road with Nelson Bay Road to improve right turn facilities is required (Better Transport Futures 2018).

The upgrade of the local roads and intersection upgrades would both occur offsite likely to be confined to the road reserve. These would be subject to separate environmental impact assessment and approvals with Port Stephens Council and/or the NSW Roads and Maritime Service.

No other offsite infrastructure is expected as part of the proposed action.

2.1.3 Adjoining Areas and indirect impacts

Areas that may experience indirect impacts include:

- residential properties to the west in Fern Bay
- Worimi Regional Park to the north.

The Worimi Regional Park constitutes part of the wider Worimi Conservation Lands. The Worimi Conservation Lands extend from Fern Bay in the south along Stockton Bight to and Anna Bay at the northern end of Stockton Beach (see **Figure 1.1**). The Worimi Conservation Lands includes a national park, state conservation area and regional park. The Worimi Conservation Lands provide an important habitat link within a broader sub-regional wildlife corridor from the Hunter Wetlands National Park in the estuary of the Hunter River to the northwest through to Tomaree National Park and Tilligerry State Conservation Area in the north.

The majority of the Worimi Conservation Lands to the north of the proposed action are dominated by frontal dune blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*) forests on freely draining quaternary sand, with coastal tea-tree banksia scrub on low dunes rises and slopes in the south (Bell and Driscoll 2010, OEH 2015). Along the length of the beach, depressions in the dune system where groundwater meets the surface support beach wetlands with foredune spinifex occurring sporadically along the mobile dunes (Bell and Driscoll 2010).

Additionally, the active sand dune system of Stockton Bight borders the eastern boundary of the proposed action. This coastal sand dune system extends from Stockton in the south, approximately 28 km north to Anna Bay.

Potential indirect impacts are likely to be associated with residential construction in the western portion of the Rifle Range site, including dust emissions, noise, changes to existing traffic conditions and temporary visual impacts. These impacts are further discussed in **Section 4** and are anticipated to be managed through the implementation of a Construction Environmental Management Plan (CEMP).

2.2 Full Scope of Works

The Proposed Action involves the implementation of the concept Master Plan for the residential development of the Rifle Range site (refer to **Figure 2.1**). The Proposed Action includes the following elements:

- rezoning of part of the Rifle Range site from the current Environmental Conservation (E2) to Medium Density Residential (R3) under the LEP to allow for a residential subdivision and conservation (see **Figure 2.2**). The rezoning application also includes seeking amendment of the following planning controls under the LEP:
    - amendment of the minimum lot size map (Sheet LSZ_004A) to retain the existing 40 ha minimum lot size over the conservation zoned land with 200sqm in the centre and 500sqm at the outer edges of the residential zoned land
    - amendment of the height of buildings map (Sheet HOB_004a) to apply a maximum building height of nine (9) metres to most of the residential zoned land with up to 15 m either side of the proposed park
- development of a mix of residential, recreation and conservation purposes generally in accordance with the concept Master Plan presented in **Figure 2.1**
- divestment of land within the proposed action area from the Commonwealth. DHA currently owns all the land within the Rifle Range, however, DHA intends to provide 50 per cent of the proposed residential housing for sale to the private market as well as divesting the 1.6 ha park areas to Council.

To enable the development of the Rifle Range in accordance with the concept master plan, the proposed action will require the clearing of up to approximately 22.65 ha of primarily disturbed native vegetation.

2.2.1 Rezoning

The Proposed Action seeks to rezone the part of the site to R3 Medium Density Residential, while maintaining the existing E2 Environmental Conservation zone over the remainder of the site (see Figure 2.2). The Proposed Action allows for the rezoning of approximately 25 ha of land to R3 Medium Density Residential and retains approximately 87 ha as E2 Environmental Conservation. The area of the site proposed to be rezoned to R3 Medium Density Residential adjoins the existing residential areas within Fern Bay and will retain the northern and eastern parts of the site as E2 Conservation Zone creating a buffer between the residential areas and the adjoining Worimi Conservation Lands and avoiding impacts to areas within the site with Aboriginal Cultural and ecological value.

The proposed rezoning will facilitate the development of the site for a range of residential uses beyond those currently permitted under the current E2 Environmental Conservation zone specifically multi-dwelling housing and semi-detached dwellings.

2.2.2 Proposed Master Plan

A concept Master Plan has been developed for the Rifle Range site to demonstrate the future development potential (refer to Figure 2.1). The proposed Rifle Range Master Plan has sought to retain the landscape and focus development within the disturbance footprint of the former Rifle Range.

As noted in **Section 1.7**, the proposed Master Plan has been amended since the referral to the Department in July 2017. A summary of the changes is provided in **Table 2.3**.

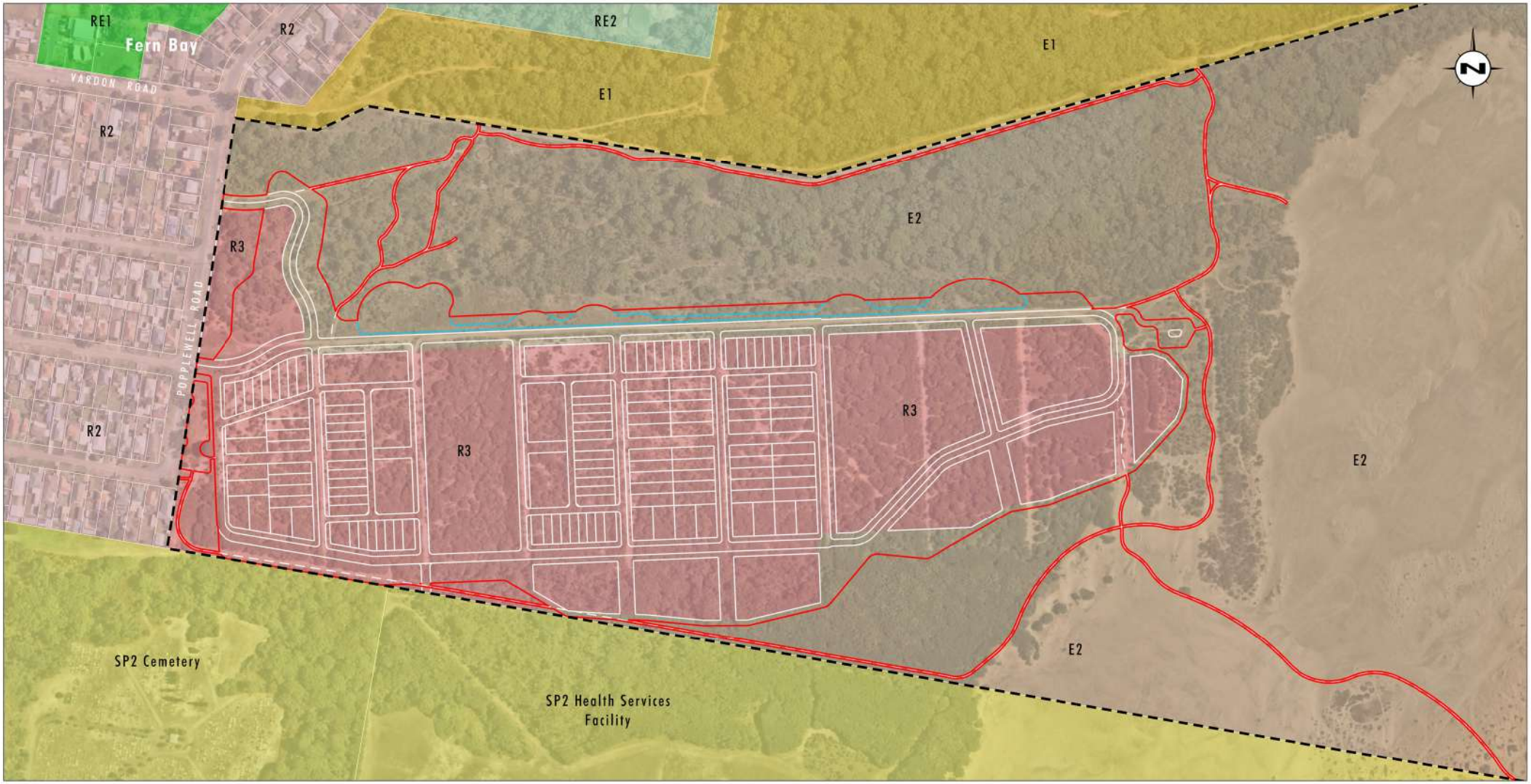

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Architectus (2019), Port Stephens LEP (2013), Newcastle LEP (2012)

0 100 200 250m
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Legend

- Referral Area
- Development Footprint
- Stormwater Detention Basin

Zoning

- E1 - National Parks and Nature Reserves
- E2 - Environmental Conservation
- R2 - Low Density Residential
- R3 - Medium Density Residential
- RE1 - Public Recreation
- RE2 - Private Recreation
- SP2 - Infrastructure

FIGURE 2.2

Proposed Land Zoning within the Development Footprint

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Table 2.3 Changes to the Concept Master Plan

Aspect of the proposed action	Concept Master Plan July 2017[1]	Concept Master Plan 2019[2]
Area of Development Footprint	18.3 ha	22.65 ha
Area of native vegetation clearance	15.3 ha	17.5 ha
Area of cleared land/sand dunes to be developed	3 ha	5.15 ha
Proposed rezoning	R2 General Residential	R3 Medium Density Residential
Maximum building height (residential area only)	Nine (9) metres	Part up to 9 m and small areas up to 15 m either side of the park.
Minimum lot size (residential area only)	Majority 500 sqm with small area of 200 sqm on northern edge	Part 500 sqm in the northwest, east and south). and 200sqm over majority of the development
Community park	0.65 ha	1.6 ha
Stormwater detention basin area	12387 sqm	12387 sqm
Proposed Divestment	50 per cent of proposed residential housing to private market and recreational areas to PSC	50 per cent of proposed residential housing to private market and recreational areas (park) to PSC
Total dwellings	249	318
Residential Dwelling Type:		
Townhouse attached 1-3 storey	56	Up to 68
Coastal cluster houses	113	Up to 120
Courtyard homes	48	Up to 48
Single eco-homes	32	Up to 16
Dune apartments	0	Up to 66

1. Rifle Range Draft Indicative Master Plan; Revision G; 2/05/2017
2. Rifle Range Draft Indicative Master Plan; Revision H; 10/05/2018

A site specific Development Control Plan (DCP) will be developed with PSC and implemented to guide the future development of the site ensuring the future residential development enhances and protects the existing ecological and Aboriginal cultural heritage value of the site. The Master Plan proposes application of a maximum building height of 9 m across most of the residential zoned land in order to control development capacity of the land and manage potential visual impact on surrounding areas. A higher maximum building height of up to 15 m is nominated in the centre of the residential development either side of the park. The application of a 200sqm minimum lot size in the centre of the residential zoned land would allow development of medium density housing with 500sqm minimum lot size at the outer edges of the residential zoned land. The minimum lot size of 40 ha in the E2 Environmental Conservation zone would not be changed.

The proposed Master Plan for the Rifle Range site includes a mix of residential typologies primarily placed within the former Rifle Range footprint (refer to **Figure 2.1**). The Master Plan has sought to retain the

landscape and focus development within the previously disturbed areas of the site. The residential typologies for the Rifle Range include the following:

- **Townhouses –** up to 68 attached one to three storey dwellings with a lightweight design that facilitates layouts that are responsive to site features and context.
- **Coastal cluster houses –** up to 120 townhouse style dwellings set within natural landscape areas. Private open space is limited to decks and immediate terrace areas attached to each dwelling.
- **Courtyard homes –** up to 48 large courtyard family homes including four bedrooms, three bathrooms, open plan living space, single garage and an ample rear garden.
- **Single eco-homes –** up to 16 lightweight, climate responsive individual homes set within generous lots.
- **Dune apartments –** up to 66 small scale apartments with one to three bedrooms each, in blocks up to four stories.

The Master Plan residential development requires an Asset Protection Zone (APZ). Details of the APZ are provided in the Rifle Range Bushfire Assessment prepared by Kleinfelder (2018). In summary the APZ varies from a minimum width of 13 m at the interface with scrub in the east, increasing to 25 m to forest along the northern development interface, ranging from 25 to 32 m to forest along the southern development interface. The separation distance would provide for a minimum Bushfire Attack Level (BAL) construction standard of BAL 29 (Kleinfelder 2018).

In addition, the following ancillary works will be included as part of the proposed action:

- permanent and temporary infrastructure
- land or vegetation disturbance
- landscaping
- fencing
- stockpiles of materials (waste and spoil)
- storm water diversion channels
- erosion control measures
- rehabilitation works.

2.2.3 Divestment

Following construction of the proposed residential development, DHA are seeking to make 50 per cent of the new housing available for private sale to members of the public. The other remaining 50 per cent would be retained as Defence housing. DHA are also seeking to divest the community park to Port Stephens Council.

2.3 Layout Plan

The proposed layout of the residential development is provided in **Figure 2.1**.

2.4 Construction methods, techniques and materials

The proposed construction method is indicative and based on the current design. The construction method would be further developed during the detailed design of the proposed action by the nominated contractor in consultation with DHA.

In the event that construction results in environmental impacts that are greater than those anticipated in this assessment, further environmental assessment would be carried out and subject to approval by the Department.

It is anticipated that the proposed action would be constructed in stages. Construction work would be expected to involve the following methods and general staging:

- pre-construction identification and marking of sensitive areas as identified in this documentation and the Construction Environmental Management Plan (CEMP)
- site establishment (including temporary fencing and construction compound) within the Project Area boundary
- installation of traffic management measures such as placing safety barriers in accordance with a traffic control plan
- vegetation removal and installation of erosion and sediment controls
- excavation
- drainage and stormwater work
- road pavement construction and associated line marking and signposting
- building construction
- landscaping work
- site clean up and stabilisation.

A range of plant and equipment would be used during completion of the proposed action. The final equipment and plant requirements would be determined by the construction contractor. An indicative list of plant and equipment is provided below:

- bulldozers
- dump trucks
- road trucks
- excavators
- concrete pumps / vibrators
- road sweepers
- water trucks
- water pumps
- concrete saws
- asphalt pavers
- roller/compacters/compressors
- line marking truckers
- graders
- scrapers
- concrete trucks
- generators

- chainsaws
- jackhammers
- hand tools
- mulchers

The proposed action would be constructed within standard construction hours:

- Monday to Friday from 7:00am until 6:00pm
- Saturday from 8:00am until 1:00pm
- No work on Sunday or public holidays.

Ancillary facilities for the proposed action would include a compound site within the Project Area. The compound site may be relocated during various stages of the proposed action due to the size of the project area and its staged construction method. The location of the compound site would be in accordance with the following principles:

- at least 40 m away from the nearest waterway
- of low ecological and heritage conservation significance
- at least 100 m away from residential dwellings and other land uses that may be sensitive to noise
- of relatively level ground
- outside the 1 in 10 year Average Recurrence Interval (ARI) floodplain
- in plain view of the public to deter theft and illegal dumping
- vehicle and pedestrian traffic management
- maintenance works.

Compound site facilities would include portable buildings with amenities (such as lunch facilities and toilets), secure and bunded storage areas for site materials (where required), including fuel and chemicals, office space for on-site personnel, and associated parking. The compound site would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions. Upon completion of work, the temporary site compound, work areas and stockpiles would be removed, the site cleared of all rubbish and materials, and restored.

Construction of the proposed work would generate heavy vehicle movements that would be associated with:

- delivery of construction materials
- spoil and waste removal
- delivery and removal of construction equipment and machinery
- movement of materials, resources and construction staff between the work areas and the compound site.

The proposed work would also generate light vehicle movements, being broadly associated with staff movements between work areas and the compound site. This generation of light construction vehicles is

likely to be small, will be managed through appropriate safeguards and would take place outside of peak hours.

The proposed work would require the development of a Traffic Management Control Plan for all stages of construction. This would include plans for general traffic, school bus routes, heavy vehicle movements, parking and property access.

2.5 Operational requirements of the action

The proposed action when developed would have an ongoing demand for utility supply and generate traffic.

A transport study for the Planning Proposal has identified that the proposed action would generate in the order of 156 trips in the morning and 172 trips in the afternoon (Better Transport Futures 2018). These trips are likely to be to the north to 50 per cent to the north towards the RAAF Base and 50 per cent to the south towards Stockton and/or Newcastle. Proposed upgrades would be required to local roads and to improve access off Nelson Bay Road (Better Transport Futures 2018). The transport study also considers public transport and cycling options.

Development of the site will increase demand for social facilities and services. Defence families likely to be accommodated at the Rifle Ranges site would primarily be working the air force at RAAF Base Williamtown and approximately two-thirds are likely to have households with children. There will be an increasing demand for childcare services, education, health, public transport, public open spaces and recreational facilities.

2.6 Timing and Duration

The construction period is anticipated to take between 3-5 years to be fully completed and operational. Works are scheduled to commence in 2022. This timeframe is indicative only.

2.7 Cumulative impacts from other developments

The proposed action would directly impact approximately 22.65 ha of land, including approximately 17.37 ha of Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast and 0.12 ha Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast. Both these plant community types (PCT) have been impacted by residential development in the Fern Bay area, particularly the Seaside residential development to the north of Worimi Regional Park (refer to **Figure 2.3)**.

The Seaside residential development received approval to clear approximately 90 ha of native vegetation and fauna habitat (ERM 2009) including approximately 13 ha of swamp forest (in keeping with the Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast PCT), 19 ha of coastal heath and 61 ha of dry sclerophyll forest (in keeping with Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast PCT).

While the proposed action would increase cumulative impacts on the Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast (previously called Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree Banksia Scrub) it has largely avoided impacts on the Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast (previously called Mahogany-Baloskion Swamp Forest).

It is noted that neither of these PCT's are listed as threatened ecological communities under State or Commonwealth legislation. Descriptions of these PCT's is provided in **Section 3.2**, and potential impacts are discussed in **Section 4.1** and **Section 4.2**.

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019)

0 0.25 0.5 1.0km
1:20 000

Legend
Referral Area

FIGURE 2.3

Nearby Developments

File Name (A4): R09/3764_080.dgn
20200224 13.31

3.0 Description of the Existing Environment

Section 3 of the Referral document described the general environmental values present at Lot 5 DP 233358 (**Appendix 1**). This section provides further details of the environmental values present, as requested in the Guidelines for Preliminary Documentation.

The Department determined that the proposed action was a controlled action under the EPBC Act (**Appendix 2**) due to the likelihood of significant impacts to the following:

- Threatened species and communities: protected as Matters of National Environmental Significance (MNES) under the EPBC Act (discussed in **Section 3.1**).
- The 'Whole of the Environment', which must be considered as the Proponent is a Commonwealth Agency (discussed in **Section 3.2**).

3.1 EPBC Act Protected Matters

3.1.1 Matters of National Environmental Significance

The following EPBC Act-listed threatened species were identified within the Referral as being present within the Referral Area:

- Potential Earp's gum (*Eucalyptus parramattensis* subsp*. decadens*), vulnerable under the EPBC Act
- Grey-headed flying-fox (*Pteropus poliocephalus*) (GHFF), listed as vulnerable under the EPBC Act.

Umwelt note that in regard to Earp's gum, an atypical eucalypt was recorded within the Referral Area that appeared to hybridise between *Eucalyptus parramattensis* subsp*. decadens* and *E. robusta*. Multiple samples were sent to The Royal Botanic Gardens in Sydney for formal identification, but results came back inconclusive. Under the precautionary approach, the individuals recorded have been aligned with *Eucalyptus parramattensis* subsp*. decadens*. The final development layout does not require the removal of any of these individuals (Umwelt 2018).

The Department has also identified the potential presence of Koala (*Phascolarctos cinereus*) (combined populations of QLD, NSW and the ACT), being listed as vulnerable under the EPBC Act, in the Referral Area.

All other threatened species potentially occurring within the Referral Area have been assessed within the Referral (2017/7993) as unlikely to be significantly impacted by the proposed action (refer to **Appendix 1**).

No threatened ecological communities listed under the EPBC Act have been recorded in the Referral Area.

In addition to the threatened species identified above, the proposed action also involves impacts to the following patches of native vegetation:

- PCT1646 Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
    - Moderate (Forest)
    - Disturbed (Forest)
    - Moderate (Coastal Tea-tree – Banksia Scrub), and
    - Cleared

- PCT1725 Swamp Mahogany – Broad-leaved Paperbark – Swamp Water Fern – Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower Coast
    - Moderate.

3.2 Quality of Native Vegetation

The quality of native vegetation within the Referral Area was determined under the BAM methodology to vary from Moderate to Cleared (refer to **Appendix 4**).

Two Plant Community Types (PCTs), having five different condition classes were identified in recent ecological surveys of the Referral Area to inform the BDAR (Umwelt, 2019). These PCTs and vegetation zones (VZ) are outlined in **Table 3.1. Figure 3.1** demonstrates the distribution of these PCTs across the Referral Area as identified in the BDAR (Umwelt 2019), while **Figure 3.2** demonstrates the PCTs within the proposed Development Footprint.

Table 3.1 Native Vegetation Plant Communities, Condition and Disturbance Areas

Plant Community Type	Vegetation Zone and Condition	Disturbance area (ha) in Development Footprint	Percentage (%) of Development Footprint
PCT1646 Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	VZ1 Moderate (Forest)	0.68	3.0
	VZ4 Disturbed (Forest)	1.55	6.8
	VZ2 Moderate (Coastal Tea-tree – Banksia Scrub)	15.14	66.8
	VZ5 Cleared	5.02	22.2
PCT1725 Swamp Mahogany – Broad-leaved Paperbark – Swamp Water Fern – Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower Coast	VZ3 Moderate	0.12	0.5
Beach wetlands	-	0.01	<0.01
Sand dunes	-	0.13	0.6
	Total	22.65	100

The Development Footprint supports 77.2 per cent native vegetation cover, however only 10.4 per cent of the native vegetation comprises intact remnant forest with the dominant vegetation being a moderate condition Coastal Tea-tree – Banskia Scrub (66.8 per cent) and cleared land (22.2 per cent) regenerating from previous land use.

The Development Footprint also includes up to 0.01 ha of Beach Wetlands and 0.13 ha of Sand Dunes that may be disturbed by indicative walking tracks (Umwelt 2019). DHA have committed to final detailed design of these tracks to avoid all impacts to beach wetlands and sand dunes.

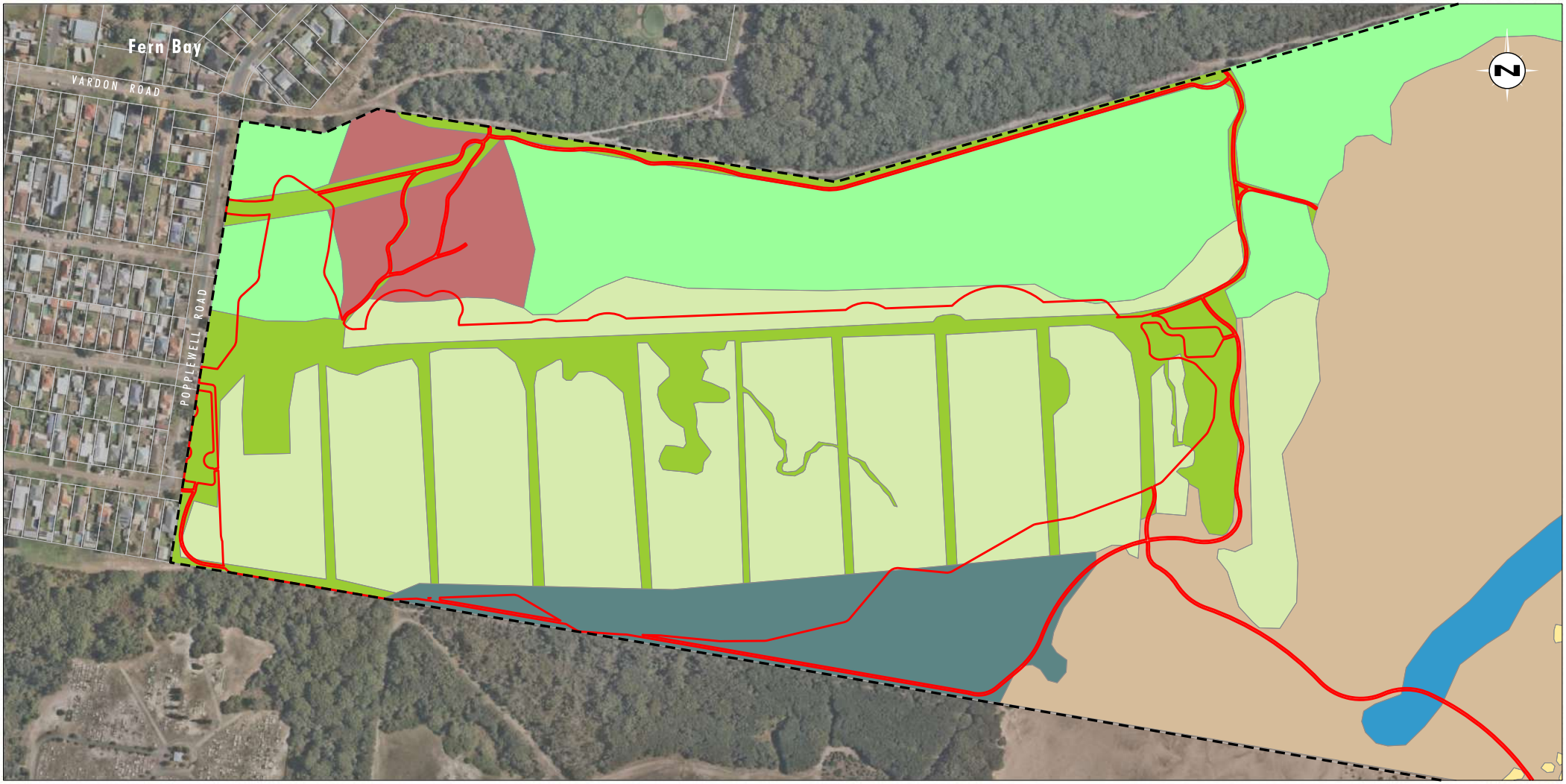

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Architectus (2019)

Legend

- Referral Area
- Development Footprint
- VZ1 PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast - Moderate Forest
- VZ2 PCT1646 - Moderate (Tea Tree - Banksia Scrub)
- VZ3 PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast - Moderate
- VZ4 PCT1646 - Disturbed (Forest)
- VZ5 PCT1646 - Cleared
- Sand Dune
- Beach Wetland
- Foredune Spinifex

FIGURE 3.1

Vegetation Zones in the Referral Area

File Name (A4): R09/3764_081.dgn
20200401 16.49

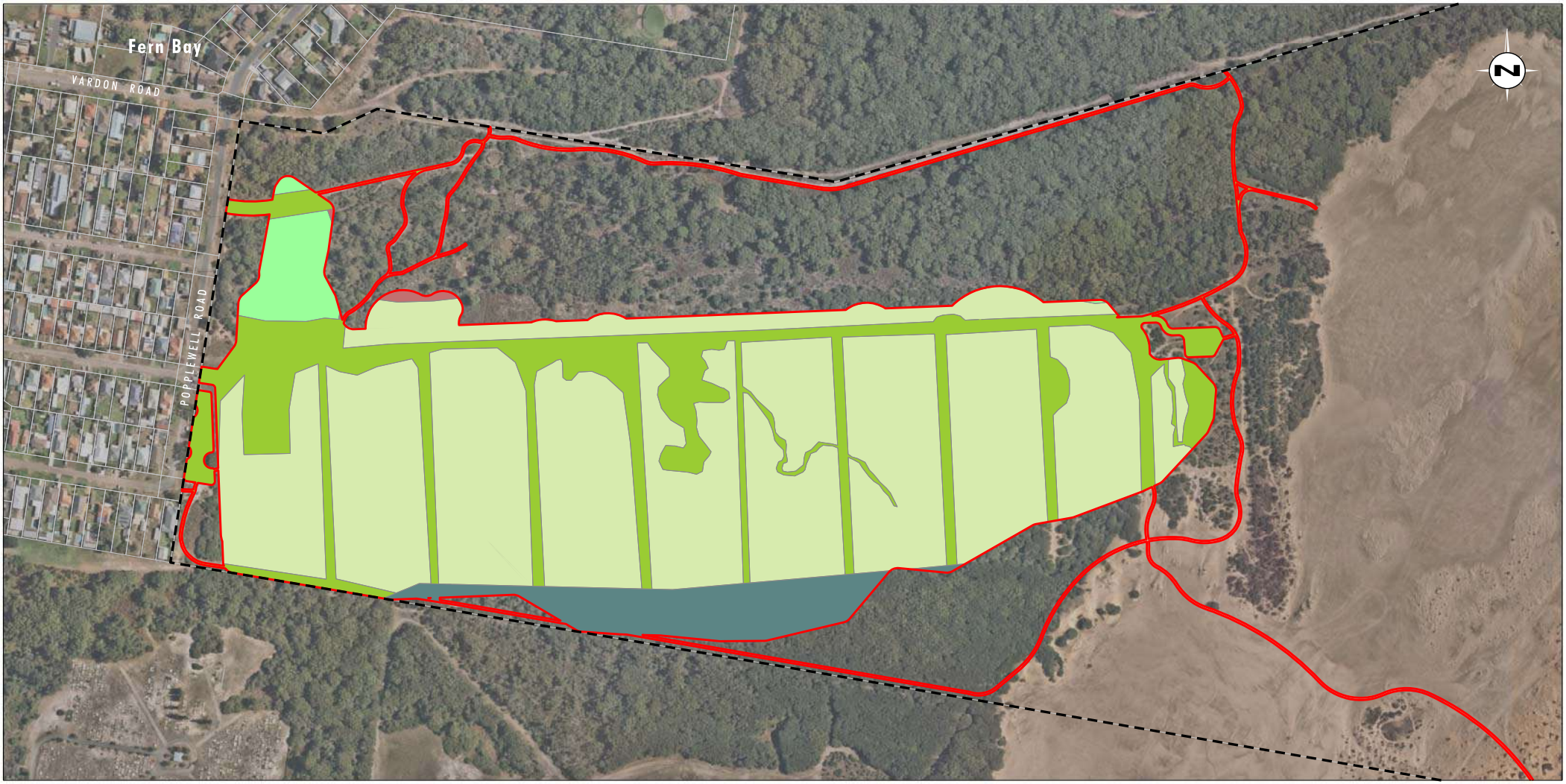

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Architectus (2019)

Legend

- Referral Area
- Development Footprint
- VZ1 PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast - Moderate Forest
- VZ2 PCT1646 - Moderate (Tea Tree - Banksia Scrub)
- VZ3 PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast - Moderate
- VZ4 PCT1646 - Disturbed (Forest)
- VZ5 PCT1646 - Cleared
- Sand Dune
- Beach Wetland

FIGURE 3.2

Vegetation Zones in the Development Footprint of the Referral Area

File Name (A4): R09/3764_070.dgn
20200221 13.34

PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Moderate (Forest)*

PCT Name	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	
Condition	**Moderate (Forest)**	
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Class	Coastal Dune Dry Sclerophyll Forests	
Area in Development Footprint (ha)	0.68	
General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. This vegetation community condition class is located primarily to the north of the Development Footprint adjoining the habitats of Worimi Regional Park.	
Vegetation Structure Description	This community is a moderately open forest with a shrubby understorey. The canopy is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis*). The midstorey was dominated by old man banksia (*Banksia serrata*), Sydney golden wattle (*Acacia longifolia subsp. longifolia*) and coastal tea-tree (*Leptospermum laevigatum*), with occasional coast banksia (*B. integrifolia*), and coffee bush (*Breynia oblongifolia*). The ground cover consisted primarily of bracken fern (*Pteridium esculentum*) with spiny-headed mat-rush (*Lomandra longifolia*), raspwort (*Gonocarpus teucrioides*), blue flax lily (*Dianella caerulea*), blady grass (*Imperata cylindrica*) and kangaroo grass (*Themeda triandra*) also present. The exotic bitou bush (*Chrysanthemoides monilifera subsp. rotundata*) and lantana (*Lantana camara*) also occur in this community.	
PCT Allocation	VZ 1 was aligned with PCT1646 as it supports a number of the species and stratum specifics identified for the PCT as listed on the VIS Classification Database (OEH 2018c). The canopy is dominated by Sydney red gum/smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis),* both of which are key diagnostic species of PCT1646. Three of the four key diagnostic species listed for the PCT were found in this community. A total of 10 of the 12 diagnostic species (83%) were recorded in this vegetation zone, giving a high level of confidence to this PCT allocation. PCT1646 was determined to be the best overall fit in terms of diagnostic species and the community's location in the landscape.	
BC Act Status	This vegetation community does not conform to a TEC listed under the BC Act.	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Moderate (Tea-tree – Banksia Scrub)*

PCT Name	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
Condition	Moderate (Tea-tree – Banksia Scrub)
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Class	Coastal Dune Dry Sclerophyll Forests
Area in Development Footprint (ha)	15.14
General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. This vegetation community condition class is likely to be derived from the Frontal Dune Blackbutt-Apple Forest that is a dominant community to the north and south of the Referral Area. Historical disturbances from the former use of the Rifle Range have modified this community with groundcovers and shrubs now dominating. This community is likely to have previously conformed to the Frontal Dune Blackbutt-Apple Forest. This community occurs in the central portion of the Referral Area associated with the Rifle Range footprint.
Vegetation Structure Description	This community occurs as a shrubland and is primarily dominated by coastal tea-tree (*Leptospermum laevigatum*) with occurrences of coastal wattle (*Acacia longifolia* subsp. *sophorae*), tree broom-heath (*Monotoca elliptica*) and coast banksia (*Banksia integrifolia*). The native groundcover is largely absent, and when present, consists primarily of pig face (*Carpobrotus glaucescens*) and spiny-headed mat-rush (*Lomandra longifolia*). The exotic bitou bush (*Chrysanthemoides monilifera subsp. rotundata*) and fireweed (*Senecio madagascariensis*) also occur in this community.
PCT Allocation	VZ 2 was aligned with PCT1646 as it occurs adjacent to, or in proximity to, mainly intact vegetation which is consistent with PCT1646. This vegetation zone also contains a number of species which are consistent with this PCT. Considering the disturbed nature of this vegetation zone and the vegetation that occurs adjacent to or nearby this vegetation zone, PCT1646 was considered to be the most appropriate allocation. It is likely this area was once dominated by a more naturally occurring and intact version of PCT1646 prior to historical disturbance.
BC Act Status	This vegetation community does not conform to a TEC listed under the BC Act.
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.

PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast - *Moderate*

PCT Name	PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast
Condition	**Moderate**
Formation	Forested Wetlands
Class	Coastal Swamp Forests
Area in Development Footprint (ha)	0.12
General Description	This vegetation community occurs on a low lying area in the north-west of the Referral Area and is located either side of the Frontal Dune Blackbutt-Apple Forest resulting in ecotonal influences.
Vegetation Structure Description	This community is characterised by an open canopy of swamp mahogany (*Eucalyptus robusta*). Common midstorey species include coastal tea tree (*Leptospermum laevigatum*) and tantoon (*Leptospermum polygalifolium*)), with occasional instances of old man banksia (*Banksia serrata*) and coastal wattle (*Acacia longifolia subsp. sophorae*). The native groundcover is dominated by pomax (*Pomax umbellata*), spiny-headed mat-rush (*Lomandra longifolia*), blue flax-lily (*Dianella caerulea*), kangaroo grass (*Themeda triandra*) and bracken fern (*Pteridium esculentum*). Edge effects are present in this vegetation community due to the number of tracks through this part of the Referral Area. A number of exotic species occur in the ground layer, including whiskey grass (*Andropogon virginicus*), fleabane (*Conyza bonariensis*), and bitou bush (*Chrysanthemoides monilifera subsp. rotundata*).
PCT Allocation	VZ3 was aligned with PCT1725 as it supports some of the species and stratum specifics identified for the PCT as listed on the VIS Classification Database (OEH 2018c). The canopy is dominated by swamp mahogany (*Eucalyptus robusta*), with a mid-storey containing tantoon (*Leptospermum polygalifolium*) both of which are diagnostic species of PCT1725. A total of 5 of the 11 diagnostic species (45%) were recorded in this vegetation zone. PCT1717, PCT1721 and PCT1724 were also considered for this vegetation community but were ruled out due to species composition; namely, a lack of *Casuarina* and *Melaleuca* species present.
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Disturbed (Forest)*

PCT Name	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	
Condition	Disturbed (Forest)	
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Class	Coastal Dune Dry Sclerophyll Forests	
Area in Development Footprint (ha)	1.55	
General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. This vegetation community condition class occurs in a small patch to the south of the Referral Area.	
Vegetation Structure Decsription	This community is a moderately open forest with a shrubby understorey. The canopy is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis*), and a sub-canopy comprised of coastal tea-tree (*Leptospermum laevigatum*) and old man banksia (*Banksia serrata*). The midstorey was dominated by bitou bush (*Chrysanthemoides monilifera subsp. rotundata)* and lantana (*Lantana camara*), with occasional coastal wattle (*Acacia longifolia subsp. sophorae*) and tree broom-heath (*Monotoca elliptica)*. The ground cover consisted primarily of bracken fern (*Pteridium esculentum*) with spiny-headed mat-rush (*Lomandra longifolia*), blue flax lily (*Dianella caerulea*), blady grass (*Imperata cylindrica*) and panic veldtgrass (*Ehrhata erecta*) also present. The exotic asparagus fern (*Asparagus aethiopicus*) was also present in the ground layer.	
PCT Allocation	VZ4 was aligned with PCT1646 as it supports a number of the species and stratum specifics identified in VZ1. The canopy is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis),* both of which are key diagnostic species of PCT1646. Two of the four key diagnostic species listed for the PCT were found in this community. A total of 8 of the 12 diagnostic species (75%) were recorded in this vegetation zone, giving a high level of confidence to this PCT allocation. PCT1646 was determined to be the best overall fit in terms of diagnostic species and the community's location in the landscape.	
BC Act Status	This vegetation community does not conform to a TEC listed under the BC Act.	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Cleared*

PCT Name	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	
Condition	Cleared	
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Class	Coastal Dune Dry Sclerophyll Forests	
Area in Development Footprint (ha)	5.02	
General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. Historical disturbances from the former use of the Rifle Range have modified this community, with large cleared areas occurring amongst scattered shrub and groundcover species. This community occurs in the central and western portions of the Referral Area and extends to the dune margins at the eastern end of the Referral Area.	
Vegetation Structure Description	This community occurs as a highly disturbed shrubland, with sparse vegetation cover occurring across cleared areas. Where vegetation does occur, the dominant species are coastal tea-tree (*Leptospermum laevigatum*) and tantoon (*Leptospermum polygalifolium* subsp. *cismontanum*), with occurrences of coastal wattle (*Acacia longifolia* subsp. *sophorae*) and the exotic bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*). Native groundcover is largely absent, and when present, consists primarily of tussock grass (*Poa labillardierei*) and pig face (*Carpobrotus glaucescens*). Numerous exotic groundcover species occur, particularly on the dune margins, and include red natal grass (*Melinis repens*), quaking grass (*Briza maxima*), fireweed (*Senecio madagascariensis*) and prickly pear (*Opuntia stricta*).	
PCT Allocation	VZ5 was aligned with PCT1646 as it occurs adjacent to, or in proximity to, mainly intact vegetation which is consistent with PCT1646. This vegetation zone also contains a number of species which are consistent with this PCT. Considering the disturbed nature of this vegetation zone and the vegetation that occurs adjacent to or nearby this vegetation zone, PCT1646 was considered to be the most appropriate allocation. It is likely this area was once dominated by a more naturally occurring and intact version of PCT1646 prior to historical disturbance.	
BC Act Status	This vegetation community does not conform to a TEC listed under the BC Act.	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

Ecological field surveys have been carried out in the Referral Area over many years and seasons including in December 2002 (Ecotone 2003), April 2007 (SMEC 2008), October 2015 (Kleinfelder 2015) to inform an assessment of the ecological value of the native vegetation. Throughout these surveys, the following has been undertaken:

- flora surveys including four 20m x 20m quadrats
- diurnal fauna observations including signs of presence surveys and targeted bird surveys
- habitat assessments
- nocturnal spotlighting, call playback and Anabat surveys
- reconnaissance vegetation mapping and weed mapping.

A site inspection was undertaken by Umwelt ecologists on 25 May 2016 in order to complete ground-truthing of previous surveys and identification of any important ecological features. Surveys were undertaken in accordance with the BBAM (2014) (see **Appendix 4**). This included:

- rapid vegetation mapping reconnaissance
- systematic plots/transect surveys
- targeted orchid surveys
- habitat tree survey
- recording dominant weed species and infestations
- habitat assessments for threatened species
- diurnal bird surveys
- spot Assessment Technique (SAT) surveys for koala (*Phascolarctos cinereus*) as per Phillips and Callaghan (1995)
- call playback for masked owl (*Tyto novaehollandiae*), powerful owl (*Ninox strenua*), squirrel glider (*Petaurus norfolcensis*) and koala
- spotlighting searches for nocturnal threatened fauna
- two remote camera survey locations over seven nights targeting ground-dwelling threatened mammal species
- one Anabat survey location over seven nights targeted threatened micro-bat species (set up on 25 May 2016 and collected after seven nights on 1 June 2016)
- opportunistic observations throughout the site inspection.

Targeted orchid surveys were completed by two Umwelt ecologists on 8 September 2016 for sand doubletail (*Diuris arenaria*) and rough doubletail (*Diuris praecox*) within suitable habitat. No individuals were recorded (Umwelt 2018).

To inform the BDAR, Umwelt undertook floristic and vegetation integrity surveys and additional targeted threatened species surveys over the following survey periods:

- 16 August 2018
- 17 August 2018
- 21 September 2018
- 19 December 2018
- 23 January 2019
- 21 February 2019 and
- 22 February 2019.

A total of 14 Biodiversity Assessment Method (BAM) plots were conducted within the Referral Area including 10 BAM Plots within the Development Footprint during the surveys undertaken for this assessment (refer to **Appendix 4**). Threatened species transects, walking transects and opportunistic observations and habitat mapping, call playback (diurnal and nocturnal), tree hollow inspections, Koala SAT surveys and shorebird searches were also conducted. It is noted that the most recent species surveys considered the following survey guidelines:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* – Working Draft (DEC 2004)
- *NSW Guide to Surveying Threatened Plants* (OEH 2016)
- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009)
- *Survey Guidelines for Australia's Threatened Orchids* (DoE 2013a).

Further method details and survey conditions are described in the Biodiversity Development Assessment Report (BDAR) in **Appendix 4**.

3.3 Ecological Value of Native Vegetation

The Department has asked for further information on the ecological value of native vegetation to be removed and retained in the environment of the proposed action as habitat for the koala and GHFF. **Section 3.3.1** provides a breakdown of areas of native vegetation while **Section 3.3.2** and **3.3.3** provide an analysis of the habitat value of the native vegetation in the Referral Area and Development Footprint for the koala and GHFF, respectively.

3.3.1 Area of removed and retained native vegetation

As shown in **Table 3.1** and **Table 3.2**, the majority of vegetation clearance will occur in areas of PCT1646 Moderate Condition (Coastal Tea-tree – Banksia Scrub) (67 per cent of the Development Footprint or 87 per cent of native vegetation to be cleared). The other PCT dominating the Development Footprint is PCT1646 Cleared land (22 per cent of the Development Footprint). Both PCTs occurs principally in the Development Footprint (refer **Figure 3.1**) with only 18 per cent of the Coastal Tea-tree – Banksia Scrub and 29 per cent of PCT1646 Cleared land to be retained in the Referral Area.

Table 3.2 Native Vegetation to be removed and retained

Native Vegetation	Vegetation Zone and Condition	Area of Native Vegetation ((ha) and proportion of total)		
		In Referral Area	To be removed	To be retained
Plant Community Type				
PCT1646 Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	VZ1 Moderate (Forest)	13.38	0.68 (5%)	12.7 (95%)
	VZ4 Disturbed (Forest)	4.07	1.55 (38%)	2.52 (62%)
	VZ2 Moderate (Coastal Tea-tree – Banksia Scrub)	18.54	15.14 (82%)	3.40 (18%)
	VZ5 Cleared	7.02	5.02 (71%)	2 (29%)
PCT1725 Swamp Mahogany – Broad-leaved Paperbark – Swamp Water Fern – Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower Coast	VZ3 Moderate	2.25	0.12 (5%)	2.13 (95%)
Not assigned to Plant Community Type				
Foredune spinifex		1.45	0	1.45
Beach Wetland		3.12	0	3.12
Dune		60.98	0	60.98

Both these PCTs are the result of historical disturbance from the former use of the Rifle Range which modified PCT1646 removing the upper strata and regenerating shrubs now dominate the Coastal Tea-tree – Banksia scrub with bitou bush. The high level of impact of the proposed action on these PCTs is not accidental as the Development Footprint was focused on the previously disturbed lands to avoid and minimise clearance of more intact vegetation formations of PCT1646 and PCT1725 in the north of the Referral Area.

The Development Footprint would clear a small area (0.68 ha or five per cent) of PCT1646 Moderate Condition (Forest) and a large tract of this PCT (12.7 ha or 95 per cent) would be retained in E2 zoned land (refer **Figure 3.1**) with connectivity to the Worimi Conservation Lands to the north of the Referral Area.

The Development Footprint would clear a small area (0.12 ha or five percent) of PCT1725 Moderate Condition and the majority of this PCT (2.13 ha or 95 per cent) would be retained in E2 zoned land (refer **Figure 3.1**) with connectivity to the Worimi Conservation Lands to the north of the Referral Area.

The Development Footprint would clear 1.55 ha or 38 per cent of PCT1646 Disturbed Condition forest along the southern boundary of the Referral Area. The remainder of this PCT (2.52 ha or 62 per cent) would be retained in E2 zoned land (refer **Figure 3.1**) in the south-west corner of the Referral Area with connectivity to vegetation in the Stockton Centre.

3.3.2 Koala Habitat

Koalas naturally inhabit a range of forest, woodland and semi-arid communities dominated by *Eucalyptus* species. Koala habitat can be broadly defined as any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees.

Describing and assessing Koala habitat has relied upon studies completed in the ecology assessment and BDAR (Umwelt 2019), local, state and federal definitions of koala habitat. Consideration of federal definitions has been provided in **Section 4.1**.

At a local level, koala habitat in the Port Stephens LGA has been mapped and defined in the Port Stephens Comprehensive Koala Plan of Management (CKPoM). The CKPoM was prepared in accordance with NSW State Environmental Planning Policy (SEPP) 44 (Koala Habitat Protection) based on vegetation mapping, targeted field investigations and community consultation.

Koala habitat categorisation in the Port Stephens area was undertaken by Lunney *et al.* (1998) identifying the following habitat types:

- preferred koala habitat
- supplementary koala habitat
- marginal koala habitat
- habitat buffers
- habitat linking areas.

Preferred and habitat buffers are given the highest conservation value.

Preferred habitat on the coastal strip of Port Stephens generally occurs in the intact Swamp Sclerophyll Forest community and supplementary habitat includes areas where the Swamp Sclerophyll Forest intergrades with the Smooth-barked Apple Blackbutt Forest vegetation community. Lunney *et al.* (1998) identified approximately 7,366 hectares of preferred habitat, 9,778 hectares of supplementary and 22,781 hectares of marginal koala habitat in the Port Stephens LGA.

The Port Stephens Koala Habitat Planning Map (PSC 2007) maps the Referral Area as 'mainly cleared' with edges of 'supplementary habitat' occurring to the north in association with the Frontal Dune Blackbutt-Apple Forest and the Worimi Conservation Lands (refer to **Figure 3.3**). The koala habitat planning map in the CKPoM does not recognise the presence of native vegetation in the Referral Area (refer to **Figure 3.3**).

The CKPoM has identified and ranked locally koala feed trees based on community information on the occurrence of the koala and field observations including:

- three locally preferred koala feed that define areas of preferred koala habitat:
    - swamp mahogany (*Eucalyptus robusta*) on all substrates
    - Parramatta red gum (*E. parramattensis* subsp *decadens*) on all substrates,
    - Forest red gum (*E. tereticornis*) where occurs on soils derived from quaternary alluvials and volcanics
- trees that may be important for the local population.

The CKPoM also recognises that hybrids of any of these species are likely to be preferred koala food trees (PSC 2002).

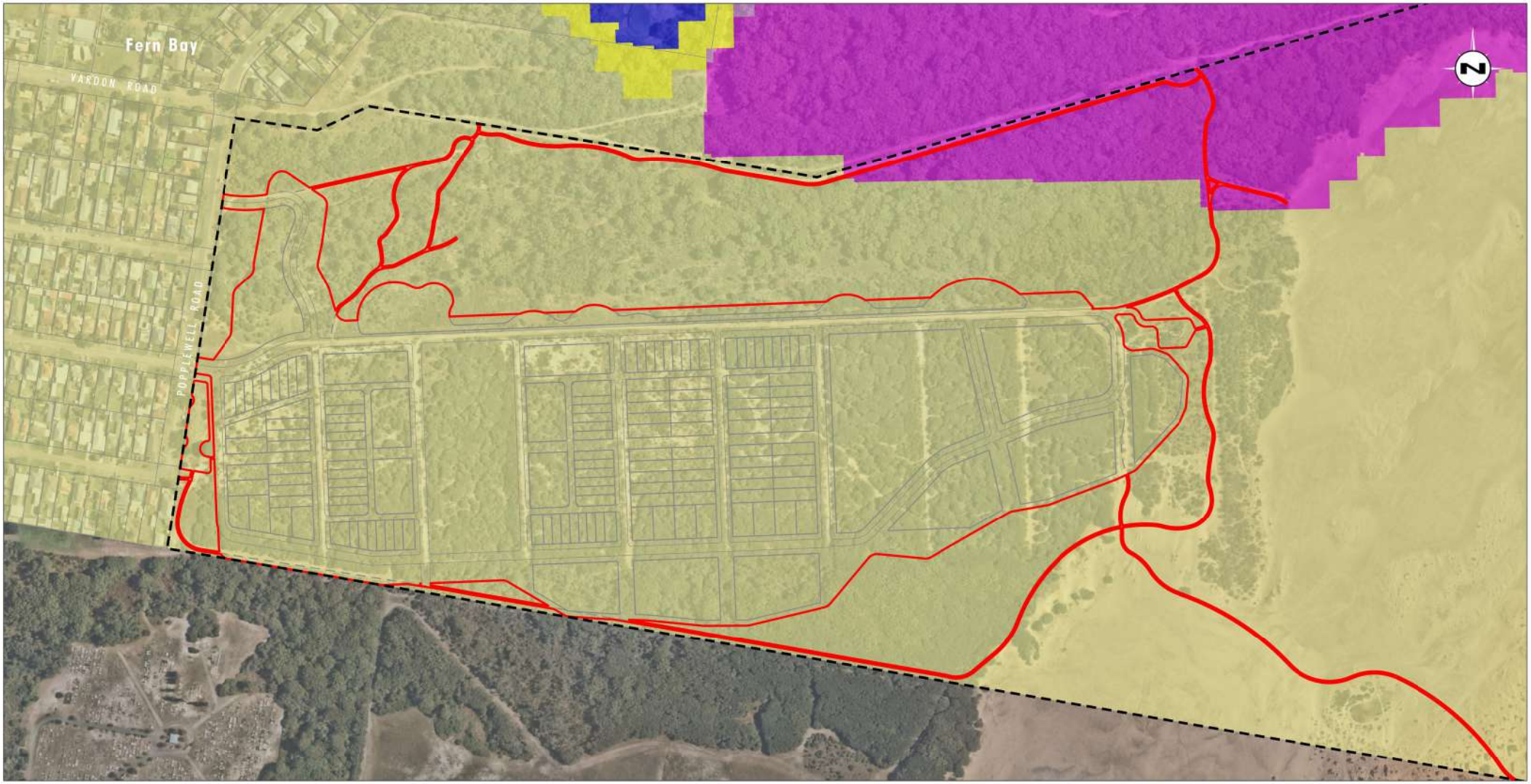

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Architectus (2019), Port Stephens Council (2007)

0 100 200 250m
1:5 000

Legend

- Referral Area
- Development Footprint

Koala Habitat Planning

- Preferred
- Supplementary
- Mainly Cleared
- 50m Buffer over Supplementary
- 50m Buffer over Cleared

FIGURE 3.3

Port Stephens Council
Koala Habitat Planning Map

File Name (A4): R09/3764_071.dgn
20200401 16.34

At a local level, preferred koala habitat is the most important category of koala habitat and includes vegetation associations where *E. robusta* and/or *E. parramattensis* subsp *decadens* are dominant or sub-dominant (preferred food trees constitute between 10 and 35 per cent of the overstorey) components of the understorey on aeolian and swamp landscapes associated with quaternary deposits (Lunney et al 1988).

At a state level, the recently gazetted NSW State Environmental Planning Policy (SEPP) (Koala Habitat Protection) 2019, defines core koala habitat as an area where koalas are present or an area of land assessed as being highly suitable koala habitat where koalas have been recorded as being present in the previous 18 years. The new SEPP has revised the definition of koala habitat from 'potential' as provided in SEPP 44 to '*highly suitable koala habitat'* being where 15 per cent or greater of the total number of trees within any PCT are the regionally relevant koala feed species.

Under the new SEPP (Koala Habitat Protection), 123 tree species known to be used by koalas have been categorised into nine Koala Management Areas in NSW, according to what trees koalas prefer to use in various regions. Port Stephens occurs with the Central Coast Management Area in SEPP (Koala Habitat Protection) 2019.

Table 3.3 provides a list of species that are recognised in the literature as being locally and regionally relevant koala feed trees and identifies the PCT and VZ in which they were recorded in the Referral Area (taken from the BDAR Umwelt 2019).

Table 3.3 Local and Regionally Relevant Koala Feed Trees

Scientific Name	Common Name	CC KMA	Local CKPoM	Occurrence in Referral Area
Allocasuarina littoralis	Black She-oak	✓	-	-
Allocasuarina torulosa	Forest Oak	✓	-	-
Angophora bakeri	Narrow-leaved Apple	✓	-	-
Angophora costata	Smooth-barked Apple	✓	Important	PCT1646 VZ1
Angophora floribunda	Rough-barked Apple	✓	-	-
Casuarina glauca	Swamp Oak	✓	Important	
Corymbia eximia	Yellow Bloodwood	✓	-	-
Corymbia gummifera	Red Bloodwood	✓	Important	-
Corymbia maculata	Spotted Gum	✓	Important	-
Eucalyptus acmenoides	White Mahogany	✓	Important	-
Eucalyptus agglomerata	Blue-leaved Stringybark	✓	-	-
Eucalyptus albens	White Box	✓	-	-
Eucalyptus amplifolia	Cabbage Gum	✓	-	-
Eucalyptus beyeriana	Beyer's Ironbark	✓	-	-
Eucalyptus blakelyi	Blakely's Red Gum	✓	-	-
Eucalyptus bosistoana	Coast Grey Box	✓	-	-
Eucalyptus botryoides	Bangalay	✓	-	-
Eucalyptus camaldulensis	River Red Gum	✓	-	-
Eucalyptus camfieldii	Camfield's Stringybark	✓	-	-

Scientific Name	Common Name	CC KMA	Local CKPoM	Occurrence in Referral Area
Eucalyptus canaliculata	Large-fruited Grey Gum	✓	-	-
Eucalyptus capitellata	Brown Stringybark	✓	Important	-
Eucalyptus carnea	Thick-leaved Mahogany	✓	-	-
Eucalyptus consideniana	Yertchuk	✓	-	-
Eucalyptus crebra	Narrow-leaved Ironbark	✓	Important	-
Eucalyptus cypellocarpa	Monkey Gum	✓	-	-
Eucalyptus deanei	Mountain Blue Gum	✓	-	-
Eucalyptus eugenioides	Narrow-leaved Stringybark	✓	-	-
Eucalyptus fibrosa	Broad-leaved Red Ironbark	✓	-	-
Eucalyptus glaucina	Slaty Red Gum	✓	-	-
Eucalyptus globoidea	White Stringybark	✓	-	-
Eucalyptus grandis	Flooded Gum	✓	Important	-
Eucalyptus haemastoma	Broad-leaved Scribbly Gum	✓	Important	-
Eucalyptus imitans		✓	-	-
Eucalyptus largeana	Craven Grey Box	✓	-	-
Eucalyptus longifolia	Woollybutt	✓	-	-
Eucalyptus macrorhyncha	Red Stringybark	✓	-	-
Eucalyptus melliodora	Yellow Box	✓	-	-
Eucalyptus michaeliana	Brittle Gum	✓	-	-
Eucalyptus microcorys	Tallowwood	✓	Important	-
Eucalyptus moluccana	Grey Box	✓	-	-
Eucalyptus nicholii	Small-leaved Peppermint	-	Important	-
Eucalyptus oblonga	Stringybark	✓	-	-
Eucalyptus paniculata	Grey Ironbark	✓	Important	-
Eucalyptus parramattensis	Parramatta Red Gum	✓	Preferred (including hybrids)	PCT1725
Eucalyptus pilularis	Blackbutt	✓	Important	PCT1646 VZ1
Eucalyptus piperita	Sydney Peppermint	✓	Important	-
Eucalyptus propinqua	Small-fruited Grey Gum	✓	-	-
Eucalyptus punctata	Grey Gum	✓	Important	-
Eucalyptus quadrangulata	White-topped Box	✓	-	-
Eucalyptus racemosa	Narrow-leaved Scribbly Gum	✓	-	-
Eucalyptus resinifera	Red Mahogany	✓	Important	-
Eucalyptus robusta	Swamp Mahogany	✓	Preferred (including hybrids)	PCT1725

Scientific Name	Common Name	CC KMA	Local CKPoM	Occurrence in Referral Area
Eucalyptus saligna	Sydney Blue Gum	✓	Important	-
Eucalyptus scias	Large-fruited Red Mahogany	✓	-	-
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum	✓	-	-
Eucalyptus siderophloia	Grey Ironbark	✓	-	-
Eucalyptus sideroxylon	Mugga Ironbark	✓	-	-
Eucalyptus sieberi	Silvertop Ash	✓	-	-
Eucalyptus signata	Scribbly Gum	✓	Important	-
Eucalyptus sparsifolia	Narrow-leaved Stringybark	✓	-	-
Eucalyptus squamosa	Scaly Bark	✓	-	-
Eucalyptus tereticornis	Forest Red Gum	✓	Preferred (including hybrids)	-
Eucalyptus umbra	Bastard White Mahogany	✓	Important	-
Eucalyptus viminalis	Ribbon Gum	✓	-	-
Melaleuca quinquenervia	Broad-leaved Paperbark	✓	Important	-
Syncarpia glomulifera	Turpentine	✓	-	-

1. Source: Regionally relevant feed trees for the Central Coast (CC) Koala Management Area (KMA) from Appendix 2 SEPP (Koala Habitat Protection) 2019 with local feed trees from the Port Stephens CKPoM (PSC 2002).

Forested areas in moderate condition within the Development Footprint contain swamp mahogany (*Eucalyptus robusta*) a locally preferred koala feed tree and a hybrid of the preferred koala feed trees *Eucalyptus parramattensis* subsp *decadens* and *Eucalytpus robusta*, which is also recognised as a locally preferred koala feed tree for the species (PSC 2002). Both trees are identified as regionally relevant feed trees (**Table 3.3**). Other trees that may be locally important for the koala and regionally relevant feed trees include the blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*) (PSC 2002). Both species occur in PCT1646 moderate (VZ1) and disturbed forest (VZ4).

At a state level, PCT1646 moderate (VZ1) and disturbed forest (VZ4), and PCT1725 (VZ3) have been assessed as *highly suitable koala habitat*.

Importantly, as outlined in correspondence with The Department, dated 21 September 2017 (refer to **Appendix 5** for detailed discussion), Umwelt does not consider the Coastal Tea-tree – Banksia Scrub (PCT1646 VZ2) within the Referral Area to conform to the definition of koala habitat at a local or state level. As shown in **Table 3.3,** the PSC CKPoM does not list coastal tea-tree or *Banksia serrata* or any of the other shrub species recorded in the Referral Area, as a known koala food species in the Port Stephens LGA. Further, the coastal tea-tree and *Banksia serrata* have not been listed as one of the 123 feed species for the koala in NSW in the recently gazetted SEPP (Koala Habitat Protection) 2019. Based on this information, Umwelt does not consider the Coastal Tea-tree – Banksia Scrub within the Referral Area to conform to the definition of locally preferred or supplementary koala habitat or *highly suitable koala habitat* as per the state SEPP.

Under the SEPP (Koala Habitat Protection) 2019, any development application must be consistent with the approved koala plan of management that applies to the land. Accordingly, the definition of koala habitat in the Port Stephens CKPoM has been applied to the Referral Area.

A review of the CKPoM koala habitat planning map was undertaken based on vegetation mapping provided in the BDAR (Umwelt 2019). In accordance with the CKPoM definitions for koala habitat as provided in Lunney *et al.* (1998), the Referral Area supports the following locally described koala habitats:

- PCT1725 (Mahogany-Baloskion Swamp Forest) meets the definition of preferred koala habitat based on dominance of *Eucalyptus robusta*, presence of the hybrid between *E. robusta* and *E. parramattensis* subsp *decadens* and environmental setting
- PCT1624 (Frontal Dune Blackbutt-Apple Forest) moderate (VZ1) and disturbed forest (VZ4) are considered supplementary koala habitat under the PSC CKPoM (refer to **Figure 3.4**).

In summary, the Referral Area supports 19.7 ha of potential koala habitat. Koala habitat has been described as locally preferred koala habitat (2.25 ha) and supplementary koala habitat (17.45 ha). A breakdown of the area of all koala habitat in the Development Footprint and the Referral Area is provided in **Table 3.4.** As shown in **Table 3.4**, the Development Footprint has been focused on areas that do not support koala feed trees being 'other'.

Table 3.4 Koala habitat to be removed and retained

Koala Habitat	Area of Habitat ((ha) and proportion of total)		
	In Referral Area	To be removed	To be retained
Foraging habitat for the koala			
Preferred	2.25	0.12 (5%)	2.13 (95%)
Supplementary	17.45	2.23 (13%)	15.2 (87%)
Potential foraging habitat for the koala:	**19.7**	**2.35 (12%)**	**17.34 (87%)**
Habitat not supporting koala feed trees			
Other (includes Coastal Tea-tree – Banksia Scrub)	23.11	15.15 (66%)	7.95 (34%)
Mainly Cleared (includes dunes)	68	5.15 (8%)	62.98 (92%)
Total	**110.81**	**22.65**	**88.16**

Up to 2.35 ha or 12 per cent of potential koala habitat would be removed by the Development Footprint being 0.12 ha of preferred koala habitat and 2.23 ha of supplementary koala habitat. The majority (95 per cent) of preferred koala habitat and a large percentage of supplementary koala habitat (87 per cent) would be retained in environmental conservation zoned land. 17.34 ha or 88 per cent of the potential koala habitat would be retained in the Referral Area.

Further consideration of the occurrence of the koala in the Referral Area is provided in **Section 3.1.5**.

3.3.3 GHFF Habitat

No evidence of roosting and/or a breeding camp have been identified within the Referral Area during field investigations undertaken in the Referral Area since December 2002.

At dusk GHFFs were observed flying from the south-west towards Fern Bay and Fullerton Cove, over the Development Footprint. It is likely that these individuals have dispersed from nearby nationally important flying-fox camps at Carrington mangroves or from or from Blackbutt Nature Reserve in Newcastle LGA:

- The Carrington camp is about 5 km to the south-west of the Referral Area and is estimated to have less than 500 individuals in August 2019 (National Flying-fox monitoring viewer, 2020).
- The camp in Blackbutt Nature Reserve is about 12 km to the south-west and was estimated to have >2,500 but less than 10,000 individuals in August 2019 (National Flying-fox monitoring viewer, 2020).

In addition to these camps, there is another large nationally important flying-fox camp within foraging range of the GHFF. This camp is located at Raymond Terrace, about 14 km to the north-west of Fern Bay, and in August 2019 was estimated to support >10,000 but less than 16,000 individuals (National Flying-fox monitoring viewer 2020).

The Referral Area supports foraging habitat for the GHFF dispersing from the nearby camps. The draft Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus* (DoEE 2017) identifies that the GHFF feed primarily on blossoms and fruit in canopy vegetation including rainforest species, especially *Ficus* spp and blossoms of myrtaceous species such as *Eucalyptus* spp, *Corymbia* spp, *Angophora* spp*, Melaleuca* spp and *Syzygium* as well as *Banksia* spp.. Foraging behaviour and preference alters in response to flowering season, but it is the winter and spring flowering species that are important to the survival of the GHFF. Important winter and spring flowering species as listed in the draft recovery plan are listed in **Table 3.5**.

In accordance with the *Survey Guidelines for Australia's threatened bats* (DEWHA 2010), the significance of each vegetation community as feeding habitat for GHFF may assessed against the ranking of blossom diet by Eby and Law (2008). Eby and Law (2008) identified species in the blossom diet of GHFF and a sub-set of these were statistically significant food plants for the GHFF. The occurrence of blossom species (Eby and Law 2008) in the Referral Area and whether they are a significant food plant are highlighted in **Table 3.5.**

Table 3.5 Important Foraging Resources for the GHFF

Scientific Name	Common Name	Important Foraging Resources		Occurrence in Referral Area
		Winter and Spring[1]	Blossom Diet[2]	
Castanospermum australe	Black Bean	Yes	Significant food plant	No
Banksia integrifolila	Coast Banksia	Yes	Significant food plant	Yes
Banksia serrata	Old Man Banksia	-	Blossom diet	Yes
Grevillea robusta	Silky Oak	Yes	Significant food plant	No
Angophora costata	Smooth-barked Apple	-	Blossom diet	Yes
Angophora floribunda	Rough-barked Apple	-	Blossom diet	No
Angophora leiocarpa	-	-	Blossom diet	No
Corymbia citriodora citriodora	Lemon-scented Gum	Yes	Significant food plant	No
Corymbia eximia	Yellow Bloodwood	Yes	Blossom diet	No
Corymbia gummifera	Red Bloodwood	-	Significant food plant	No
Corymbia henryi	Large-leaved Bloodwood	-	Blossom diet	No
Corymbia intermedia	Pink Bloodwood	Yes	Significant food plant	No
Corymbia maculata	Spotted Gum	Yes, south of Nowra	Significant food plant	No
Corymbia tessellaris	Carbeen	-	Blossom diet	No
Corymbia trachyphloia	Brown Bloodwood	-	Blossom diet	No

Scientific Name	Common Name	Important Foraging Resources		Occurrence in Referral Area
		Winter and Spring[1]	Blossom Diet[2]	
Corymbia variegata	Northern Spotted Gum	-	Significant food plant	No
Eucalyptus acmenoides	White Mahogany	-	Blossom diet	No
Eucalyptus albens	White Box	Yes	Blossom diet	No
Eucalyptus amplifollia	Cabbage Gum	-	Blossom diet	No
Eucalyptus andrewsii	New England Blackbutt	-	Significant food plant	No
Eucalyptus bancrofti	Orange Gum	-	Blossom diet	No
Eucalyptus botryoides	Southern Mahogany	-	Blossom diet	No
Eucalyptus camaldulensis	River Red Gum	-	Significant food plant	No
Eucalyptus campanulata	New England Blackbutt	-	Blossom diet	No
Eucalyptus crebra	Ironbark	Yes	-	No
Eucalyptus deanei	Mountain Blue Gum	-	Significant food plant	No
Eucalyptus fibrosa	Broad-leaved Ironbark	Yes	Blossom diet	No
Eucalyptus grandis	Flooded Gum	-	Blossom diet	No
Eucalyptus longirostrata	Grey Gum	-	Blossom diet	No
Eucalyptus maidenii	Maiden's Gum	-	Blossom diet	No
Eucalyptus major	Grey Gum	-	Blossom diet	No
Eucalyptus melanophloia	Silver-leaved Ironbark	-	Blossom diet	No
Eucalyptus melliodora	Yellow Box	Yes	Blossom diet	No
Eucalyptus moluccana	Grey Box	-	Significant food plant	No
Eucalyptus muelleriana	Yellow Stringybark	-	Blossom diet	No
Eucalyptus paniculata	Grey Ironbark	Yes	Blossom diet	No
Eucalyptus parramattensis	Parramatta Red Gum	-	Blossom diet	Hybrid?
Eucalyptus pilularis	Blackbutt	Yes	Significant food plant	Yes
Eucalyptus piperita	Sydney Peppermint	-	Blossom diet	No
Eucalyptus planchoniana	Needlebark	-	Blossom diet	No
Eucalyptus propinqua	Small-fruited Grey Gum	-	Blossom diet	No
Eucalyptus punctata	Large-fruited Grey Gum	-	Blossom diet	No
Eucalyptus pyrocarpa	Large-fruited Blackbutt	-	Blossom diet	No
Eucalyptus resinifera	Red Mahogany	-	Blossom diet	No

Scientific Name	Common Name	Important Foraging Resources		Occurrence in Referral Area
		Winter and Spring[1]	Blossom Diet[2]	
Eucalyptus robusta	Swamp Mahogany	Yes	Significant food plant	Yes
Eucalyptus rummeryi	Steel Box	-	Blossom diet	No
Eucalyptus saligna	Sydney Blue Gum	-	Significant food plant	No
Eucalyptus seeana	Narrow-leaved Red Gum	-	Significant food plant	No
Eucalyptus siderophloia	Grey Ironbark	Yes	Significant food plant	No
Eucalyptus sideroxylon	Mugga Ironbark	-	Blossom diet	No
Eucalyptus tereticornis	Forest Red Gum	Yes	Significant food plant	No
Eucalyptus tricarpa	Red Ironbark	-	Blossom diet	No
Lophostemon confertus	Brush Box	-	Blossom diet	No
Melaleuca quinquenervia		Yes	Significant food plant	No
Syncarpia glomulifera	Turpentine	-	Significant food plant	No

1. Species identified as an important winter and spring flowering food source (DoEE 2017)

2. Blossom diet species ranking from Eby and Law (2008). Significant food plants are species with a high (greater than 0.65 score) weighted productivity*reliability score for the habitat.

As shown in **Table 3.5**, the Referral Area supports important winter and spring foraging habitat with winter and spring foraging resources and significant blossom food plants dominating the canopy including:

- PCT1646 moderate condition forest (VZ1) and disturbed forest (VZ4) – *Eucalyptus pilularis*, and
- PCT1725 moderate condition (VZ3) – *Eucalyptus robusta*.

Other blossom diet trees in the Referral Area include *Banksia serrata* and *Angophora costata*. These species also occur in PCT1646 moderate condition VZ1 and PCT1646 disturbed forest VZ4 and may provide foraging resource throughout the year. While not listed in the literature the hybrid of *Eucalyptus parramattensis* subsp *decadens* and *Eucalytpus robusta* is likely also to be a blossom diet tree.

The Coastal Tea-tree – Banksia Scrub within the Referral Area has been subject to ongoing disturbances over the decades, resulting in this community having a relatively young coastal tea-tree-dominated landscape. It supports the important winter and spring foraging species and significant blossom food plant *Banksia integrifolia* however the banksias occur at low densities limiting foraging habitat value of this community. Further the dominant species *Leptospermum laevigatum* and *Acacia* species are not identified as a foraging resource (refer to **Table 3.5**). For this reason, Umwelt does not consider that the Coastal Tea-tree - Banksia Scrub within the Referral Area to be an important winter and spring foraging habitat critical to the survival of the GHFF but nonetheless have recognised that it provides marginal foraging resource.

In summary, important winter and spring foraging habitat in the Referral Area occurs in PCT1646 (VZ1), PCT1646 (VZ4) and PCT1725 moderate condition (VZ3) while PCT1646 (VZ2) is assessed as providing marginal foraging resource due to low occurrence of important foraging trees. A breakdown of the area of foraging resource for the GHFF to be removed within the Development Footprint and retained in the Referral Area is provided in **Table 3.6**.

Table 3.6 Potential GHFF foraging resource to be removed and retained

GHFF Foraging Resource	Area of Habitat ((ha) and proportion of total)		
	In Referral Area	To be removed	To be retained
Important winter and spring foraging habitat	19.7	2.35 (12%)	17.35 (88%)
Marginal foraging resource	18.54	15.14 (82%)	3.4 (18%)
No foraging habitat value	7.02	5.02 (71%)	2 (29%)
Excluded (includes dunes, spinifex and beach wetland)	65.55	0.14 (<1%)	65.41 (99%)
Total	**110.81**	**22.65**	**88.16**

3.4 Maps

Figure 3.4 provides a revised koala habitat planning map for the Referral Area based on a review of the koala habitat categories as provided in the CKPoM. **Figure 3.4** identifies that:

- PCT1725 (Mahogany-Baloskion Swamp Forest) meets the definition of preferred koala habitat based on dominance of *Eucalyptus robusta*
- PCT1624 (Frontal Dune Blackbutt-Apple Forest) Moderate Condition Forest (VZ1) and Disturbed Forest (VZ4) confirm to Category C vegetation and would be considered supplementary koala habitat
- Coastal Tea-tree – Banksia Scrub is defined as other vegetation
- A standard 50 m habitat buffer has been applied to the preferred koala habitat. While not shown in **Figure 3.4**, the habitat buffer has been applied over supplementary koala habitat, over other and over cleared.

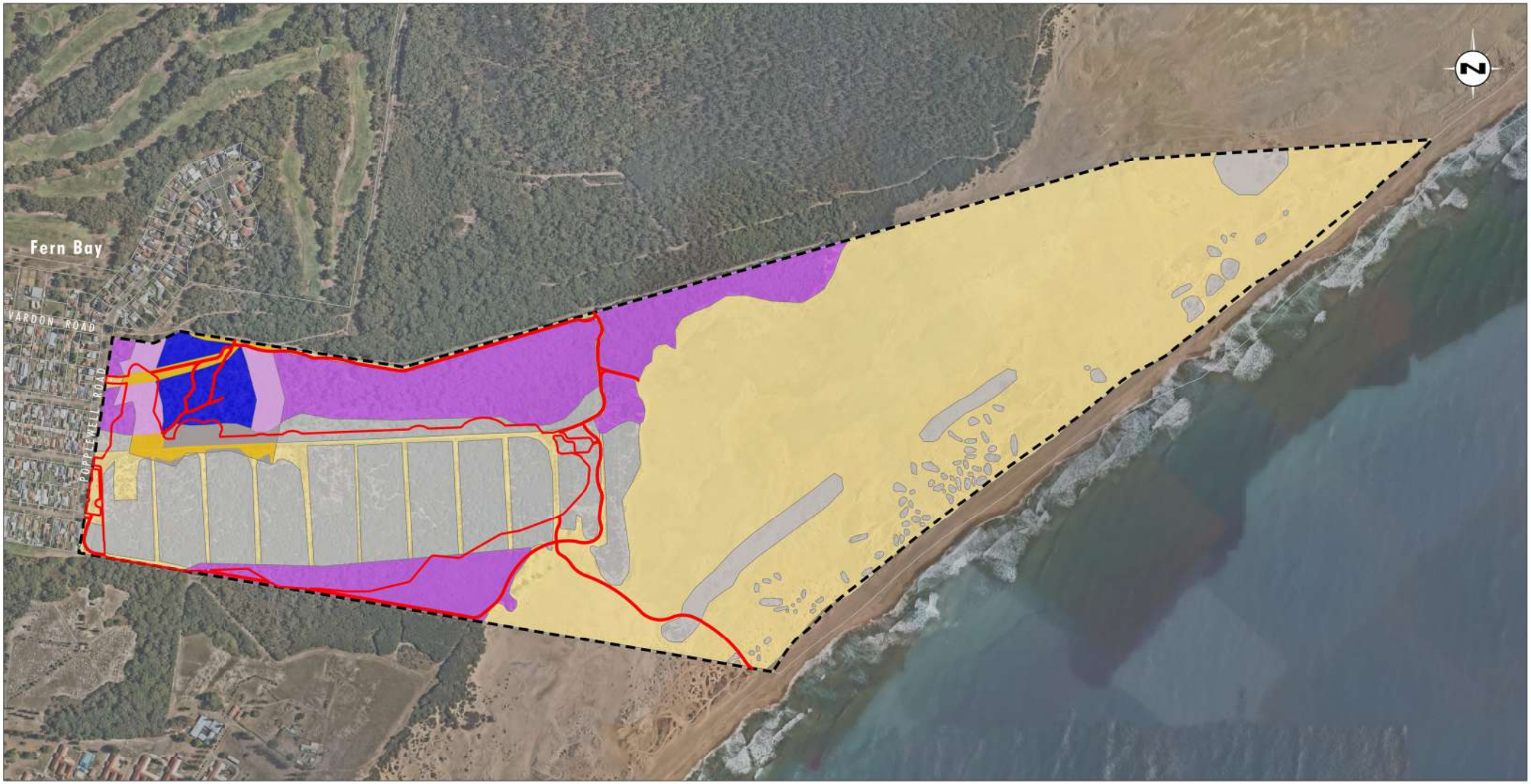

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Atlas (2016)

0 100 250 500m
1:10 000

Legend

- Referral Area
- Development Footprint

Koala Habitat Entities:

- Preferred Koala Habitat
- Supplementary Koala Habitat
- Other Vegetation
- Mainly Cleared
- 50m Buffer over Mainly Cleared (VZ5)
- 50m Buffer over Supplementary Koala Habitat (VZ1)
- 50m Buffer over Other Vegetation (VZ2)

FIGURE 3.4

Koala Habitat in the Study Area
(Mapped by Umwelt)

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20200401 16.38

3.5 Occurrence of the Koala and GHFF

The following discussion provides further information on the occurrence of the koala and GHFF in the Referral Area and Development Footprint based on desktop review of records, surveys completed on site and further analysis of the suitability of habitat building on from discussions of the ecological value of habitat in **Section 3.3**.

3.5.1 Koala

As discussed in **Section 3.3.2** and shown in **Figure 3.4**, the Referral Area supports preferred koala habitat and supplementary koala habitat as defined by the local CKPoM.

Targeted and opportunistic surveys for the species were undertaken across the Referral Area in May 2016, August 2018, September 2018, December 2018, January2019 and February 2019.

Surveys for the koala Referral Area as part of the BDAR considered the following survey guidelines:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* – Working Draft (DEC 2004)
- *Survey Guidelines for Australia's Threatened mammals* (DSEWPC 2011).

Table 3.7 identifies the specific dates and methods targeting the koala.

Table 3.7 Species credit species survey methodology and timing

Survey Date	Method
25 May 2016	Koala SAT surveys Call playback for koala Spotlighting searches Two remote camera survey locations over seven nights Opportunistic observations throughout the site inspection
16 August 2018 – 19 December 2018	Remote cameras targeting threatened terrestrial and arboreal mammals (left onsite until December 2018)
21 September 2018	Opportunistic observations and habitat assessments
19 December 2018	Nocturnal call playback and spotlighting
21 – 22 February 2019	Nocturnal call playback Koala SAT surveys

The koala has not been recorded within the Referral Area during any of these surveys.

To further assess whether the koala habitat in the Development Footprint and the Referral Area supports core koala habitat, Umwelt has used the recently revised definition for core koala habitat as provide in SEPP (Koala Habitat Protection) 2019, where *core koala habitat means:*

- *an area of land where koalas are present, or*
- *an area of land*
    - *which has been assessed by a suitably qualified and experienced person in accordance with the Guideline as being highly suitable koala habitat*
    - *where koalas have been recorded as being present in the previous 18 years.*

The koala has not been recorded within the Referral Area during any of these surveys. A review of the NSW wildlife database did not identify any koala records within the Referral Area. Accordingly, the Referral Area does not meet the definition of core koala habitat being an area of land where koalas are present.

A review of database records was undertaken to identify whether the highly suitable koala habitat in the north of the Referral Area and in the large tract of suitable habitat to the north of the Referral Area support a koala population of koalas, particularly whether the habitats have supported generations of the koala over the last 18 years, that is from 2001 to 2019.

There are about 21 records of the koala within 10 km of the Referral Area. Within about five kilometres of the Development Footprint there are about 16 koala records, being:

- The closest record of the koala is about 300 m to the west of the Development Footprint from 2001.
- Within 1500 m there are four records including a roadkill on Nelson Bay Road. All of these records are to the north of the Referral Area from 1980 to 2001.
- There are two recent records (2015) of the koala in habitat in the north of Seaside Fern Bay estate including a roadkill on Nelson Bay Road where the fire trail from the residential estate intersects with Nelson Bay Road. The third record from this estate is from 1969.
- There is a cluster of eight records of the koala about three kilometres to the north of the Referral Area near Coxs Lane, Fullerton Cove. This area of the coastal dune forest includes large stands of Swamp Mahogany – Broad-leaved Paperbark Forest either side of Nelson Bay Road. The records in this cluster range from 1991 to 2018 including two road kills (1989 and 1991), road injury in 2014 and six records that would indicate occurrence in the last 18 years.
- There are no records to the south of the Referral Area.

The above analysis indicates that habitats north of and including remnant vegetation in Seaside Fern Bay, support core koala habitat with a number of records of the koala within the last 18 years, that is 2001 to 2019.

In summary, koalas within the Port Stephens LGA comprise an important population for the species. The Referral Area supports 19.7 ha of koala habitat with 2.25 ha of preferred koala habitat and 17.45 ha of supplementary koala habitat (refer to **Figure 3.4** and **Table 3.4**), contiguous with habitats in coastal forest along Stockton Bight/Newcastle Bight. Core habitat for the koala does occur to the north of Seaside Fern Bay residential area as evident by occurrence of koala records suggesting generational persistence of koalas. However, the Referral Area is unlikely to be core koala habitat given absence of evidence of a resident population, and/or absence of evidence of generational persistence in the Referral Area and immediate environs.

3.5.2 Grey-headed flying fox

The GHFF is listed as Vulnerable under the EPBC Act and BC Act. It is a species that historically occupied forests and woodlands in the coastal lowlands, tablelands and slopes of south-eastern Australia stretching from Bundaberg in Queensland to Geelong in Victoria (DoEE 2017). Recently however, camps of the species have been recorded in South Australia and the Australian Capital Territory as well as inland areas of central and southern New South Wales and Victoria.

The primary threat to the survival of this species is the loss and degradation of foraging and roosting habitat (DoEE 2017). The species feeds primarily on blossoms and fruit in canopy vegetation that is supplemented with leaves (DoEE 2017). Major food plants include the fruit and blossom of rainforest species as well as the blossoms of myrtaceous species such as *Eucalyptus* spp., *Corymbia* spp.*, Angophora* spp., *Melaleuca* spp. and the Proteaceae genus *Banksia* spp. (Eby and Law 2008).

The feeding behaviour of the GHFF changes based on the availability of native food sources (DoEE 2017). They will often forage across distances less than 20 km however are known to travel as far as 40 km to feed before returning to their roost site in the same night (DoEE 2017). Larger distances are likely to be travelled when food sources are scarce.

The species roosts in large aggregations, known as camps, in the exposed branches of trees. The camps provide resting habitat, social interactions and refuge for animals during signification phases of their annual cycle including birth, lactation and conception (DoEE 2017). They are typically stable through time and several sites have been documented as exceeding 100 years of use (Lunney and Moon 1998).

The draft recovery plan for the grey-headed flying fox described habitat critical to the survival of the species as being continuous time-based rotation of productive foraging habitats, that are linked by migration corridors or interim resting habitats as well as suitable roosting habitat within nightly commuting distance from foraging habitat (DoEE 2017). Important winter and spring vegetative components for the species are listed in **Table 3.5**.

The Referral Area supports a number of the abovementioned species however they are not the dominant components of the communities within the Development Footprint, that is PCT1646 Moderate Condition Tea tree – Banksia scrub and PCT1646 Cleared. The most suitable foraging habitat for the GHFF occurs along the northern boundary of the Referral Area, of which only nominal areas are being impacted by the proposed action (refer to **Table 3.6**).

Survey for the grey-headed flying fox undertaken in Referral Area considered the following survey guidelines:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* – Working Draft (DEC 2004)
- *Survey Guidelines for Australia's threatened bats* (DEWHA 2010).

Targeted and opportunistic surveys for the species were undertaken across the Referral Area in May 2016, August 2018, September 2018, December 2018, January 2019 and February 2019. **Table 3.8** identifies the specific dates and methods targeting the GHFF in the Referral Area.

Table 3.8 Species credit species survey methodology and timing

Survey Date	Method
25 May 2016	Habitat assessments for threatened species Spotlighting searches for nocturnal threatened fauna Opportunistic observations throughout the site inspection.
16 - 17 August 2018	BAM floristic surveys and vegetation integrity data collection Opportunistic observations and habitat mapping
12 September 2018	Opportunistic observations and habitat assessments
21 September 2018	BAM floristic surveys and vegetation integrity data collection Opportunistic observations and habitat mapping
21 September 2018	Opportunistic observations and habitat assessments
19 December 2018	BAM floristic surveys and vegetation integrity data collection Nocturnal call playback and spotlighting
23 January 2019	Nocturnal searches
21 – 22 February 2019	Nocturnal searches

The species has been recorded within the Referral Area, up to five individuals were observed foraging in the forested habitat in 2007, and individuals were recorded flying overhead during surveys in 2018 and 2019. There are 20 records of the species within 10 km of the Referral Area. No camps have been recorded in the Referral Area, either historically or currently. The closest active camp, likely to be the source for GHFF observed within the Referral Area, is located about 5 km in Carrington to the south-west of the Referral Area.

In summary, the Referral Area does not support a breeding population but does provide foraging resources for the GHFF dispersing from nationally important flying-fox camps in suburban Newcastle and in Raymond Terrace. The blackbutt and swamp mahogany in PCT1646 and PCT1725 provide an important winter and spring foraging resource. The habitat value of PCT1646 Tea tree – Banksia Scrub has been assessed as marginal as the dominant coastal shrub species are not a foraging resource and while *Banksia integrifolia* occurs in this community it occurs in low numbers.

4.0 Relevant Impacts

4.1 Listed Threatened Species

As outlined in **Section 3.0**, two listed threatened species have been identified as potentially occurring within the Referral Area: koala and GHFF. This chapter provides a discussion and assessment of potential impacts to these species as a result of the proposed action, with consideration to the Significant Impact Guidelines 1.1 for Matters of National Environmental Significance (SIG 1.1) (DoE, 2013) and other relevant guidelines.

4.1.1 Koala

The EPBC Act Referral Guidelines state that actions are likely to have a significant impact on the koala if they adversely affect habitat critical to the survival of the koala.

To inform assessment of likelihood of occurrence and the impact assessment, an assessment of whether the habitat in the Referral Area is critical to the survival of the koala was undertaken based on the Koala Habitat Assessment in the Referral Guidelines (DoE 2014) (**Table 4.1**).

Table 4.1 Koala Habitat Assessment Tool, EPBC Act Referral Guidelines

Koala Habitat Assessment Tool (Table 4 from DoE 2014)			Referral Area Assessment	
Attribute	**Score**	**Coastal**	**Allocated Score**	**Score Justification**
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 2 years.	**1**	**Desktop:** • EPBC PMST report identified the koala or koala habitat as 'known to occur' in the Referral Area. • Atlas of NSW Wildlife point buffer search identified 0 koala records within the Referral Area. In the last five years there have been five records within 5 km to the north of the Referral Area. **On-ground:** • The koala has not been recorded on the site. • This species has been recorded in habitats to the north of the Referral Area in Seaside Fern Bay, the Golf Course and the Worimi Regional Park.
	+1 (medium)	Evidence of one or more koalas within 5 km of the edge of the impact area within the last 5 years.		
	0 (low)	None of the above.		
Vegetation composition	+2 (high)	Has forest or woodland with 2 or more known koala food tree species in the canopy. **OR**	**2**	**Desktop:** The Port Stephens Council CKPoM maps the site as mainly cleared. **On-ground:** PCT 1725 supports the locally preferred koala feed tree

Koala Habitat Assessment Tool (Table 4 from DoE 2014)			Referral Area Assessment	
Attribute	**Score**	**Coastal**	**Allocated Score**	**Score Justification**
		1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.		swamp mahogany (*Eucalyptus robusta*). While not confirmed it is likely that the Earp's gum hybrid (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*) would also be a koala feed tree. Other trees that may be important for the local koala population include smooth-barked apple (*Angophora costata*) and blackbut (*Eucalyptus pilularis*) (PSC 2002). Both of these species occur in PCT1646.
	+1 (medium)	Has forest or woodland with only 1 species of known koala food tree present in the canopy.		
	0 (low)	None of the above.		
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 500 ha.	**2**	The Referral Area occurs at the southern end of a large tract of contiguous habitat in the Worimi Regional Park and Worimi Conservation Lands, extending along the Stockton Bight to Anna Bay in the north. The landscape to the south and east is fragmented and developed land.
	+1 (medium)	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.		
	0 (low)	None of the above.		
Key existing threats	+2 (low)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.	**1**	**Desktop:** A desktop search has identified evidence of infrequent koala mortality from vehicle strike including records in 1989, 1991 and 2015 along Nelson Bay Road between the Bayside Village and Coxs Lane overpass. **On-ground:** It is expected that the local koala population is adversely affected by vehicle strike associated with Nelson Bay Road and by dogs from the local residential area.
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.		
	0 (high)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the Referral Area at present, or Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.		
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	**0**	**Desktop:** Table 1 of the Referral Guidelines (DoE 2014) prescribes, that for coastal areas, the interim recovery objective(s) are to:

Koala Habitat Assessment Tool (Table 4 from DoE 2014)			Referral Area Assessment	
Attribute	**Score**	**Coastal**	**Allocated Score**	**Score Justification**

	+1 (medium)	Uncertainty exists as to whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		• Protect and conserve large, connected areas of koala habitat, particularly large, connected areas that support koalas that are:
				  • of sufficient size to be genetically robust/operate as a viable sub-population OR
				  • free of disease or have a low incidence of disease OR
				  • breeding.
				• Maintain corridors and connective habitat that allow movement of koalas between large areas of habitat."
				Despite the small size of the koala habitat within the Referral Area, contiguous habitats to the north are likely to be important for the local koala population. However large parts of the habitat in the Development Footprint are not likely to be important to the survival of the koala.
				On-ground: Minimal clearing of preferred koala habitat is proposed. Disturbance of buffer and supplementary habitat will not result in fragmentation of retained habitats and is not likely to influence the recovery objectives.

	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		
TOTAL SCORE			**6**	**≥ 5 indicates habitat critical for the survival of the koala.**

As the assessment of koala habitats resulted in a score greater than five (refer to **Table 4.1**), the Referral Area is considered to contain habitat critical to the survival of the species (DoE 2014). This habitat is associated with PCT1725 and PCT1624 moderate condition forest and disturbed forest.

4.1.1.1 Nature and Extent of Impact

Desktop and field investigations have identified that the koala population in the Port Stephens LGA is an important population. While there has been no confirmed presence of koala within the Referral Area there is 19.7 ha of foraging habitat for the koala in the Referral Area. The Referral Area mainly consists of supplementary koala habitat (17.45 ha) with 2.25 ha of preferred koala habitat in the north-west of the Referral Area. There is no evidence that the Referral Area supports breeding habitat for the species.

The proposed action has been sited to avoid and minimise impact on koala habitat. However, the proposed action would clear 2.35 ha of koala habitat in the Development Footprint with 17.35 ha or 88 per cent of koala habitat to be retained in the Referral Area. Further actions would be employed to minimise direct and indirect impacts on koala habitat including:

- Where possible, koala feed trees will be selectively retained within the Development Footprint.
- A plan of management, based on the Port Stephens CKPoM, would be adopted to minimise impacts during construction and operation. Operational management measures would include offset planting of koala feed trees, traffic management, domestic dog management and measures to reduce risk of drowning in swimming pool.

The EPBC Act referral guidelines for the koala provides guidance on assessing adverse effects on critical habitat identifying that the loss of 20 hectares or more of high-quality habitat critical to the survival of the koala, that is habitat with a score of ≥ 8 is highly likely to have a significant impact for the purposes of the EPBC Act (DoE, 2014). While the proposed action would clear 22.65 ha only 2.35 ha of this has been defined as habitat for the koala as the majority of the Development Footprint does not support known koala feed trees and the habitat score is less than 8. This is not applicable for the proposed action.

The loss of between 2 and 20 ha of habitat critical to the survival may have a significant impact on the koala for the purposes of the EPBC Act. Whether this is more likely or unlikely depends on the characteristics of the action. An assessment of the significance of the impact of the proposed action on the koala is provided in **Table 4.2**.

Table 4.2 Assessment of significance for koala

Criteria	Response
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of an important population of a species	Extensive foraging and breeding habitat for koala occurs to the north of the Referral Area and is likely to support core habitat for an important population. However, based on lack of evidence of occupation and historical data it is unlikely that this important population extends to the Referral Area. Targeted surveys for the species were completed in 2016 and again in 2018, no evidence (scats, scratches, etc) of koala occupation was recorded in the Referral Area. Database records indicate that there is unlikely to be generational persistence of koala within the Referral Area. We consider that 2.35 hectares of suitable foraging habitat for the koala occurs in the Development Footprint, however we do not consider the Referral Area to support breeding habitat for the species. Thus, the important population is not considered to be present within the Referral Area. Based on this, it is unlikely that the proposed action will lead to a long-term decrease in the size of an important population of the koala.
reduce the area of occupancy of an important population	Extensive foraging and breeding habitat for koala occurs to the north of the Referral Area and is likely to support an important population. The proposed action will remove 2.35 ha of suitable foraging habitat including 0.12 ha of preferred koala habitat and 2.23 ha of supplementary koala habitat. 17.34 ha of koala habitat would be retained within the Referral Area in E2 zoned land.

Criteria	Response
fragment an existing important population into two or more populations	Extensive foraging and breeding habitat for koala occurs to the north of the Referral Area. The Referral Area occurs at the southern end of a large tract of koala habitat extending along the coastal dune forest of Stockton Bight through to the coastal sand plain forest of Tomago and Tilligerry. Habitat to the south of the Referral Area has been cleared and developed with a small remnant immediately to the south of the Referral Area. There are no records of the koala in this area. As habitat to the south of the Referral Area is already fragmented and/or isolated, the proposed action is unlikely to fragment an existing important population into two or more populations.
adversely affect habitat critical to the survival of a species	Targeted surveys for the species were completed in 2016 and again in 2018, no evidence (scats, scratches, etc) of koala occupation was recorded in the Referral Area. The Referral Area supports habitat critical to the survival of the local population primarily in the north of the site in areas identified as preferred and supplementary koala habitat. The Development Footprint is focused on an area of the site that does not support koala feed trees and would not be considered critical to the survival of the species. About 88 per cent of koala habitat in the Referral Area would not be disturbed directly by the action and would be managed to improve or maintain habitat values. The proposed action will not adversely affect habitat critical to the survival of the koala.
disrupt the breeding cycle of an important population	An important population is not considered to occur the Referral Area. Furthermore, targeted surveys for the species were completed in 2016 and again in 2018, no evidence (scats, scratches, etc) of koala occupation was recorded in the Referral Area. We consider that 2.35 hectares of suitable foraging habitat for the koala occurs in the Development Footprint, however we do not consider the Referral Area to support breeding habitat for the species. Thus, we do not consider that the proposed action will disrupt the breeding cycle of an important population.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed action has been sited to remove an area that does not support preferred koala feed trees. However, up to 2.35 hectares of suitable foraging habitat for the koala does occur in the Development Footprint. Up to 17.34 ha of suitable foraging habitat would be retained in the Referral Area and importantly this area is zoned E2 and is contiguous with the Worimi Conservation Lands. The proposed action will not modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed action is not considered likely to increase occurrence of invasive species.
introduce disease that may cause the species to decline	The proposed action is not considered likely to introduce disease that may cause the koala to decline.
interfere substantially with the recovery of the species	The proposed action would conserve a large area of koala foraging habitat connected to Worimi Conservation Lands. The proposed action is unlikely to interfere substantially with the recovery of the koala.

Criteria	Response
Conclusion	
While it is acknowledged that the proposed action will remove some foraging habitat for koala (2.35ha), this is not considered to be a significant impact to the species, as the Referral Area does not support breeding habitat and about 88 per cent of koala habitat within the Referral Area would be retained in the E2 zoned land. Further, there is also substantial and more preferable habitat located in the north of the Referral Area and to the north of the proposed action. Through the tree felling procedure proposed and other additional mitigation and management measures (see **Section 5.0**), no significant impact to the species is expected.	

4.1.2 Grey-headed Flying-fox

Nature and Extent of Impact

According to the Ecological Assessment undertaken by Umwelt (2018), GHFF have been recorded within the Referral Area, with up to five individuals observed foraging in the forested habitats in April 2007.

No camps have been recorded in the Referral Area, either historically or currently. The closest active camp is located approximated 5 km to the southwest of the Referral Area near Carrington, NSW. There is an additional camp in Blackbutt Reserve, approximately 12 km north east of the Referral Area. Both camps are recorded on the National Flying-fox monitoring viewer (accessed 2020).

It is likely that the species utilises the Referral Area as foraging habitat. The Referral Area supports a number of the winter and spring foraging vegetative species as identified in the draft recovery plan grey-headed flying fox (DoEE, 2017). We note that the draft recovery plan for the GHFF recognised loss of foraging habitat as the primary threat to the species and clearing of winter forage is of particular concern (DoEE, 2017). Specifically, those species that occur within the Referral Area are identified below:

- Blackbutt (*Eucalyptus pilularis*)
- Swamp mahogany (*E. robusta*)
- Coast banksia (*Banksia integrifolia*).

Vegetation within the Development Footprint while supporting one blossom foraging species (coast banksia) it is not considered to provide *important* foraging habitat for the species due to its low quality, dominance of coastal shrubs not recognised as foraging resource, low density of *Banksia integrifolia* and disturbed nature.

We consider an abundance of foraging habitat is available to the species within a 20 km radius of each of the Newcastle suburban camps, including habitat that would be considered to be of high quality based on the proportion of winter and spring foraging species present and the size of the patches of vegetation. This includes Glenrock State Conservation Area, habitat to the west of Newcastle, the Tomago sandbeds, Tilligerry State Conservation Area, the Worimi Conservation Lands which extends directly to the north of the Referral Area, providing connected foraging habitat through to Anna Bay (approximately 38 km north east).

Nonetheless, it is noted that within the Referral Area there is approximately 19.7 ha of habitat that supports blackbutt and swamp mahogany and would be an important winter and spring foraging resource. These habitats occur along the northern and southern boundaries.

In summary, 2.35 ha of important foraging habitat for GHFF will be removed as part of the proposed action with 17.35 ha to be retained in the Referral Area in E2 zoned land. An assessment of significance for the species is provided in **Table 4.3** below.

Table 4.3 Assessment of significance for GHFF

Criteria	Response
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of an important population of a species	The Referral Area is unlikely to be depended on by local GHFF colonies. Although the proposed action will result in the removal of a small area of foraging habitat for the species, this habitat is considered to be marginal in quality. Noting the abundance of foraging and breeding habitat to the north of the Referral Area and in the broader surroundings, it is considered unlikely that the proposed action would lead to a long-term decrease in the size of an important population of GHFF.
reduce the area of occupancy of an important population	The proposed action will result in a reduction of foraging habitat for GHFF. Due to the small area of impact, retention of forested vegetation and existing fragmentation within the Referral Area (due to previous disturbance and the subsequent quality of habitat), the proposed action is unlikely to reduce the area of occupancy of an important population of GHFF.
fragment an existing important population into two or more populations	GHFF is highly dispersive and it is unlikely that the proposed action would create a significant change to the species' dispersal capacity or create a significant barrier to their movement. It is unlikely that the proposed rezoning would result in the fragmentation of an importation population of GHFF.
adversely affect habitat critical to the survival of a species	The proposed action will result in the removal of 2.35 ha of important winter and spring foraging habitat for GHFF. However, the Referral Area is unlikely to contain significant breeding and roosting habitat for the species. In light of the small area proposed for removal, and the preservation of important winter and spring foraging habitat to the north of the Referral Area, it is considered unlikely that the proposed action would have a significant impact on the foraging resources of the species.
disrupt the breeding cycle of an important population	No GHFF breeding populations or camps have been identified in the Referral Area. The proposed action is not expected to disrupt the breeding cycle of an important population of this species.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	There is no high-quality breeding or roosting habitat available within the Referral Area. It is considered unlikely that the proposed action would modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the GHFF would decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	There are not any invasive species that are likely to become established as a result of the proposed action that would impact upon any habitat relevant for GHFF. The threat of weed invasion would be managed during the construction and post-construction phases of the proposed action. Refer to **Section 5.0**.
introduce disease that may cause the species to decline	No diseases that may cause GHFF to decline are likely to be introduced as a result of the proposed action.

Criteria	Response
interfere substantially with the recovery of the species	It is acknowledged that the proposed action would contravene the objectives of the Draft Recovery Plan for GHFF (DECCW 2009). However, as outlined in **Section 6.0**, the proposed action seeks to provide compensatory measures for the loss of foraging habitat for the species. In light of this compensatory measure, in addition to the management measures outlined in **Section 5.0**, it is considered unlikely that the proposed action would substantially interfere with the recovery of the species.
Conclusion	
The proposed action includes a number of mitigation and management measures, as well as compensatory measures, that are further discussed in **Section 5.0** and **Section 6.0** respectively. Subject to the implementation of these measures, it is considered unlikely that the proposed action would have a significant impact on GHFF.	

4.2 The Environment as a result of a Commonwealth Action

The Referral provided an impact assessment in accordance with the Significant Impact Guidelines 1.2 for the proposed action. The original Referral document is attached in **Appendix 1.** The following section provides additional analysis, responding to questions raised by the Department in its determination for the action to be assessed against Preliminary Documentation.

4.2.1 Impacts on Landscapes and Soils

A geotechnical investigation was prepared by Douglas Partners (2016) (DP) for the proposed action. This report is attached in **Appendix 6**.

The proposed action will involve the clearing and levelling of approximately 22 ha within the Development Footprint. The majority of the Referral Area will be preserved for conservation. The coastal ridgeline to the east of the proposed action area will also be maintained.

The proposed action is likely to involve up to approximately 130,000 tonnes of excavated soil. This is considered to be medium to large scale excavation. However, it is noted that this anticipated excavation amount reflects the large area of the site, as opposed to the depth of excavation. A maximum depth of two metres excavation is expected for the proposed action. As noted in the Referral, deep earthworks will be minimised through construction of raised buildings, rather than using slab designs.

As noted within the Referral, sedimentation and erosion controls will be implemented during construction as part of the Construction Environmental Management Plan (CEMP).

Table 4.4 provides responses to questions raised by the Department in relation to impacts on landscapes and soils within the Preliminary Documentation guidance document.

Table 4.4 Responses to Information requests by the Department

Information Request	Response
What soils or other substrates are present?	According to the DP report, NSW Coalfield 1:100,000 geology map indicates that the proposed action area is located in Quaternary coastal sand. This was confirmed during geotechnical investigations of the proposed action area.
What is the soil type/structure?	Conditions encountered during the geotechnical investigations of the proposed action area included medium dense or dense sand to full depth of investigation. The depth of penetration for the investigation ranged from 2.7 m to 3.45 m.
Are any other substrates present? e.g., sand, gravel and rock.	Subsurface conditions predominantly consist of sand. It was noted within the geotechnical investigation that there was evidence of fill, particularly along the northern boundary and western entrance of the proposed action area. This consists of gravel and small amounts of concrete. These are largely attributed to the former access road along the northern boundary and will require removal prior to construction. The presence of this fill is not expected to be greater than 2 m in depth. Additional geotechnical investigations will be undertaken prior to construction, as is standard practice.
Is it likely that the soil/substrate will be directly or indirectly impacted by the action, and if so, to what extent?	The sand soil/substrate will be directly impacted by the proposed action to the extent that excavation will occur. The geotechnical investigation concludes that there are no obvious signs of deep-seated instability, and that it is considered suitable for development. Management measures will be incorporated into the detailed design of the proposed action, including batter slops and provision of vegetation to minimise potential erosion.
Is the soil/substrate valuable, or does it contain objects that are rare or otherwise valuable, e.g., archaeological items with heritage value?	Potentially. This is further discussed in **Section 4.2.5**.
Is the soil susceptible to impacts or will disturbance of the soil cause further impacts?	The soil within the proposed action area is susceptible to impacts and disturbance to the extent that construction occurs. While it is noted that sand soil is susceptible to erosion, this will be sufficiently managed through construction and design of the proposed action.
Are there steep slopes?	The proposed action area consists of a flat terrain, having an elevation of approximately 8 m. A slight rise in the topography exists towards the eastern and southern boundaries. A coastal ridgeline exists at the eastern boundary of the proposed action area, having an elevation of approximately 15 m. This ridgeline will be maintained. Only minor levelling within the proposed action area is anticipated to be required for the proposed action.
Is there evidence of previous erosion?	Historical photography analysis within the geotechnical investigation report does not highlight any previous erosion. It is possible that sand mining activities have occurred at the site, noting the stockpiling within the centre of the site in 2009. However, other than the construction and demolition of some small buildings and vegetation clearing and growth, the site has remained relatively unchanged.

Information Request	Response
Is the soil/substrate friable (easily eroded)?	It is noted that sand is highly susceptible to erosion. As such, appropriate measures will need to be incorporated into the design of the proposed action. This includes appropriate batters, formed at suitable angles and appropriately protected, such as with the provision of vegetation. Retaining walls will also need to be constructed in accordance with the parameters outlined within the geotechnical investigation. These design features and parameters will be incorporated into the detailed design of the proposed action.
Are acid sulphate soils present?	The results of the screening tests undertaken for the geotechnical investigation indicate an absence of acid sulfate soil. A Chance Discovery Protocol for contamination, including acid sulfate soil, will be incorporated into the CEMP.

Having consideration for the findings of the geotechnical investigations, and the commitment by the proponent to incorporate appropriate erosion control measures both during construction and as part of the detailed design, the proposed action is considered unlikely to have a significant impact on landscapes and soil.

4.2.2 Impacts on Water Resources

The Referral (**Appendix 1**) found that it was unlikely that the proposed action would have a significant impact on water resources. The Department requested the following in its determination for the proposed action to be assessed on Preliminary Documentation:

Due to the uncertainty of post construction impacts on water resources, please provide a summary of the final Stormwater Management Plan with key outcomes from the MUSIC Model, which reveals the estimated quality of effluent (stormwater) that may or may not be discharged to the Hunter River.

A Stormwater Management Plan was prepared by ADW Johnson Pty Limited (2018) for the Planning Proposal for the proposed action area. The management plan addresses both stormwater quantity and quality, as well as providing MUSIC modelling to simulate pollutant source elements for the proposed development. This report is attached in Attachment E of **Appendix 3**.

4.2.2.1 Stormwater Drainage - Quantity

As noted in the Referral, there are no rivers, creeks or drainage channels located within the Referral Area. However, the Stormwater Management Plan notes that drainage is discharged to the north and north-east of proposed action area. The site is also underlain by an unconfined aquifer, in which stormwater recharges through infiltration. Once developed, the proposed action area is expected to continue to drain to the north.

In response to this, the concept masterplan has been planned and designed to according to Water Sensitive Urban Design (WSUD) principles, with protection of waterways and management of stormwater within the landscape a key focus. In particular, infiltration basins along the northern and part of the western boundary of the proposed development are included within the proposed master plan (see **Figure 2.1**). The Stormwater Management Plan indicated that there is sufficient available infiltration zoning to cater for the proposed action.

In addition, the proposed action area is protected from the effects of sea level rise from both the east and west and is above the predicted Hunter River 1% Annual Exceedance Probability (AEP). The proposed action is therefore considered not to be constrained by sea level rise as a result of climate change.

4.2.2.2 Stormwater Drainage - Quality

The proposed action incorporates measures to manage stormwater quality prior to discharging into the natural environment. A treatment train approach is proposed, in which a number of devices are used to cleanse the discharge prior to entering into the infiltration zones. As required by the Department, a MUSIC model was prepared to determine the required land-take to facilitate appropriate stormwater treatment devices.

The proposed treatment devices include Gross Pollutant Traps (GPT) and Biofiltration Basins. The results from the MUSIC model indicate that the treatment train will successfully reduce pollutant loads to an acceptable level. Furthermore, the report determines that there is sufficiently available land within the proposed action area to cater for the proposed development of the land.

As noted throughout the Referral, appropriate erosion and sediment control measures will be established as part of the CEMP in order to protect local water quality during construction.

It is therefore considered that the proposed action will not have a significant impact on water resources, either during construction or once operational.

4.2.3 Impacts on Plants

A Biodiversity Development Assessment Report (BDAR) has been prepared by Umwelt (2019) to assess the potential biodiversity impacts of the proposed residential subdivision in accordance with the NSW Biodiversity Assessment Methodology (BAM). The BDAR is attached in **Appendix 4**.

Surveys of the Development Footprint identified two Plant Community Types (PCTs) across five condition classes being:

- PCT1646 Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- PCT1725 Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast.

The Department requested the following in its determination for the proposed action to be assessed on Preliminary Documentation:

Please analyse and discuss the potential for the vegetation to regenerate into higher quality habitat, timeframes and proposed management measures to enhance the regeneration.

Native vegetation in the Referral Area has been assessed as moderate condition or poorer primarily due to previous land clearing, land use activities from 1941 to 1997, vehicle tracks, waste dumping and weed infestation primarily in the understorey strata. The range was closed in December 1997, rehabilitated and revegetated.

The following discussion provides a background as to the factors that have influenced the condition of the native vegetation in the Development Footprint:

- A review of aerial photographs provided in Douglass Partners (**Appendix 6**) identified that in 1954, the Development Footprint was cleared of native vegetation.
- Douglass Partners identified that in 1975 several of the buildings had been removed and ponds were noted in the north-west of the range.
- By 2001 (**Figure 9,** Douglas Partners) while the site was similar to 1975 all of the buildings had been removed. In 2001 the Development Footprint appears to be largely cleared of native vegetation. The dominant community described in the BDAR, Tea tree – Banksia scrub, has regrown since 2001.
- More recently (2009 to 2010) parts of the previous range has also been disturbed by remediation activities refer Attachment M **Appendix 3**.

The revegetated area, primarily the Development Footprint, is dominated by coastal tea-tree (*Leptospermum laevigatum*) that was frequently used in coastal revegetation projects with other coastal shrub species. The closed canopy and dominance of coastal tea-tree in the scrub is limiting occurrence of native groundcover species. Bitou bush is a significant weed species in this community that is recognised as a key threatening process under the BC Act. None of the canopy species diagnostic of the adjacent open forest area occur in the scrub. The condition of this community would require active management to improve ecological value. Management actions would include rubbish removal, closure of tracks, weed management, spread of seed and/or seedlings to establish groundcover species and emergent canopy species. Improvement of habitat value of this community and the cleared area to approach the community that was cleared for the rifle range would be a long term investment of several decades.

Less investment of resources and time would be required to improve the condition of the Moderate condition forest areas along the northern boundary of the Referral Area and the disturbed forest along the southern boundary of the Referral Area. Actions would be focused on rubbish removal, weed management and closure of access tracks. There is a higher likelihood of successful rehabilitation of these areas to improve habitat quality over a shorter time frame likely less than 10 years.

4.2.4 Impacts on Animals

An Ecological Assessment was prepared by Umwelt (2018) that discusses the impacts of the proposed action on native animals. The assessment noted that several general fauna habitat types occur within the Referral Area. Each of these broad habitat types has a range of characteristics which influence the habitat value, and the range of fauna species that are likely to be identified within each type. The broad habitat types recorded within the Referral Area consist of forest, shrubland and dune spinifex/wetland habitat.

Table 4.5 addresses information requested by the Department in relation to potential impacts on animals.

Table 4.5 Responses to Information requests by the Department

Information Required	Response
Please describe the native animal species present (this should include all native species i.e. not be limited to the Matters of National Environmental Significance described in Section 4.1) and what are their characteristics?	Forested habitats of the Referral Area are dominated by eucalypt species which are likely to provide a seasonally prolific nectar resource for birds such as honeyeaters and lorikeets. The forested habitats of the Referral Area contain limited hollow resources due to a lack of mature and old growth trees. The forest understorey provides potential foraging habitat for micro-bats, macropods, birds and some limited nesting potential in protected areas for small woodland birds. The ground cover is dense with several fallen hollow branches and trees, providing foraging and refuge resources for reptiles and small terrestrial mammals. The shrubland habitat in the central portion of the Referral Area may provide habitat resources for a wide range of nectarivorous species. This habitat is considered to be derived from the surrounding forest habitat, with the community likely a result of ground disturbance in this area. Small birds such as the brown quail (*Coturnix ypsilophora*), superb fairy wren (*Malurus cyaneus*) and red-browed finch (*Neochmia temporalis*), and reptiles such as the eastern striped skink (*Ctenotus robustus*) are provided foraging habitat as well as refuge habitat within he dense shrub layers. The dune spinifex and wetland habitat in the Referral Area is subject to coastal winds with minimal vegetation and no fauna species were recorded at the time of the surveys. Regardless, it is likely that sea birds such as gulls and terns would occasionally utilise these areas for foraging or roosting. Common species such as silver gull (*Chroicocephalus novaehollandiae*), crested tern (*Thalasseus bergii*) and red-capped plovers (*Charadrius ruficapillus*) are likely to occur in these habitats. There is also potential for migratory wader birds to forage along the tideline or nest on sandflats between the dunes immediately behind the beach.

Information Required	Response
Please assess and describe whether the action likely to directly or indirectly impact upon these animal species?	Direct impacts to these species, as a result of the proposed action, will include loss of native vegetation and fauna habitats through vegetation clearance for the construction of residential buildings, roads, gardens and parklands. It is noted that the majority of vegetation clearance will occur within disturbed shrubland habitat. In light of the substantial habitat available in conservation lands to the north of the Referral Area, it is considered unlikely that the clearing of such vegetation will result in a significant impact so as to reduce the long-term viability of these species. The proposed action may also result in the following minor indirect impacts: • Edge effects resulting in increased weed species invasion as a result of native vegetation removal. • Increases in the occurrence of feral fauna species such as foxes, rabbits, dogs and cats resulting from disturbances. • Noise impacts have the potential to adversely impact native species such as disturbing the roosting and foraging behaviour of fauna specie and reducing the occupancy of areas of suitable habitat. • Dust impacts have the potential to adversely impact native species during construction. Potential impacts include dust covering vegetation thereby reducing vegetation health and growth. • Vehicle strike impacts on ground-dwelling fauna species with increased vehicle movements in the post-construction landscape. These indirect impacts will be managed through the implementation of mitigation measures, as outlined in **Section 5.0**. As such, in light of the existing disturbed nature of the habitat proposed for clearing, and the proposed mitigation measures, it is unlikely that the proposed action will result in a significant impact to native animals.
Will the action result directly or indirectly in animal deaths or injury?	The proposed action does not include direct animal death or injury. All efforts to avoid animal death and injury will be undertaken during construction and operation. A robust tree felling procedure will be implemented to minimise the potential for impacts on native fauna species as a result of clearing habitat trees. Any injured animals will be taken to the nearest veterinary clinic or wildlife carer as soon as possible for assessment and treatment. Mitigation and management measures are discussed further in **Section 5.0**.
Can animals be translocated?	The proposed tree felling procedure will include relocating animals on the day of capture into nearby suitable secure habitat. This will be undertaken by qualified and experienced ecologists. Further information regarding the proposed mitigation and management measures are discussed in **Section 5.0**.
Will the action impact upon habitat, water or other resources utilised by animals?	Water resources are limited within forested habitats. As noted in the Referral, there are no rivers, creeks or drainage channels located within the Referral Area. The proposed action also incorporates measures to manage stormwater quality prior to discharging into the natural environment, as discussed in **Section 4.2.2.** As discussed above in Points A and B, the proposed action will have an impact on habitat for native animals. This will be largely limited to disturbed areas of native vegetation, with higher quality habitat preserved to the north of the Referral Area. This is discussed in **Section 3.3**.

Information Required	Response
Please cross reference with Section 4.1 as appropriate for the Koala and GHFF.	As outlined in **Section 4.1.1**, Umwelt considers that 2.35 hectares of suitable foraging habitat for the koala occurs within the Referral Area, however we do not consider the Referral Area to support breeding habitat for the species. Through the implementation of the tree felling procedure and the additional mitigation and management procedures outlined in **Section 5.0**, it is considered unlikely that the proposed action will have a significant impact on koala. As discussed in **Section 4.1.2,** no GHFF camps have been recorded in the Referral Area, either historically or currently. The closest active camp is located approximated 5 km to the south-west of the Referral Area near Carrington, NSW. There is an additional camp in Blackbutt Reserve, approximately 12 km south-west of the Referral Area with a large camp also located at Raymond Terrace, about 14 km to the north-west. All of these camps are currently identified as nationally important camps for the GHFF. The vegetation within the Referral Area is not considered to provide important foraging habitat for the species. We consider an abundance of foraging habitat is available to the species within a 20 km radius of each of these camps, including habitat that would be considered to be of high quality based on the proportion of winter and spring foraging species present and the size of the patches of vegetation. This includes the Worimi Conservation Area which extends directly to the north of the Referral Area, providing connected foraging habitat through to Anna Bay (approximately 38 km north east). Through the implementation of the tree felling procedure and the additional mitigation and management procedures outlined in **Section 5.0**, it is considered unlikely that the proposed action will have a significant impact on koala or GHFF.

4.2.5 Impacts on Heritage

4.2.5.1 Impact on Historical Values

A Heritage Impact Statement (HIS) for the proposed action was prepared in 2017 by Urbis. This report was submitted with the Referral and has since been revised. This revised report is attached in Attachment I of **Appendix 3**.

The HIS identified two items of some heritage significance occurring within the proposed action area, being the Links Anti-Aircraft Battery (Links Battery) and the remnants of the 1000-yard Firing Range. Neither of these items were assessed to meet the Commonwealth heritage threshold. It was also determined that only the Links Battery was only remaining built element that had any heritage significance. In response to the Referral, the Department has requested the following information (**Table 4.6)**:

Table 4.6 Responses to Information request by the Department regarding Historic Heritage

Information Request	Response
Information in detail about how the Links Battery on the proposed action site will be stabilised, repaired where necessary, and appropriately conserved to promote the heritage values of the site and better allow the Battery to demonstrate the story of WWII on the range.	As noted within the statement of significance, while the Links Battery constitutes the only significant built element remnant on the site, it is not known to be associated with any significant historical event and is one of a number of similar facilities constructed in Newcastle and NSW generally. Furthermore, the fabric is in very poor condition. However, as recommended by the Urbis, an interpretation strategy will be developed along with the detailed designs that will outline the restoration works of the Links Battery. This will be provided to the Department prior to construction commencing. Further, the proposed action will be sympathetic to the Links Battery, with no development proposed to occur in the area occupied by the Links Battery.
There are nine heritage items, which were identified on the proposed action site in 2008 (Heritage Impact Statement, 2016), but only two (the rifle range and Battery) were identified during the 2017 study. Please discuss the other heritage items.	As noted within the HIS, there are no heritage listings relevant to built heritage on a local, state or Commonwealth level within the proposed action area. As there, there are no pertinent legislative requirements to assess the impact of the proposed action against in terms of built heritage. This is further confirmed by the HIS, in which it notes that the remaining seven elements of potential heritage significance no longer apparent within the proposed action area. These elements have either been removed, completely degraded or have been buried under sand/vegetation. Prior to construction, further archaeological investigations and salvage works will be undertaken to ensure that there are no impacts to any items of potential heritage significance as a result of the proposed action. A salvage plan will be submitted to the Department and an interpretation plan will be developed prior to commencing any works.
If additional heritage items of significance are identified, please analyse impacts of the action on these heritage items.	There are no known additional heritage items of significance within the proposed action. Additional archaeological investigations and full salvage works will be undertaken across the proposed action area prior to any further work. This will allow for all heritage items to be identified, assessed and salvaged. It is acknowledged that the proposed action may impact on unknown historical heritage items, particularly during the construction phase. However, a Chance Find Protocol will be included within the CEMP. This will ensure that any additional historic heritage items are not impacted during construction.

4.2.5.2 Impact on Indigenous Values

The Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) report prepared by Umwelt was finalised in June 2017. The ACHAA is attached in Attachment J of **Appendix 3**.

It is acknowledged that the proposed action area contains Aboriginal cultural values. As noted within the Referral, consultation with local Aboriginal groups was undertaken to inform the master planning of the proposed development and to ensure minimal impact on these values.

The Karuah Indigenous Corporation, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd and Worimi Local Aboriginal Land Council undertook a pedestrian survey of the site in late 2016. The registered parties then had the opportunity to provide feedback as a group, provided in full in the ACHAA. A key point raised with regard to significance was the importance of the northern side of the current access road, which has storylines attached to it. Key recommendations from this consultation was no development to the northern side of the access road; no impact at the intersection of Braid Road and Popplewell Road due to known burials in the area and no impact in the south-western corner of the Rifle Range due to known burials.

These recommendations have been adopted into the design of the proposed development.

In response to the Referral, the Department has requested the following information:

i. **Details about how the burial sites, located at the south western corner of the proposed action site, will be protected.**

The proposed development area includes a portion of the Fern Bay site complex (AHIMS 38-4-0895) and six sites (burials and artefacts). A further seven sites (artefact scatters, shell middens and an artefact reburial site) are located within the property boundary, but outside of the proposed area of impact. The Fern Bay site complex consists of middens, artefact scatters and isolated finds. It is likely that further artefacts and shell will occur within the site complex.

Of the six sites identified as potentially occurring within the development area, four were identified as burial sites. Their Aboriginal Heritage Information Management System (AHIMS) site IDs are listed in **Table 4.7**. The recorded coordinates for these sites were visited during the survey undertaken for the ACHAA report. However, Mr Leonard Anderson, who originally submitted the site cards and was present during the survey, confirmed that the coordinates available on AHIMS were incorrect. Anderson advised that that the potential burials are in fact located in the southwest corner of the Referral Area, in the vicinity of the boundary fence with Popplewell Road and outside the Rifle Range within the road reserve. One in particular is located at the intersection of Braid Road and Popplewell Road. The identification of the sites was associated with ground penetrating radar which was undertaken as part of an assessment for a project located outside the boundaries of the current Referral Area.

Following identification of the correct coordinates for the burial sites, it has been confirmed that one of the correct locations is outside the Referral Area. The remaining three are located within the south west corner of the Referral Area, but outside of the proposed area of impact. The corrected coordinates are listed in **Table 4.7.**

Table 4.7 Corrected Burial Site Locations

AHIMS site ID	Correct Easting (MGA)	Correct Northing (MGA)
38-4-1127	387432	6361816
38-4-1128	387591	6362226
38-4-1129	387436	6361848
38-4-1130	387440	6361869

No development is proposed to occur within the south-western corner of the Referral Area. This area will be demarcated prior to construction to ensure no impacts occur. Mitigation measures regarding impacts to Aboriginal Heritage values are further discussed in **Section 5.0.**

The original AHIMS locations are demonstrated in **Figure 4.1**, while the corrected coordinates are shown in **Figure 4.2**.

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Architectus (2019), AHIMS (2016)

0 100 200 250m
1:5 000

Legend

- Referral Area
- Burial Area
- Fern Bay Complex Boundary
- Aboriginal Resource and Gathering
- Artefact Reburial Site
- Artefact Scatter (Open Camp Site)
- Burial (Incorrect Locations)
- Isolated Find
- Potential Archaeological Deposit
- Shell
- Shell and Artefact

FIGURE 4.1

Archaeological Sensitivity

File Name (A4): R09/3764_075.dgn
20200221 13.45

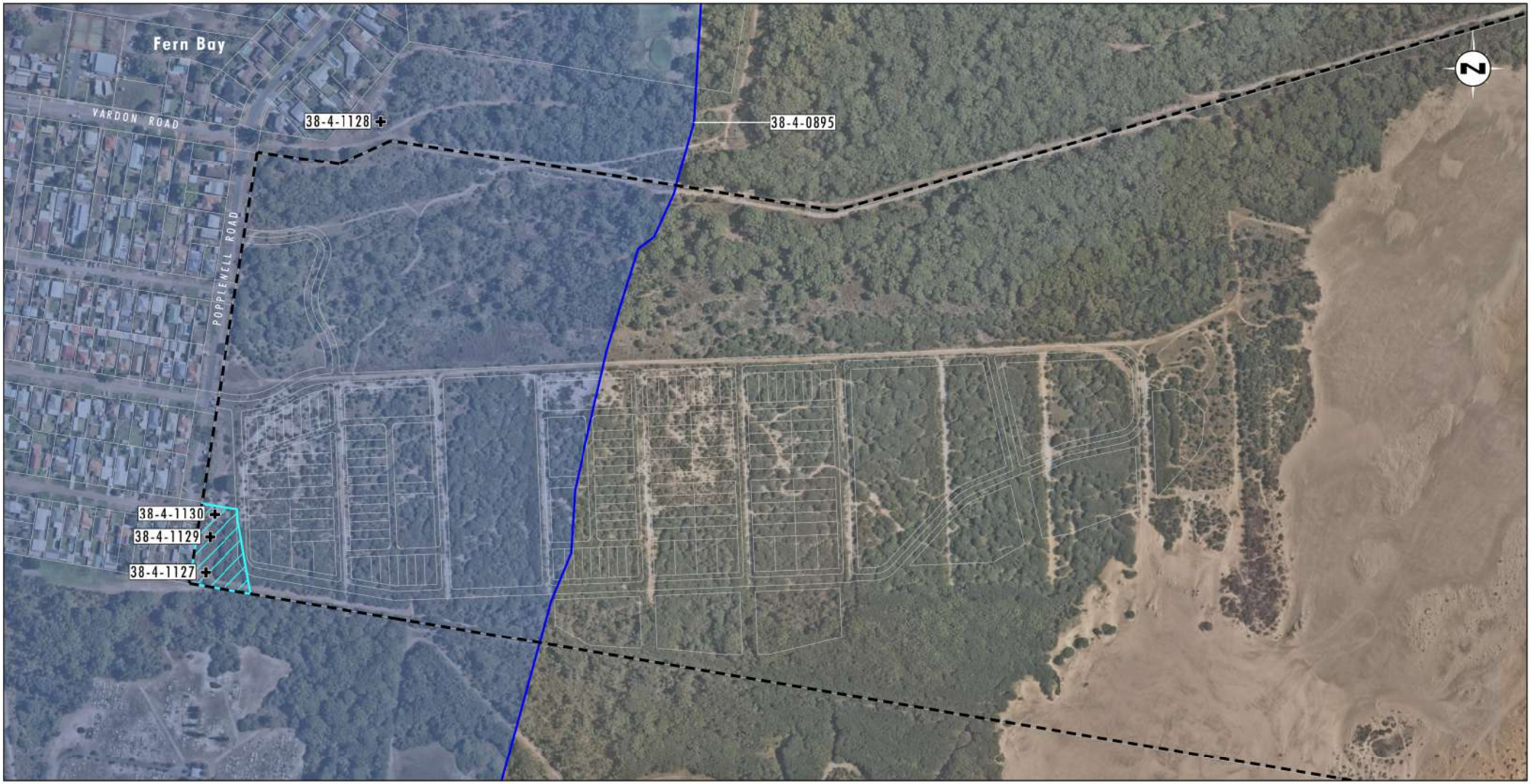

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Architectus (2019), AHIMS (2020)

0 100 200 250m
1:5 000

Legend

- Referral Area
- Burial Area
- Fern Bay Complex Boundary
- Burial

FIGURE 4.2

Map showing correct coordinates for Aboriginal Burials

ii. **The Department considers the Indigenous consultation process is incomplete until the Department is provided with the final Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) report, with reference to the impacts on Indigenous heritage in the Heritage Impact Statement. To confirm impacts on indigenous heritage matters are appropriately considered (whether there is the potential for either a direct, indirect, short term, long term, temporary or permanent impact on Indigenous heritage values), please ensure the final ACHAA includes any relevant responses and recommendations from RAP.**

As aforementioned, the ACHAA report was prepared by Umwelt and finalised in June 2017. The ACHAA is attached in Attachment J of **Appendix 3**. This report was included in the Planning Proposal application through the gateway process.

As outlined within the report, registered Aboriginal parties were extensively consulted. This consultation was undertaken in accordance with Part 8A, Clause 80C of the *National Parks and Wildlife Regulation 2009* (the Regulation). A detailed Aboriginal party consultation log and all correspondence is summarised within the ACHAA report. Five Aboriginal parties registered an interest in ongoing consultation regarding the project:

- Karuah Indigenous Corporation
- Mur-Roo-Ma Inc.
- Nur-Run-Gee Pty Ltd
- Worimi Local Aboriginal Land Council, and
- Wonn1.

The registered Aboriginal parties identified the area to the north of the central access road as a culturally sensitive area that requires protection in order to preserve story lines. The area to the south west corner of the site was also identified by the Aboriginal parties as the correct locations of the recorded burials that also require protection. The registered Aboriginal parties assisted in the development of mapping which identified areas of cultural sensitivity.

In accordance with the recommendations of the ACHAA report, DHA propose to apply for an Aboriginal Heritage Impact Permit (AHIP) in accordance with Section 90 of the *National Parks and Wildlife Act 1974* (NSW) (NPW Act). The AHIP will cover the entirety of the impact area, in recognition that archaeological material has been identified and/or predicted throughout the Referral Area as a result of the disturbance of former dunes throughout the site. The AHIP will include provision for the completion of salvage works (both surface collection and sub-surface investigation).

It is noted that the AHIP would specifically exclude impacts to recorded burial sites. In the event that suspected human skeletal material is identified within the other portions of the Referral Area, all woks would cease immediately, and the NSW Police Department, NSW Office of Environment and Heritage and the registered Aboriginal parties would be contacted. This is further discussed in **Section 5.0**.

5.0 Proposed Avoidance, Mitigation and Management Measures

5.1 Avoidance

The Master Plan proposed as part of the Rifle Range Residential Development has been prepared through careful consideration of the ecological values and heavily disturbed portions of the Referral Area that have been identified through a long history of site investigations spanning some 18 years (2002 – 2019). The Development Footprint has almost entirely avoided the most intact areas of native vegetation (VZ1 PCT1624) within the Referral Area through prioritisation of development within the highly disturbed central portion. The area of impact to this vegetation is limited to the outermost extent of the development to provide for Asset Protection Zones and Stormwater Detention Basins as well as a small number of Cluster Homes.

Importantly, the Development Footprint has been planned to ensure a natural corridor of native vegetation and suitable threatened species habitat and buffer area remains between the Development Footprint and the Worimi Conservation Area to the north.

Although the Master Plan identifies that a walking track is proposed to the shoreline and that the walking track may cross through these two vegetation communities, it should be noted that the location of the track is indicative only. DHA have committed to avoiding direct impacts to the Beach Wetlands and Sand Dunes through a detailed design phase of the walking track. Avoidance will be possible by locating the track along existing vehicles track disturbances.

Additionally, the Master Plan has been designed specifically to avoid the north side of the current access road and the south western corner of the Referral Area, to minimise any impacts to areas of Aboriginal heritage and cultural value. The Master Plan was prepared through consultation with registered Aboriginal parties, as outlined in **Section 4.2.5.**

These avoidance actions have significantly reduced the impacts of the proposed action on the local environment.

5.2 Mitigation and Management

The Department has requested that the Preliminary Documentation include a consolidated list of mitigation measures proposed to be undertaken by the Proponent to avoid, minimise and manage relevant impacts of the action. **Table 5.1** provides this consolidated list of mitigation and management measures, which have been drawn from the Referral and the various specialist studies that have been undertaken for this proposed action.

It is noted that the Preliminary Documentation advice provided by the Department included a proposed summary table which included the following headings:

For each EPBC matter likely impacted, please provide the proposed avoidance and mitigation measures in a table, which outlines:

a. *stage of development (e.g., construction phase or ongoing occupancy phase)*
b. *objectives (e.g., to protect water quality of nearby receiving water, to mitigate soil excavation)*
c. *avoidance (e.g., avoidance of clearance of habitat)*
d. *mitigation measures (e.g., implementation of construction management plan)*
e. *performance criteria (e.g., erosion and sediment control measures are consistent with those specified by a relevant Council)*
f. *monitoring and reporting (e.g., monitoring is to be undertaken weekly during construction)*
g. *corrective action (e.g., immediately reinstate appropriate erosion and sediment control devices after the identification of a failure)*
h. *responsible party (e.g., project environmental officer, who will ensure the measures are undertaken)*
i. *timing (the construction management plan to be approved by a relevant body prior to the commencement of construction), and*
j. *the cost of the mitigation measures, including how measures will be funded to ensure enduring protection (and by whom).*

Not all of these matters could be addressed at this stage of the proposed action. However, DHA are committed to providing copies of all proposed management plans to the Department for approval prior to commencing works.

Table 5.1 Consolidated List of Mitigation and Management Measures Proposed

Issue	Phase	Proposed Mitigation / Management Measures	Specific actions	Relevant Plan	Responsibility
General	Post Development Approval	A CEMP is to be prepared following development approval of the proposed action in accordance with the requirements of the Department.	The CEMP is to include the following sub-management plans: • Vegetation Management Plan in accordance with PSC Technical Specifications including pre-clearance inspections, tree felling procedures, weed management procedures, fauna management measures particularly those provided for in the CKPoM • Stormwater Management Plan • Erosion and Sedimentation Control Plan • Traffic Management Plan • Waste Management Plan • Chance Find Protocol The CEMP is also to include general site management measures that would seek to reduce any potential environmental or amenity impact to the Referral Area and its surrounds. This would include addressing issues relating to noise, vibration, air quality and lighting.	CEMP	Proponent / Contractor
General	Post Construction	An Operational Environmental Management Plan is to be prepared and implemented within 12 months of completing the proposed action in accordance with the requirements of the Department.	The OEMP is to provide operational management measures relating to the following: • Traffic management, including traffic controls and signage • Dog and cat ownership policies • Restricted vehicle and controlled pedestrian access along frontal dune system • Lighting and noise restrictions	OEMP	Proponent / Contractor

Issue	Phase	Proposed Mitigation / Management Measures	Specific actions	Relevant Plan	Responsibility
Impacts to Plants and Animals / Threatened Species	Post Development Approval	Implement a tree felling procedure prior to clearing vegetation in accordance with Section 5.1.1 of the Ecological Assessment (Umwelt, 2018).	Pre-clearance surveys to be undertaken by a suitably qualified and experience ecologist, involving: • Determination of appropriate timing of proposed clearing activities • Demarcation of areas approved for clearing to reduce risk of accidental clearing • Identification and marking of habitat resources and habitat trees • Translocation and salvage of species or habitat features by appropriately accredited persons	Tree Felling Procedure	Proponent / Contractor
			Ensure tree felling is supervised by an appropriately qualified and experienced ecologist after pre-clearance surveys have taken place. • Tree felling is to be undertaken by appropriately qualified personnel • All personnel are to receive training regarding the risks and implications of impacts on native animals and plants that are not approved for clearing • All habitat trees will be subject to a visual inspection to survey for animals • Where no animals are identified, trees are to be shaken • All reasonable attempts to reduce impacts on animals is to be undertaken, including delaying felling trees if fauna is present or felling in sections • Lowering of hollow-bearing trees will be done as gently as possible • Uninjured animals should be released on the day of capture into nearby suitable secure habitat • Injured animals will be taken to nearest veterinary clinic or wildlife carer		
			Post-felling inspections are to take place to ensure remaining or injured animals are treated, and to ensure habitat features are restored e.g. no hollows are blocked.		
			All felled habitat trees are to remain in place for at least one night to allow animals still present to move on.		
			Detailed records of the habitat features cleared, animals encountered and treated and/or relocated are to be maintained.		

Issue	Phase	Proposed Mitigation / Management Measures	Specific actions	Relevant Plan	Responsibility
Impacts to Plants	Post Development Approval	A weed management plan is to be prepared as part of the CEMP following receipt of development approval for the proposed action.	The following measures will be included within the weed management plan: • Any vehicles or equipment brought into the Referral Area to be involved in ground disturbance activities and/or travelling around the site must be inspected and cleaned prior to commencing work • The limits of ground disturbance are to be clearly demarcated and no unnecessary disturbance will be undertaken outside of these areas • Regular inspection of the Referral Area to monitor the spread of weed species • Training of relevant personnel on the identification of target weed species.	Weed Management Plan	Proponent / Contractor
	Construction	Implementation of the weed management plan by appropriately trained personnel as required under the *Biosecurity Act 2016* and local land services, throughout the entirety of the construction phase and wherever within the Referral Area priority weeds are apparent.	Weed control eradication techniques may include: • Spraying with herbicides • Physical removal e.g. chipping, or • Minimisation of area available for weed infestation through prompt revegetation of bare areas.		
Impacts to Animals / Threatened Species	Construction	Implementation of the traffic management plan throughout the construction phase.	Traffic management measures during construction to limit impacts to native animals may include: • Traffic control measures, including speed limitations and restricted vehicle access • Signage • Timing restrictions on heavy vehicle movement • Procedures for responding to and reporting injures / death of native animals	Traffic Management Plan	Proponent / Contractor

Issue	Phase	Proposed Mitigation / Management Measures	Specific actions	Relevant Plan	Responsibility
Impacts to Koalas	Post Development Approval	Finalise and Implement mitigation measures as provided for in the CKPoM as included in Appendix E of the Ecological Assessment (Umwelt, 2018).	The following measures are proposed to minimise the impacts on the local koala population potentially resulting from the proposed action: • Traffic control measures are to be enforced to minimise fauna injury/road kill • Fencing along the perimeter of the site is to be established to restrict Koala from construction / developed areas • Detailed pre-clearing surveys, including pre-clearing nocturnal spotlighting and call playback surveys prior to clearing activities • Dog management during both construction and operation • Targeted koala feed tree planting such as swamp mahogany and Earps red gum (*Eucalyptus parramattensis* subsp. *decadens*).	Koala Management Plan CEMP OEMP	Proponent / Contractor
Impacts to Plants and Animals Impacts to Soils and Landscapes	Post Development Approval	A Conservation Management Plan (CMP) is to be prepared once development approval has been received and implemented prior to construction. The CMP is to focus on protection of the nearby Worimi Regional Park and coastal dune rehabilitation.	The CMP is to provide site-specific, fit-for-purpose management responses to the following potential indirect impacts resulting from the proposed action on surrounding environmentally sensitive areas: • Erosion and sedimentation • Stormwater runoff • Wastewater • Management implications relating to pests, weeds and edge effects • Fire and the location of asset protection zones • Boundary encroachments and access through OEH lands • Visual, odour, noise, vibration, air quality and amenity impacts • Threats to ecological connectivity and groundwater dependent ecosystems • Threats to cultural heritage	Conservation Management Plan	Proponent / Contractor

Issue	Phase	Proposed Mitigation / Management Measures	Specific actions	Relevant Plan	Responsibility
Impacts to Plants and Animals Impacts to Soils and Landscapes		Undertake vegetation and dune rehabilitation to remove current weed infestations and improve native coastal vegetation communities and fauna habitats occurring in the Referral Area.	The CMP is to provide measurable rehabilitation biodiversity objectives that would seek to: • Create a sustainable and stabilising vegetation community on the fore dunes • Focus on the planting of endemic coastal flora species • Provide fauna movement habitat between the northern and southern boundaries of the Referral Area • Encourage ecological stewardship by promoting community planting days and wildlife watching. Dune rehabilitation and landscaping is to be conducted progressively during the construction and establishment of the development to ensure that a self-sustaining coastal ecological community is established. Rehabilitation works are to use local provenance endemic species, with consideration for seed availability.		
Impacts to Heritage	Post Development Approval	Complete archaeological testing and salvage works within the area proposed for development prior to any impacts in the Referral Area, with reference to Section 10.0 of the ACHAA Report.	Further targeted subsurface salvage and monitoring of the Referral Area is to be undertaken prior to and during construction, respectively. All surface objects within the areas of impact would be subject to collection prior to ground disturbing works.	Salvage Design and Methodology Plan Chance Find Protocol	Proponent / Contractor
	Construction	No development is to occur on the north side of the current access road or the south-western corner of the Referral Area.	• These areas are to be clearly demarcated prior to any works being undertaken within the Referral Area • All personnel are to be trained on the procedures of the Chance Find Protocol • Ensure that all personnel are aware that it is an offence under Section 86 of the NPW Act to harm or desecrate an Aboriginal object unless that harm or desecration is the subject of an AHIP.	CEMP Chance Find Protocol	Proponent / Contractor

Issue	Phase	Proposed Mitigation / Management Measures	Specific actions	Relevant Plan	Responsibility
Impacts to Heritage	Post Development Approval Construction	Prepare and implement a Chance Find Protocol prior to commencement of work.	The Chance Find Protocol is to provide clear stop work procedures in the event that an Aboriginal object or other item of heritage significance is identified during construction. In the event that suspected human skeletal material is identified within other portions of the Referral Area, all works must cease immediately and the NSW Police Department, OEH and the registered Aboriginal parties are to be contacted so that appropriate management strategies can be identified and implemented.		Proponent / Contractor
	Prior to Development Approval	Stabilise, repair and where necessary, appropriately conserve the Links Battery following development approval and receipt of all relevant historic heritage approvals.	Clear the vegetation that is currently growing over the Links Battery and maintain the item until it has been determined whether it can be incorporated into an Interpretation Strategy for the site. This is to be undertaken by an appropriately qualified heritage specialist.	CEMP	Proponent / Contractor
		Prepare an interpretation strategy, to be implemented once the proposed action is completed	An interpretation strategy is to be prepared in conjunction with the master planning of the Referral Area. The strategy would consider the location of interpretative devices which would communicate the historic values associated with the Referral Area.	Interpretation Strategy	

Issue	Phase	Proposed Mitigation / Management Measures	Specific actions	Relevant Plan	Responsibility
Impacts to Water Resources	Post Development Approval Construction	Prepare and implement an updated, detailed Erosion and Sedimentation Control Plan (ESCP), with reference to the Stormwater Management Plan prepared by ADW Johnson (2018)	All erosion and sediment controls and practices are to be in accordance with the relevant Port Stephens Council Development Control Plan and '*Managing Urban Stormwater*' by Landcom/NSW Department of Housing.	ESCP	Proponent / Contractor
	Construction		Treatment devices are to be implemented during construction to contain any pollutants generated. This may include: • Sediment basins • Silt fencing • Hay bale and geotextile fencing • Kerb inlet controls • Sandbag kerb inlet sediment traps • Shaker ramp • Diversion drains Runoff generated from within the Referral Area is to be treated and managed using a combination of the above stated treatment devices.		

6.0 Offsets

As provided for under the Amending Agreement No 1 of the bilateral agreement made under Section 45 of the EPBC Act, as the proposed action will require development approval under the NSW Environmental and Planning system, DHA has opted to determine the offsetting requirements of the proposed action in accordance with the endorsed NSW State policies.

The proposed action has demonstrated the avoid and mitigate hierarchy of principles in assessing the impacts of the proposed action on matters of national environmental significance.

The principle of offsetting of residual impacts has been assessed under the Biodiversity Offsets Scheme under the *Biodiversity Conservation Act 2016* (NSW) (BC Act), which commenced on 25 August 2017. The BOS has been endorsed by the Commonwealth as an 'endorsed state policy' for the purposes of the EPBC Condition-setting policy under Section 7.2 of the Amending Agreement No 1.

6.1 Impacts Not Requiring Assessment

Under the NSW Biodiversity Assessment Method (BAM), impacts to areas of land without native vegetation do not require further assessment (**Appendix 4**). The Development Footprint does not contain any such land. The highly disturbed vegetation that is predominantly cleared and dominated by introduced flora species, does comprise some native flora species and is therefore further assessment of the need for biodiversity offsets is required.

6.2 Impacts Not Requiring Offset

Impacts on native vegetation not requiring offsets under the BAM include native vegetation that has a vegetation integrity score of:

- less than 20 (where it is not associated with ecosystem-credit species habitat or a threatened ecological community (TEC))
- less than 17 (where it is associated with ecosystem-credit habitat or a vulnerable ecological community (VEC)) or
- less than 15 (where it is representative of an endangered ecological community (EEC) or critically endangered ecological community (CEEC)).

Vegetation Zone 5 (PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – Cleared) calculated a vegetation integrity score of 11.6, below the offsetting threshold. Therefore, this area does not require offsetting.

Figure 6.1 identifies the area in the Development Footprint that does not require offset.

6.3 Impacts Requiring Offset

Two PCTs (over four condition zones) have been determined to require offsetting in accordance with the BAM (OEH 2017) (**Table 6.1)**. The BDAR (**Appendix 4**) prepared under the BAM methodology has determined offset requirements for the GHFF and the koala as 'ecosystem credit species' as the PCTs provide:

- foraging habitat of the GHFF, loss of PCT1646 – Moderate (Forest), PCT1646 – Disturbed (Forest) and PCT1725 – Moderate; and
- foraging habitat of the koala, loss of PCT1646 – Moderate (Forest), PCT1646 – Disturbed (Forest) and PCT1725 – Moderate.

No additional species credit offset requirements were required for the koala or the GHFF as targeted surveys and database searches have not established that the Development Footprint supports important habitat or breeding habitat, respectively, as defined by the BAM (refer to Appendix B in the BDAR).

Table 6.1 Impacts Requiring Offset

Veg Zone	PCT/Species-credit	Management Zone	Vegetation Integrity Score			Area (ha)	Credits Required
			Current	Future	Change		
1	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Forest)*	Full	31.5	0.0	-31.5	0.4	**8**
		Partial	31.5	1.8	-29.8	0.28	
2	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Tea-tree – Banksia Scrub)*	Full	27.9	0.0	-27.9	14.24	**158**
		Partial	27.9	0.1	-27.8	0.9	
3	PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast *Moderate*	Full	58.6	0.0	-58.6	0.11	**3**
		Partial	58.6	1.7	-56.8	0.01	
4	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Disturbed (Forest)*	Full	51.4	0.0	-51.4	1.09	**30**
		Partial	51.4	2.1	-49.3	0.46	
5	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Cleared*	Full	11.6	0.0	-11.6	4.67	**0**
		Partial	11.6	0	-11.6	0.35	

6.4 Biodiversity Credit Report

A full Biodiversity Credit Report is included in Appendix F of the BDAR within **Appendix 4**.

A summary of the key outcomes in provided in **Table 6.2**.

Table 6.2 Credits Required to Offset the Proposed Development

PCT/Species-credit	Credits Required
Ecosystem Credits	
1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	196
1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast	3
Total	**199**

DHA is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of biodiversity values as a result of the Proposed Residential Development under the BC Act and *Biodiversity Conservation Regulation 2017*. Firstly, DHA has, where possible, altered the proposed Rifle Range Residential Development to avoid and minimise biodiversity impacts in the project planning stage, and a range of impact mitigation strategies to mitigate the impact on ecological prior to the consideration of offsetting requirements.

Fulfilling offset requirements under the BC Act can be undertaken using one or a combination of the following offset strategies:

- in-perpetuity conservation through the establishment of a Stewardship site/s and the retirement of credits
- securing required credits through the open credit market
- payments to the Biodiversity Conservation Fund and/or
- funding a Biodiversity Conservation Action (if applicable).

DHA are considering setting up a Biodiversity Stewardship Site within the Referral Area not impacted by the Development Footprint (see **Figure 6.1**). This would use the native vegetation to the north of the Development Footprint to generate credits to offset the impacts of the proposed residential development. This area would generate ecosystem credits consistent with those required for the impacts presented in this BDAR.

The area proposed as a Biodiversity Stewardship Site supports habitat for the Koala and the GHFF.

Any remaining deficit in ecosystem credits will either be sought through the open market or payment into the Biodiversity Conservation Fund will be considered.

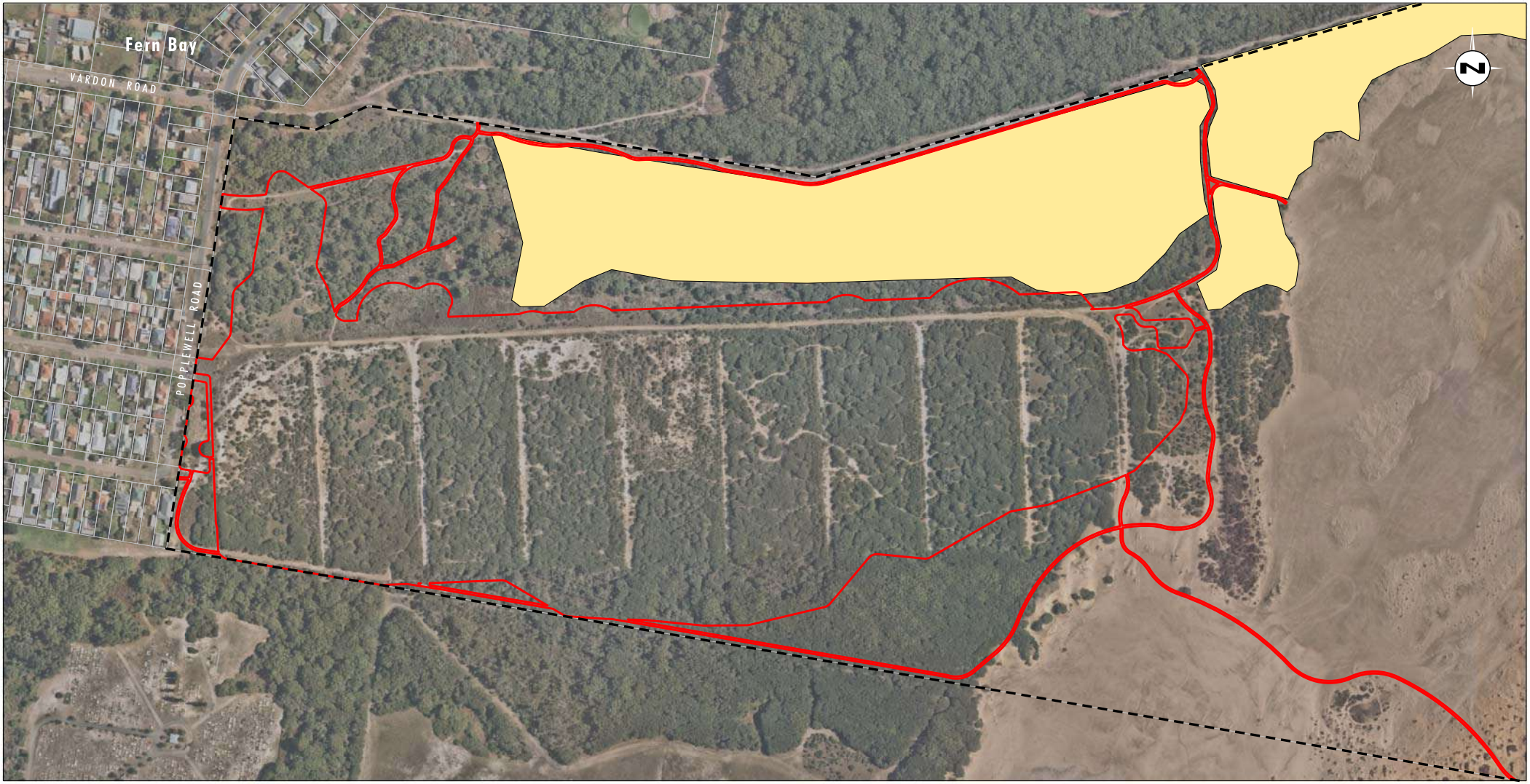

Image Source: Nearmap (Jan 2020)
Data Source: DFSI (2019), Architectus (2019)

0 100 200 250m
1:5 000

Legend

- Referral Area
- Development Footprint
- Potential Offset Area

FIGURE 6.1

Potential Offset Area

7.0 Economic and Social Matters

7.1 Economic Benefits

The following section is provided in response to Section 7 of the Additional Information required to complete the Preliminary Documentation assessment. This section has been prepared with reference to the *Rifle Range Social Impact Assessment*, prepared by GHD in August 2017.

The Rifle Range development will be a master planned residential development comprising of 318 new residential dwellings. It is anticipated that about 159 of these dwellings will be retained by DHA, on which homes will be built for Defence members and their families, with the remaining dwellings available for public purchase.

As aforementioned, Fern Bay is a small community comprising low density residential, over-50s community living (Bayway Village, the Cove Village and Seaside) and the Newcastle Golf Course. Stockton, to the south of the project accommodates low to medium density residential land uses with a small-town centre.

From a social context and accessibility perspective, the proposed action area is currently accessible from the west via Popplewell Road which links back to Newcastle via Nelson Bay Road across the Hunter River. It is about a 20-minute drive from Newcastle CBD via the Stockton Bridge to the proposed action area. Alternative the proposed action area is 6km from the 10-minute ferry service between Stockton and Newcastle.

Economic benefits of the project include the investment by DHA of over $95 million into direct costs of the residential development, over a time span of approximately five years. Further, the provision of about 107 houses for Defence members (and their families) who are based in RAAF Base Williamtown, allows for quality housing within close proximity to the base.

The proposed action also achieves the goals of the Hunter Regional Plan 2036, released in November 2016, including supporting the leading regional economy in Australia, a biodiversity-rich natural environment, thriving communities and greater housing choice and jobs. The Hunter Regional Plan seeks to deliver more housing and better housing choice in well serviced areas with high amenity, supporting the renewal of the strategically placed site.

The Port Stephens Planning Strategy 2011 also applies to the site. Areas identified as Fern Bay - Fullerton Cove, to the north and west of the Rifle Range, have been identified as future growth areas within the Strategy. This area, including the subject sites, consist of the Eastern Growth Corridor identified within strategic planning for Port Stephens. The 2019 Fern Bay North Stockton Land Use Strategy is particularly focused on a future 'neighbourhood' centre. DHA Rifle Range master plan residential development will support the viability of the future centre.

The area has been recommended to increase in density over the next 15-20 years since the Strategy's release, with potential for: 42 infill residential dwellings; and 1,396 dwellings within green field residential zoned land. The Strategy also recommends the opportunity to maximise access to existing infrastructure through density increases. As the suburb (of Stockton or Fern Bay) is among the LGA's small centres with no available commercial floorspace, the need for commercial rezoning has also been identified. The Strategy predicts a need for an indicative 14,441 additional dwellings throughout the LGA, including infill and within rural areas.

Fern Bay is identified as a locally significant centre under the Hunter Regional Plan 2036. The proposed action would contribute to the Fern Bay centre by opening the site to the community including access to the coast, a diverse and cohesive community to support local retail and services, and through the interpretation of the heritage elements of the site.

7.1.1 Public consultation

Community engagement was undertaken extensively during the development of the Planning Proposal and master plan of the Referral Area. Consultation included two community information/feedback sessions, face to face meetings, distribution of newsletters and phone/email contact. The aim of the consultation process was to inform the community about DHA, the site history, the site assessment undertaken, the Planning Proposal and process and to encourage community involvement throughout the approval process. Consultation was aimed at the directly adjoining residents, the Stockton and Fern Bay communities and local Community Action Groups. Generally, feedback was positive based on the positive economic benefit of the Proposed Action. The community also showed concern regarding potential traffic management and parking impacts.

Public submissions and those of key stakeholders have been incorporated into the proposed development.

Indigenous Stakeholders

An Aboriginal stakeholder consultation process has been undertaken for the proposed rezoning and master plan for the Rifle Range site in accordance with the NSW Office of Environment and Heritage's Aboriginal Cultural Heritage Consultation Requirements for Proponents (Office of Environment and Heritage 2010) as part of the Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) (Umwelt 2017).

The registered Aboriginal parties for the Rifle Range site are:

a) Karuah Indigenous Corporation

b) Mur-Roo-Ma Inc.

c) Nur-Run-Gee Pty Ltd

d) Worimi Local Aboriginal Land Council

e) Wonn1

A draft methodology for the ACHAA was provided to all Aboriginal parties for review and comment. No objections were raised with reference to the draft methodology.

Karuah Indigenous Corporation, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd and Worimi Local Aboriginal Land Council were provided with the opportunity to be involved in the pedestrian survey of the survey area. The registered Aboriginal parties that participated in the survey provided feedback as a group following the survey. This feedback is included in the ACHAA report (see Attachment A) and summarised in Sections 3 and 5.

A draft version of this ACHAA report was supplied to all the registered Aboriginal parties in January 2017 with an invitation to review the document, its mitigation and management recommendations and provide any cultural information they deemed appropriate to the preferred management of the Rifle Range site. Finalisation of the management recommendations will occur in consultation with the registered Aboriginal parties following input received on the draft ACHAA.

7.1.2 Economic Costs and Benefits

DHA expects to invest $90 million directly associated with the development costs of Defence Housing component of the development. It is anticipated that a further $120 million of private expenditure will be generated by the construction of residential dwellings at the Rifle Range. This represents significant capital investment into the local and regional economy.

The economic activity of the development will provide ongoing benefit to the local and regional community as the future residents directly contribute to the community and local economy and more broadly the regional economy.

The proposed development will house a mix of workers from of the ADF (RAAF base Williamtown) and non-defence families engaged in employment in the local area and Newcastle. It is likely that many of the workers at the Williamtown airport precinct will call Fern Bay home.

7.1.3 Employment Opportunities

The project is expected to generate 1677 direct jobs and 3059 indirect jobs during the construction of the civil works and dwellings. This number is based on the UDIA Direct and Indirect impact of Development-March 2010.

The renewal of currently unused areas through residential expansion will generate increased demand for services and businesses in the local area, which in turn will support the demand for a growth in retail and social services in the local community (GHD 2017).

The proposed action will accommodate Defence families to ensure the ongoing sustainable operation of RAAF Base Williamtown. As identified in the *Draft Plan for Growing Hunter City*, Fern Bay, as part of the Northern Gateway, is an important residential area proximal to employment areas in Newcastle city, its port and airport. The proposed action would therefore complement existing employment lands.

7.2 Local / Regional / National Scales

The site has not been required by Defence for defence purposes in some time and the use of the site in its current situation does not contribute to employment in the region.

The development of the former Rifle Range will result in an increase to the local population by approximately 487 people. The increased population will add to the demand for a viable retail offering and demand on existing community facilities. It is believed that the development will result in a more vibrant and self-sufficient community at Fern Bay and Stockton.

Fern Bay and Stockton are important satellite communities to Newcastle and the lower Hunter providing much needed accommodation for the workers in the regional economy. The increase in housing supply supports the orderly regional development and state planning objectives.

RAAF base Williamtown is a nationally significant defence establishment. The future development of the Williamtown airfield adds to the increased demand for housing and housing diversity in the Fern Bay area.

7.3 Capital Investment and Estimated Ongoing value

DHA Capital Investment $90 million.

Public investment (private residential house and land construction) $120 million.

8.0 Environmental Record of Person Proposing to take the Action

8.1 Does the Person taking the Action have a Satisfactory Record of Responsible Environmental Management? Please explain in Further Detail.

The Proponent is the custodian of a Commonwealth property portfolio. A number of the properties that the Proponent manages have threatened ecological communities, or species that require management and protection. The Proponent operates under all Commonwealth legislation and policy, including the EPBC Act, to ensure it remains compliant and meets its obligations with respect to environmental protection on its properties.

The Proponent has a history of managing properties in accordance with environmental management plans, which ensure the appropriate outcomes are met. This has included undertaking weed and pest management strategies to ensure its properties are maintained to a high standard that is consistent with key environmental objectives.

8.2 Provide Details of any Past or Present Proceedings under a Commonwealth, State, or Territory Law for the Protection of the Environment or the Conservation and Sustainable Use of Natural Resources Against either (a) the person proposing to take the action or, (b) if a Permit has been applied for in Relation to the Action – the person making the Application.

The Proponent does not and has not had proceedings against it under a Commonwealth, State, or Territory law for the protection of the environment, or the conservation and sustainable use of natural resources.

8.3 Will the Action be taken in Accordance with the Corporations' Environmental Policy and Planning Framework?

As a Commonwealth Agency, the Proponent operates under all Commonwealth legislation and policy, including the EPBC Act, to ensure it remains compliant and meets its obligations with respect to environmental protection on its properties.

8.4 Has the Person Taking the Action Previously Referred an Action under the EPBC Act, or been Responsible for Undertaking an Action Referred under the EPBC Act?

Yes.

8.4.1 EPBC Act No and/or Name of Proposal

Table 8.1 Previous EPBC Act Referrals submitted by DHA

Reference No.	Description	Outcome
2018/8189	Residential Development, Rifle Range Road, Mount Lofty, QLD	Currently being assessed
2017/7951	Residential Development, Stockton Peninsula, Fort Wallace, NSW	Not a Controlled Action if undertaken in a particular manner
2015/7591	Master-planning urban residential development, Lee Point, NT	Controlled Action - Conditional Approval
2011/6163	Residential Development, Weston Creek, ACT	Not a Controlled Action if undertaken in a particular manner
2010/5525	Subdivision for residential development, Muirhead, Darwin, NT	Controlled Action - Conditional Approval

9.0 Principles of Ecologically Sustainable Development

The *National Strategy for Ecologically Sustainable Development* (1992) (the Strategy) sets out the policy framework for the Australian Government to make decisions and take actions to pursue ecologically sustainable development (ESD). The Strategy defines ESD as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.'

The following ESD principles are outlined in Section 3A of the EPBC Act:

a) Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations (the 'integration principle').

b) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (the 'precautionary principle').

c) The principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (the 'intergenerational principle').

d) The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making (the 'biodiversity principle'). e) Improved valuation, pricing and incentive mechanisms should be promoted (the 'valuation principle').

Having consideration for these principles, **Table 9.1** provides responses to the questions raised by the Department relating to the Principles of ESD:

Table 9.1 Responses to questions by the Department relating to Principles of ESD

Information Requested	Response
Identification and integration of both long-term and short-term economic, environmental, social and equitable considerations	The assessment of impacts has considered both long- and short-term impacts. Although the Referral and this Preliminary Documentation has focused on MNES and the Whole of the Environment relevant to the project, an overview of social and economic considerations is also provided in **Section 7.0**. This information has been provided to ensure that decision-making considers both long term and short term economic, environmental, social and equitable considerations.

Information Requested	Response
Identification of threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation	The precautionary principle was integral to the design and assessment of the proposed action. Each of the threatened species identified was assessed in detail with reference to literature on each species and ecological surveys undertaken within the Referral Area. This research is considered to be comprehensive and scientifically valid. Where a high degree of certainty could not be achieved, the proposed action has ensured that mitigation and management measures have been included, as well as provision of potential offsets. The measures proposed have a high level of certainty regarding their effectiveness. The numerous assessments that have been undertaken for the proposed action have been carried out by qualified, experienced specialists, and has considered the extensive experience of DHA in undertaken residential developments with consideration for the EPBC Act.
How health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations	The proposed action will be undertaken in accordance with a range of mitigation measures (see **Section 5.0**) that are designed to reduce the potential for significant environmental impacts. Where residual impacts may occur, offsets will be provided as a compensatory measure. Offsets are required to deliver an overall conservation outcome that improves or maintains the viability of the protected matter. These measures will ensure that the health, diversity and productivity of the environment is maintained.
How the conservation of biological diversity and ecological integrity has been considered in the decision-making process,	Two detailed ecological investigations have been carried out for the proposed action (Umwelt 2018, and Umwelt 2019). These investigations discuss the ecological values of the Referral Area, including biological diversity and ecological integrity. This Preliminary Documentation describes a number of management measures that are proposed as part of the proposed action, designed to reduce adverse impacts on these ecological values, including: • Tree felling procedures; • Demarcation of conservation areas; • Weed and pest animal management measures; and • Erosion and sediment control measures. These measures are outlined in **Section 5.0.** Offsets will be provided through Biobanking Credits, prohibiting any future development on the identified areas of conservation in perpetuity. This will benefit a wide range of species (in addition to the target MNES) and will assist in the conservation of biological diversity and ecological integrity in the broader region.
How improved valuation, pricing and incentive mechanisms will be promoted.	The master plan includes a mix of housing for ADF personnel and the public. Through these mechanisms the proposed development will provide affordable housing for ADF personnel.

10.0 Outcome Based Conditions Environmental Outcomes

The Department has requested information on the outcomes that the Proponent will achieve for matters of national environmental significance (MNES). For the proposed action, this relates specifically to impacts to Koala and GHFF.

DHA propose to commit to the management measures outlined within Section 5.0 of this Preliminary Documentation Report. The Proponent commits to the following outcomes for the proposed action:

- no death or injury of threatened species during construction of the proposed action.
- the proposed action will only clear native vegetation that has been approved by the Department.
- no Aboriginal Heritage items will be impacted during construction.
- non-Aboriginal Heritage items will be restored where possible prior to operation of the proposed action to allow for public interpretation.

The Proponent understands that the Department will provide outcomes-based conditions that meet specific, measurable, achievable, realistic and timely (SMART) principles.

11.0 Monitoring and Reporting

The Proponent commits to ensuring that the proposed management and mitigation measures are implemented effectively.

The Proponent will commit to the following reporting requirements:

- fortnightly review of CEMP with Contractor during construction to determine whether management measures need to be adapted or altered to ensure effectiveness
- annual review of OEMP to ensure effectiveness and appropriateness of management measures and policies
- incidents will be reported to the Contractor Proponent during Construction. This process will be included within the CEMP
- incidents will be reported to the Property Manager and Proponent once the proposed action is operational. This process will be included within the OEMP.

The Proponent will commit to the following monitoring requirements:

- pre-clearance surveys and monitoring during clearance by an appropriately qualified ecologist to ensure no impacts to native fauna and that clearance is restricted to approved areas
- monitoring throughout construction by an appropriately qualified Aboriginal Heritage specialist to ensure no impact to known Aboriginal heritage items in accordance with the state Aboriginal Heritage Impact Permit requirements
- environmental audits to ensure management measures are being effectively implemented.

12.0 Conclusion

DHA propose to undertake a master planned residential development of the former Defence Rifle Range. The proposed action includes the rezoning, future residential development and partial divestment of 50 per cent of the proposed residential housing to the private market as well as divesting the 1.6 ha part areas to Council.

Through an iterative design process informed by specialist environmental assessments, DHA has identified a Development Footprint that is focused primarily on the area that was previously occupied by the rifle range.

A Planning Proposal (Architectus Group, 2018) was submitted by DHA in June 2017 to Port Stephens Council (PSC) for the rezoning of part of the land to R3 Medium Density Residential to allow for the concept masterplan medium density residential development while retaining the existing E2 Environmental Conservation on the remainder.

The Master Plan was amended in December 2018 and an updated Planning Proposal (Architectus Group, 2019) lodged with PSC in March 2019. DHA is working with PSC to progress the rezoning application. The Planning Proposal (PP_2019_PORTS_002_00) was determined by the Department of Planning, Industry and Environment (DPIE) on 25 November 2019 to proceed, subject to conditions, to amend the LEP to *rezone the land and enable the development of the site for medium-density residential development and to protect and conserve areas of ecological value*.

The Development Footprint would clear about 22.65 ha of which 20.16 ha (or 89 per cent) is disturbed native vegetation that has regenerated in the former Rifle Range footprint and about 2.35 ha (10 per cent) of moderate condition forest.

The moderate condition forest in the Development Footprint has been assessed as foraging habitat for the threatened koala and an important winter and spring foraging resource for the GHFF. The Referral Area does not support breeding populations of either threatened species. Assessments of the impact of the proposed action on the koala and GHFF have concluded that the proposed action is not likely to have a significant impact on either species.

The Preliminary Document has also identified and assessed the impact of the proposed action on the environment because the proposal is a Commonwealth action. This has included consideration of the impacts on landscapes and soils, water resources, plants, animals and Aboriginal and non-Aboriginal heritage values. The assessments herein have relied upon specialist studies that have informed the Planning Proposal package. Having consideration of the findings of these studies, and the commitment to avoid impacts, and implement mitigation measures both during construction and operation, the proposed action is unlikely to have a significant impact on the environment.

As the proposed action will require approval within the NSW Environmental and Planning system, DHA has opted to determine the offsetting requirements of the proposed action in accordance with the endorsed NSW State policies. Offsetting requirements have been determined in accordance with the BAM and provided in the BDAR (**Appendix 4**).

The BDAR prepared under the BAM methodology has determined offset requirements for the GHFF and the koala as 'ecosystem credit species' as the PCTs provide:

- foraging habitat of the GHFF, loss of PCT1646 – Moderate (Forest), PCT1646 – Disturbed (Forest) and PCT1725 – Moderate; and

- foraging habitat of the koala, loss of PCT1646 – Moderate (Forest), PCT1646 – Disturbed (Forest) and PCT1725 – Moderate.

No additional species credit offset requirements were required for the koala or the GHFF as targeted surveys and database searches have not established that the Development Footprint supports important habitat or breeding habitat, respectively, as defined by the BAM (refer to Appendix B in the BDAR).

As required by the Guidelines for Preliminary Documentation for EPBC 2017/7993, compliance of the proposed action with the objects of the EPBC Act as set out in Section 3 of the Act are provided in Table 12.1.

Table 12.1 Consideration of the Objects of the EPBC Act

Section 3 Objects of the Act	How considered in the proposed action
to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance	The proposed action has been designed to avoid and minimise impact on the environment and habitat for matters of national environment significance in particular habitat for the vulnerable koala and GHFF. The area of foraging habitat for both species in the Development Footprint has been minimised with 88 per cent of foraging habitat to be retained in the E2 zoned land in the Referral Area. A large portion of the retained habitat would be protected under in-perpetuity conservation through the establishment of a Stewardship site in the north, north-east of the Referral Area continuous with the Worimi Conservation Lands.
to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources	An assessment of compliance of the proposed action with the principles of ecological sustainable development is provided in Section 9. The assessment of impacts has considered both long- and short-term economic, environmental, social and equitable considerations. The precautionary principle was integral to the design and assessment of the proposed action. Where a high degree of certainty could not be achieved, the proposed action has ensured that mitigation and management measures have been included, as well as provision of potential offsets. The measures proposed have a high level of certainty regarding their effectiveness. These measures will ensure that the health, diversity and productivity of the environment is maintained.
to promote the conservation of biodiversity	The proposed action has been designed to • avoid impacting native vegetation with higher habitat and conservation values; • locate the Development Footprint in disturbed lands • retain connectivity between higher quality habitats and the adjacent conservation lands. The proposed action would retain higher value habitat in the north of the Referral Area. A large portion of the retained habitat would be protected under in-perpetuity conservation through the establishment of a Stewardship site in the north, north-east of the Referral Area continuous with the Worimi Conservation Lands.

Section 3 Objects of the Act	How considered in the proposed action
to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples	DHA has and will continue to work with government agencies, the community and local Aboriginal groups to protect and manage the environment in the Referral Area.
to assist in the co-operative implementation of Australia's international environmental responsibilities	The proposed action would not impact directly or indirectly on matters of national environmental significance defined by international environmental responsibilities. The nearby Ramsar wetland would not be impacted directly or indirectly by the proposed action.
to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity	In consultation with local Aboriginal groups, the Development Footprint was designed to avoid impacts on cultural heritage values. DHA will continue to work with local Aboriginal groups to through application for an AHIP, and provision of completion of salvage works. DHA would look to work with the Worimi Conservation Lands Board, managers of the adjacent Worimi Regional Park to identify a role for the local Aboriginal people in management of retained lands.
to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.	DHA would look to work with the Worimi Conservation Lands Board, managers of the adjacent Worimi Regional Park to identify a role for the local Aboriginal people in management of retained lands

13.0 References

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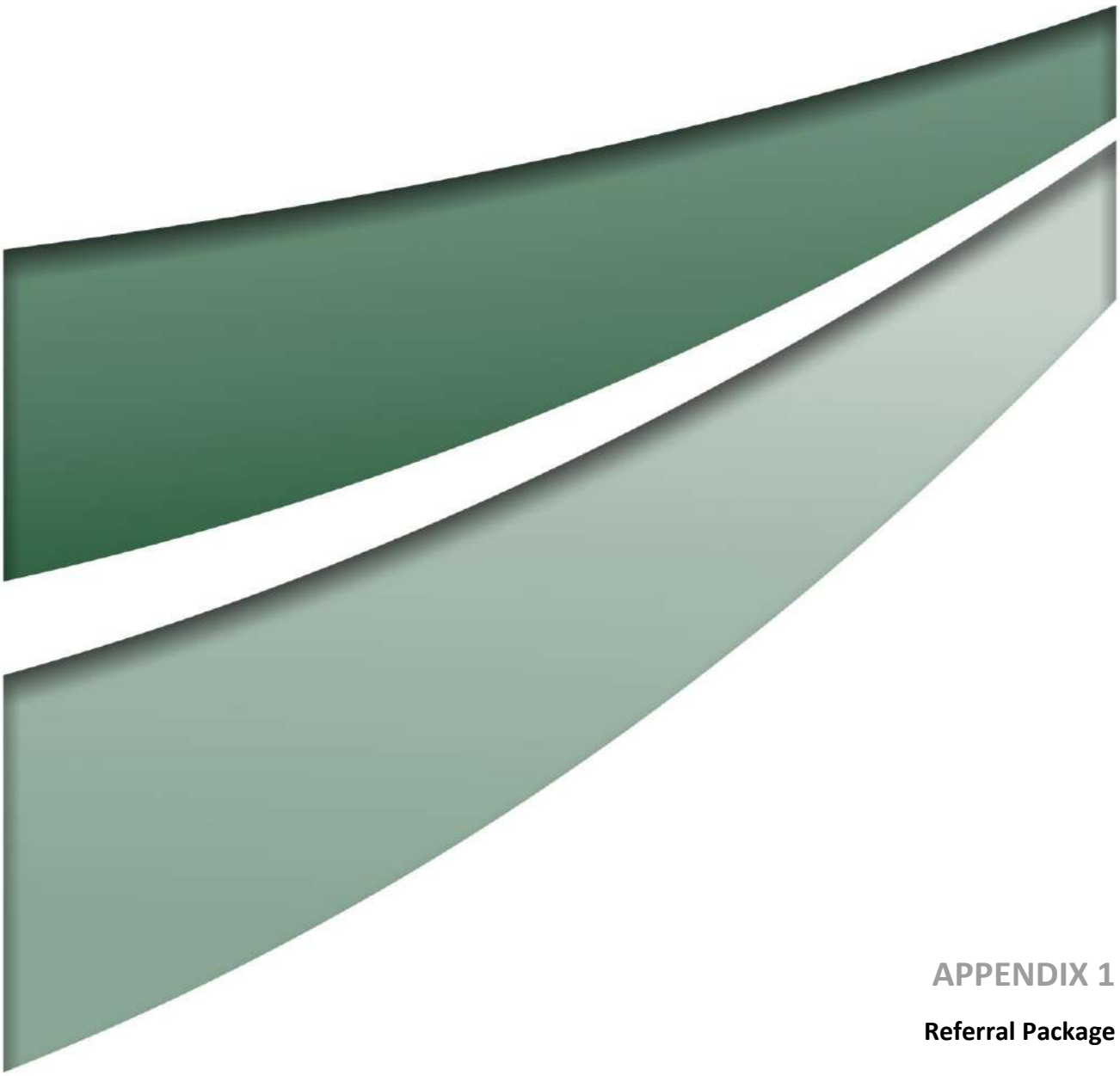

APPENDIX 1

Referral Package

Referral of proposed action

Proposed action title: Rifle Range Residential Development Proposal

1 Summary of proposed action

1.1 **Short description**

Defence Housing Australia (DHA) proposes to undertake a master-planned residential development of a former Defence site, being the Rifle Range (the Referral Area), on the Stockton peninsula north of Newcastle in New South Wales (refer to **Figure 1**). The Proposed Action includes the rezoning, future residential development and divestment of part of the land within the Referral Area from the Commonwealth.

The Proposed Action will require the rezoning of the Rifle Range site from Environmental Conservation (E2) to General Residential (R1) and National Parks and Reserve (E1) under the Port Stephens Local Environmental Plan (LEP) 2012. The proposed rezoning of the site will allow future residential development providing suitable housing for both the Australian Defence Force (ADF) personnel and the private market.

1.2 Latitude and longitude

	Longitude			Latitude		
Location Point	**Degrees**	**Minutes**	**Seconds**	**Degrees**	**Minutes**	**Seconds**
1	151	49	23	-32	52	10
2	151	49	19	-32	52	13
3	151	49	15	-32	52	16
4	151	49	14	-32	52	17
5	151	49	11	-32	52	19
6	151	49	09	-32	52	20
7	151	49	03	-32	52	24
8	151	48	57	-32	52	27
9	151	48	49	-32	52	32
10	151	48	39	-32	52	38
11	151	48	35	-32	52	41
12	151	47	48	-32	52	34
13	151	47	50	-32	52	21
14	151	47	53	-32	52	22
15	151	47	55	-32	52	21
16	151	48	10	-32	52	23
17	151	49	02	-32	52	11

1.3 **Locality and property description**

The Referral Area is located on the Stockton peninsula within the suburb of Fern Bay, approximately 4km north of Stockton town centre and 6km from Newcastle (refer to **Figure 1**). The Rifle Range site adjoins the Worimi Regional Park to the north, Stockton Beach to the east and the residential suburbs of Fern Bay and Stockton to the west and south respectively (refer to **Figure 2**).

Stockton accommodates low to medium density residential land uses with a small town centre. Newcastle city centre can be accessed from Stockton by ferry across the Hunter River, or by road. Fern Bay is a small community comprising low density residential, over 50s community living (Bayway Village, the Cove Village and Seaside) and the Newcastle Golf Course.

The site is located approximately 11km south of the Royal Australian Air Force (RAAF) Base at Williamtown.

1.4	**Size of the development footprint or work area (hectares)**	The total size of the Referral Area is approximately 112 Hectares with 18.3 hectares of disturbance.
1.5	**Street address of the site**	Popplewell Road, Fern Bay

1.6 **Lot description**

Lot 5, DP 233358

1.7 **Local Government Area and Council contact (if known)**

The Rifle Range site is located within the Port Stephens LGA. Consultation has been ongoing with Port Stephens Council.

Port Stephens Council contact:
Jeffrey Bretag
Senior Strategic Planner
Email: Jeffrey.Bretag@portstephens.nsw.gov.au

1.8 **Time frame**

A Planning Proposal for the rezoning of the Rifle Range site was submitted to Port Stephens Council in June 2017. Subject to the issue of relevant planning approvals, civil works are proposed to commence in late 2019, with housing targeted for delivery from late 2021 to 2023.

1.9	**Alternatives to proposed action**		No
		X	Yes, please also complete section 2.2
1.10	**Alternative time frames, locations or activities**	**X**	No
			Yes, you must also complete Section 2.3. For each alternative, location, time frame, or activity identified, you must also complete details in Sections 1.2-1.9, 2.4-2.7 and 3 and 5 (where relevant).
1.11	**Commonwealth, State or Territory assessment**		No
		X	Yes, please also complete section 2.5
1.12	**Component of larger action**	**X**	No
			Yes, please also complete section 2.7

1.13	**Related actions / proposals**	**X**	No
			Yes, provide details:
1.14	**Australian Government funding**	**X**	No
			Yes, please also complete section 2.8
1.15	**Great Barrier Reef Marine Park**	**X**	No
			Yes, please also complete section 3.1 (h), 3.2 (e)

2 Detailed description of proposed action

2.1 Description of proposed action

The Proposed Action involves the implementation of the concept master plan for the residential development of the Rifle Range site (refer to **Figure 1**). The Proposed Action includes the following elements:

- Rezoning of the Referral Area to provide for a mix of residential, recreation and conservation land uses;
- Development of the Referral Area for a mix of residential, recreation and conservation purposes generally in accordance with the concept master plan presented in **Figure 3**; and
- Divestment of land within the Referral Area from the Commonwealth. DHA currently owns all the land within the Referral Area, however, DHA intends to provide 50 per cent of the proposed residential housing for sale to the private market as well as divesting recreational areas to Council.

To enable the development of the Referral Area in accordance with the concept master plan, the Proposed Action will require the clearing of up to approximately 15.3 hectares of primarily disturbed native vegetation.

The Rifle Range site is currently zoned E2 Environmental Conservation under the Port Stephens LEP 2013 which allows a range of low-density development with consent. The Rifle Range was established in the early 1940s and in the past has been used as a training facility by Defence, the Police Force, school cadets and civilian rifle clubs. The site was closed by Defence in December 1997 and the site purchased by DHA in 2015 from the Department of Defence. The site is currently vacant and non-operational.

The Proposed Action seeks to rezone part of the site to R1 General Residential, while maintaining the existing E2 Environmental Conservation zone over the remainder of the site (refer to **Figure 4**). The Proposed Action allows for the rezoning of approximately 25 ha of land to R1 General Residential and retains 35 ha as E2 Environmental Conservation. The area of the site proposed to be rezoned to R1 General Residential adjoins the existing residential areas within Fern Bay and will retain the northern and eastern parts of the site as E2 Conservation Zone creating a buffer between the future residential areas of the site and the adjoining Worimi Conservation Lands and avoiding impacts to areas within the site with Aboriginal Cultural and ecological value. The proposed rezoning will facilitate the development of the site for a range of residential uses beyond those currently permitted under the current E2 Environmental Conservation zone specifically multi-dwelling housing and semi-detached dwellings.

A concept master plan has been developed for the Rifle Range site to demonstrate the future development potential (refer to **Figure 3**). The proposed Rifle Range master plan includes a range of residential development within the former Rifle Range footprint to focus development within the previously disturbed areas of the site. The residential development includes townhouses (up to 56 attached 1-3 storey dwellings), Coastal Cluster Houses (up to 113 townhouse style dwellings), Courtyard Homes (up to 40 large courtyard family homes) and Single Eco-homes (up to 26 homes with large lots). The construction and implementation of the master plan will require the clearing of vegetation, construction of housing, roads and associated infrastructure and services. The proposed master plan for the Rifle Range site indicates a maximum disturbance area of approximately 18.3 ha (approximately 16% of the total site area). This area includes approximately 15.3 ha of vegetation and 3 ha of cleared land/sand dunes. However, it should be noted that where possible vegetation will be avoided/retained particularly within the larger lots.

A site specific DCP will be developed and implemented to guide the future development of the site ensuring the future residential development enhances and protects the existing ecological and Aboriginal cultural heritage value of the site. The master plan proposes application of a maximum building height of 9m in order to control development capacity of the land and manage potential visual impact on surrounding areas. The application of a 2 ha minimum lot size to the E2 Environmental Conservation zone is also proposed to facilitate larger lots and residential development within the E2 Environmental Conservation zone ensuring the ongoing maintenance of this land in private ownership.

2.2 Feasible alternatives to taking the proposed action

Do Nothing:

DHA currently manages approximately 18,500 residences nationally, with 1,200 within the Newcastle area providing housing for ADF members posted at the Williamtown RAAF base. DHA has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle based ADF members and their families and to replace existing DHA housing stock that does not meet current standards. DHA is seeking to provide housing that is:

- Within close proximity to the Williamtown RAAF base;

- not affected by the airport ANEF contours or other unworkable site or environmental constraints; and
- Within close proximity to services and community infrastructure.

Given the current demand for suitable housing DHA do not consider the 'do nothing' option to be feasible.

Sourcing existing housing stock to meet Defence needs:

An alternative to the Proposed Action is for DHA to seek provisioning for additional housing in direct competition with the local rental market in the Newcastle and Port Stephens area. Given the limited supply for suitable housing within the target area described above, and the flow-on impacts of reducing the availability of existing housing stock and driving up the cost of accommodation, DHA does not consider this option to be feasible.

Refinement of proposed zone boundaries and master plan development:

The final layout of the proposed master plan was determined in consideration of the biodiversity, archaeological and heritage values of the Referral Area, and of the site constraints, including erosion hazard. Detailed constraints studies were undertaken to guide the design of the proposed master plan, particularly in consideration of the ecological, historic and Aboriginal values attributed to the site. Through this process, different development concepts were considered and DHA has sought to minimise the impacts associated with the proposed rezoning and future residential development. Key factors in selecting the location of the disturbance footprint for future residential development included the likely impacts on important ecological features including threatened species, threatened ecological communities (TECs) and/or their habitats. Where possible the proposed disturbance area for future residential development has been focused in areas with lower ecological value and avoids areas of high Historic and Aboriginal archaeological/cultural value. Appropriate controls on future residential development will be implemented to protect the Aboriginal archaeological and historic values of the Referral Area.

Additionally the master plan includes a range of different housing alternatives including the provision for large lots with minimal building envelopes to retain as much vegetation surrounding and within the residential lots as possible. This was considered an important mechanism particularly for the movement of species present within the Referral Area and allows for the targeted selected retention of important habitat features such a hollow-bearing trees or key foraging tree species.

2.3 Alternative locations, time frames or activities that form part of the referred action

NA

2.4 Context, including any relevant planning framework and state/local government requirements

The Proposed Action is broadly consistent with a number of local, regional and State strategic planning documents developed for the area.

The Newcastle Local Planning Strategy (2015) is a comprehensive land use strategy to guide the future growth and development of Newcastle, underpinning the Newcastle LEP 2012 and implementing the land use directions of the Newcastle 2030 Community Strategic Plan. The Proposed Action is entirely consistent with the neighbourhood vision for Stockton presented in the Local Planning Strategy and supports the key objectives for the area.

While the Local Planning Strategy presents a land use strategy for Stockton that is consistent with the Proposed Action, the current zoning of the land within the Referral Area does not permit the development envisaged by the site master plan. Therefore a planning proposal has been submitted to allow for the rezoning of land to permit the proposed master plan with development consent under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Following rezoning of the land, the future development of the Referral Area will be subject to approval under Part 4 of the EP&A Act and its regulations. This is discussed further in **Section 2.5** below.

At a regional level, the Hunter Regional Plan 2036 presents a growth strategy for the region that supports the renewal of the Referral Area to deliver a diversity of housing, serve the housing needs of the local population and support the Defence base while making the most efficient use of existing social and physical infrastructure.

The Proposed Action is considered consistent with current State Environmental Planning Policies applicable to the Referral Area, in particular, SEPP 44 – Koala Habitat Protection and SEPP 71 – Coastal Protection. Further detail of the consistency of the Proposed Action with relevant local, regional and State planning documents is provided in **Attachment A**.

2.5 Environmental impact assessments under Commonwealth, State or Territory legislation

In order for the Proposed Action to proceed, a planning proposal for the rezoning of land within the Referral Area must be prepared in accordance with Section 55 of the EP&A Act. A draft planning proposal has been submitted to Port Stephens Shire Council. Strategic planning and a technical environmental assessment of the Referral Area has been undertaken to inform the suitability of the Referral Area for housing including ecological, historic heritage, aboriginal archaeology, geotechnical, traffic,

bushfire, coastal erosion and surface water assessments. This assessment is discussed in **Section 3** and is attached to this report (refer to **Attachment A**). The assessments undertaken support the planning proposal and subsequent rezoning of the land.

If the land within the Referral Area is successfully rezoned, the future development of the land will be subject to assessment and approval under Part 4 of the EP&A Act and its regulations with Port Stephens Council being the relevant planning authorities. An appropriate level of environmental impact assessment will be required to support future applications for the development of the land under Part 4 of the EP&A Act. As part of this assessment process consideration will be required of relevant planning instruments and Development Control Plans, as well as approvals required under other Acts. The potentially relevant provisions are listed in **Table 1**.

Table 1 – Potentially Relevant NSW Planning Provisions

Planning Provision	Comment
National Parks and Wildlife (NPW) Act 1974	Aboriginal Heritage Impact Permits are required under s87 and s90 of the NPW Act for Aboriginal sites proposed to be impacted by development. While substantial efforts have been made to design the proposed master plan to avoid potential impacts on significant Aboriginal sites, it is acknowledged that archaeological material has been identified and/or predicted throughout the Referral Area as a result of the movement and redistribution of the former dunes. There is therefore the potential to impact on Aboriginal sites and an AHIP will be required for the Proposed Action. Further detail is provided in **Section 3** and **Attachment A**.
Threatened Species Conservation (TSC) Act 1995	Under the EP&A Act impacts on threatened species listed under the TSC Act are required to be assessed. An ecological assessment has been undertaken covering all threatened species listed under the TSC Act with the potential to occur within the Referral Area (refer to **Attachment A**) further detail on the ecological values relevant to the Referral Area and the ecological assessment undertaken is provided in **Sections 3** and **4.**
Heritage Act 1977	Approval is required under Section 60 of the Heritage Act to disturb an item listed on the State Heritage Register or the subject of an Interim Heritage Order. An excavation permit is required under section 140 to disturb or excavate other heritage items. No items listed on the State Heritage Register are located within the Referral Area.
State Environmental Planning Policy 44 – Koala Habitat Protection	SEPP 44 seeks to prevent Koala population decline through the requirement of plans of management for core koala habitat, encouraging the identification of core koala habitat areas and the inclusion of core koala habitat within environment protection zones. The ecological assessment (see **Attachment A**) undertaken to support the planning proposal provides an assessment against the requirements of SEPP44.
State Environmental Planning Policy 71 – Coastal Protection	The aim of this policy is to protect and manage the natural, cultural, recreational and economic attributes of the NSW coastline. A Coastal Engineering Assessment (see **Attachment A**) has been undertaken to support the planning proposal for the Proposed Action which have guided the detailed design for the proposed rezoning and future development of the site, this is discussed further in **Section 3**.

2.6 Public consultation (including with Indigenous stakeholders)

Community Consultation

Community engagement was undertaken during the development of the Planning Proposal and master plan of the Referral Area. Consultation included two community information/feedback sessions, face to face meetings, distribution of newsletters and phone/email contact. The aim of the consultation process was to inform the community about DHA, the site history, the site assessment undertaken, the planning proposal and process and to encourage community involvement throughout the approval process. Consultation was aimed at the directly adjoining residents, the Stockton and Fern Bay communities and local Community Action Groups. Generally feedback was positive based on the positive economic benefit of the Proposed Action. The community also showed concern regarding potential traffic management and parking impacts.

Indigenous Stakeholders

An Aboriginal stakeholder consultation process has been undertaken for the proposed rezoning and master plan for the Rifle Range site in accordance with the NSW Office of Environment and Heritage's Aboriginal Cultural Heritage Consultation Requirements for Proponents (Office of Environment and Heritage 2010) as part of the Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) (Umwelt 2016).

The registered Aboriginal parties for the Rifle Range site are:

a) Karuah Indigenous Corporation;

b) Mur-Roo-Ma Inc.;

c) Nur-Run-Gee Pty Ltd;

d) Worimi Local Aboriginal Land Council; and

e) Wonn1

A draft methodology for the ACHAA was provided to all Aboriginal parties for review and comment. No objections were raised with reference to the draft methodology.

Karuah Indigenous Corporation, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd and Worimi Local Aboriginal Land Council were provided with the opportunity to be involved in the pedestrian survey of the survey area. The registered Aboriginal parties that participated in the survey provided feedback as a group following the survey. This feedback is included in the ACHAA report (see **Attachment A**) and summarised in **Sections 3** and **5**.

A draft version of this ACHAA report was supplied to all the registered Aboriginal parties in January 2017 with an invitation to review the document, its mitigation and management recommendations and provide any cultural information they deemed appropriate to the preferred management of the Rifle Range site. Finalisation of the management recommendations will occur in consultation with the registered Aboriginal parties following input received on the draft ACHAA.

2.7 A staged development or component of a larger action

N/A

2.8 Related actions

N/A

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Description

The Proposed Action is not located near any World Heritage Properties. No World Heritage Properties were identified in the locality of the Referral Area in the DoE Protected Matters Search. The closest World Heritage Property occurs approximately 65 kilometres to the west of the Referral Area, being the Greater Blue Mountains Area.

Nature and extent of likely impact

The Proposed Action will not impact directly or indirectly on the World Heritage values of any World Heritage properties.

3.1 (b) National Heritage Places

Description

The Proposed Action is not located near any National Heritage Places. The closest National Heritage Place occurs approximately 65 kilometres to the west of the Referral Area, being the Greater Blue Mountains Area.

Nature and extent of likely impact

The Proposed Action will not impact directly or indirectly on the National Heritage values of any National Heritage place.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

The Referral Area does not contain any Wetlands of International Importance listed under the Ramsar convention. However, the Hunter Estuary Wetlands Ramsar Wetland of International Importance occurs within 250m to the west of the Referral Area, mapped along the edges of the northern arm of the Hunter River (refer to **Figure 1**). The Hunter Estuary Wetlands are listed internationally under the Ramsar Convention due to their unique mix of wetland types, importance for maintaining biological diversity and conservation of migratory shorebirds, including regularly supporting between 2 per cent and 5 per cent of the East Asian–Australasian Flyway population of eastern curlew (*Numenius madagascariensis*) (Australian Wetlands Database 2016).

Nature and extent of likely impact

Due to the nature of the proposed residential development and that no direct or indirect impacts are likely to occur on surrounding lands, it is unlikely that the Proposed Action would impact the Hunter Estuary Wetlands Ramsar Site.

3.1 (d) Listed threatened species and ecological communities

Description

A DoEE Protected Matters Search was undertaken to identify the range of EPBC Act threatened species and ecological communities that are predicted to occur within the Referral Area (refer to **Attachment C**). Records from this database search were assessed along with records derived through the ecological surveys of the Referral Area, literature reviews and professional opinion to identify the full range of recorded or potentially occurring EPBC Act listed threatened species and ecological communities that may occur (refer to **Attachment C**). The identification of potentially occurring threatened species and communities was then used to determine those species that would be subject to an Assessment of Significance as part of this Referral (refer to **Attachment D**).

Ecological field surveys have been carried out in the Study Area over many years and seasons including in December 2002 (Ecotone 2003), April 2007 (SMEC 2008) and October 2015 (Kleinfelder 2015). Throughout these surveys, the following has been undertaken:

- Flora surveys including four 20m x 20m quadrats
- Diurnal fauna observations including signs of presence surveys and targeted bird surveys
- Habitat assessments
- Nocturnal spotlighting, call playback and Anabat surveys and
- Reconnaissance vegetation mapping and weed mapping.

A range of additional surveys were undertaken by Umwelt in 2016. This included:

- Rapid vegetation mapping reconnaissance
- Biometric plot and transect surveys
- Habitat assessments for threatened species
- Targeted orchid surveys during the flowering period for *Diuris praecox*.
- Diurnal bird surveys
- Spot Assessment Technique (SAT) surveys for koala (*Phascolarctos cinereus*) as per Phillips and Callaghan (1995) and counting of koala feed trees
- Call playback for and koala
- Habitat tree surveys
- Spotlighting searches for nocturnal threatened fauna
- Remote camera surveys over seven nights targeting ground-dwelling threatened mammal species
- Anabat surveys over seven nights targeted threatened micro-bat species and
- Opportunistic observations.

The following EPBC Act-listed threatened species have been recorded within the Referral Area (refer to **Figure 5**):

- Potential Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*), vulnerable under the EPBC Act
- grey-headed flying-fox (*Pteropus poliocephalus*), listed as vulnerable under the EPBC Act

The following threatened species are considered to have the potential to occur within the Referral Area based on known distribution, nearby records and/or suitable habitat, however were <u>not recorded</u> during the field surveys undertaken for this assessment:

- Newcastle doubletail (*Diuris praecox*), listed as vulnerable under the EPBC Act

- regent honeyeater (*Anthochaera phrygia*), listed as critically endangered under the EPBC Act
- swift parrot (*Lathamus discolor*), listed as critically endangered under the EPBC Act
- spotted-tailed quoll (*Dasyurus maculatus maculatus*), listed as endangered under the EPBC Act
- long-nosed potoroo (*Potorous tridactylus*), listed as vulnerable under the EPBC Act
- New Holland mouse (*Pseudomys novaehollandiae*), listed as vulnerable under the EPBC Act

No threatened ecological communities listed under the EPBC Act have been recorded in the Referral Area.

Nature and extent of likely impact

The Proposed Action will result in the removal of approximately 15.3 hectares of native vegetation and habitat within the Referral Area. The majority of this impact occurs within Coastal Tea-tree – Banksia Scrub on the Rifle Range site which has been previously disturbed and modified with native and exotic groundcovers and shrubs now dominating. This community is dominated (including some areas of monospecific stands) by coastal tea-tree (*Leptospermum laevigatum*), and provides relatively low biodiversity value. Further information on the vegetation communities of the Referral Area is provided in Section 3.3(c).

Vegetation communities impacted by the Proposed Action are listed in **Table 2** and a vegetation map of the Referral Area is shown in **Figure 6**. Recent disturbance history of the Referral Area is shown in **Figure 7.**

Table 2 – Vegetation Communities in the Referral Area and Impacted by the Proposed Action

Vegetation Community	Area in the Referral Area (ha)	Area Impacted at the Rifle Range (ha) ^
Frontal Dune Blackbutt-Apple Forest	17.5	0.8
Coastal Tea-tree – Banksia Scrub	20.5	14.5
Mahogany-Baloskion Swamp Forest	2.3	0.0
Foredune Spinifex	1.4	0.0
Beach Wetlands	3.2	0.0
Total Native Vegetation	**44.9**	**15.3**
Cleared land/sand dunes	66.7	3.0
Total Non-Native Vegetation/Cleared Land	**66.7**	**3.0**
TOTAL	**111.6**	**18.3**

^under the current Master Plan

Detailed descriptions of the vegetation communities occurring within the Referral Area are provided in **Section 3.3(d)** below.

An Assessment of Significance was undertaken for the following threatened species and communities that have previously been recorded or mapped as occurring within or adjacent to the Referral Area or have the potential to occur within the Referral Area in accordance with the EPBC Act *Significant Impact Guidelines 1.1* (DoE 2013) (refer to **Attachment D**):

Critically Endangered or Endangered Species

- swift parrot (*Lathamus discolor*)
- regent honeyeater (*Anthochaera phrygia*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) SE mainland population

Vulnerable Species

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)

- rough doubletail (*Diuris praecox*)
- long-nosed potoroo (*Potorous tridactylus*)
- koala (*Phascolarctos cinereus*) combined populations of Qld, NSW and the ACT
- New Holland mouse (*Pseudomys novaehollandiae*)
- grey-headed flying-fox (*Pteropus poliocephalus*)

A summary of the Assessments of Significance (from **Attachment D**) is provided below. Those species and communities not specifically addressed below are considered unlikely to be significantly impacted as a result of the Proposed Action. Refer to **Attachment C** for a preliminary impact assessment of all EPBC Act listed threatened species and ecological communities known or predicted to occur within 10 km of the Referral Area.

Swift parrot (*Lathamus discolor*)

The swift parrot has not been recorded within the Referral Area however it has been recorded approximately 8 km north of the Referral Area near Williamtown feeding on swamp mahogany (OEH 2016). The only key foraging tree species for the swift parrot that occurs within the Referral Area is swamp mahogany (*Eucalyptus robusta*) and blackbutt (*Eucalyptus pilularis*), as outlined in the National Recovery Plan for the Swift Parrot (Saunders 2011). The Proposed Action will result in the loss of approximately 0.8 hectares of potential habitat that contains these foraging resources. The Referral Area is not known as a historical or important foraging site for the swift parrot and the species has not been recorded within the Referral Area.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of a population of these species;
- substantially reduce the area of occupancy of a population of these species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of these species;
- disrupt the breeding cycle of population of these species;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that these species is likely to decline;
- introduce a disease or result in an invasive species on site that may cause these species to decline; or
- interfere with the recovery of these species.

The Proposed Action is unlikely to result in a significant impact on the population of swift parrot. Although the Referral Area provides some small areas of potential foraging habitat for this species, it has not been recorded utilising this habitat within the Referral Area or in the immediate locality. Refer to **Attachment D** for the Assessment of Significance for swift parrot.

Regent honeyeater (*Anthochaera phrygia*)

The regent honeyeater has not been recorded within the Referral Area however it has been recorded approximately 15 km north of the Referral Area near Medowie. (OEH 2016). The only key foraging tree species for the regent honeyeater that occurs within the Referral Area is swamp mahogany (*Eucalyptus robusta*), as outlined in the National Recovery Plan for the Regent Honeyeater (DoE 2016). The Proposed Action will result in the loss of approximately 0.8 hectares of potential habitat that contains minor occurrences of swamp mahogany. The Referral Area is not known as a historical or important foraging site for the regent honeyeater and the species has not been recorded breeding or nesting within the Referral Area or the locality.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of a population of these species;
- substantially reduce the area of occupancy of a population of these species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of these species;
- disrupt the breeding cycle of population of these species;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that these species is likely to decline;
- introduce a disease or result in an invasive species on site that may cause these species to decline; or
- interfere with the recovery of these species.

The Proposed Action is unlikely to result in a significant impact on the population of regent honeyeater. Although the Referral Area provides some small areas of potential foraging habitat for this species, it has not been recorded utilising this habitat within the Referral Area or in the immediate locality. Refer to **Attachment D** for the Assessment of Significance for regent honeyeater.

Spotted-tailed quoll (*Dasyurus maculatus maculatus*)

The spotted-tailed quoll has not been recorded within the Referral Area however it has been recorded approximately 10 km north of the Referral Area near Medowie and Salt Ash. (OEH 2016). There are few recent records of this species occurring from the Port Stephens local area and no important southeast mainland populations around Port Stephens are listed in the National Recovery Plan (DELWP 2016). It is considered likely that any individuals of this species around the Referral Area would be part of a broad regional population that included the Tomaree Peninsula and the Karuah – Raymond Terrace area. The Proposed Action will result in the loss of approximately 15.3 hectares of potential habitat for the species. The Referral Area is not known as a historical or important site for the spotted-tailed quoll and no den or latrine sites have been recorded within the Referral Area or the locality.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of a population of these species;
- substantially reduce the area of occupancy of a population of these species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of these species;
- disrupt the breeding cycle of population of these species;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that these species is likely to decline;
- introduce a disease or result in an invasive species on site that may cause these species to decline; or
- interfere with the recovery of these species.

The Proposed Action is unlikely to result in a significant impact on the population of spotted-tailed quoll. Although the Referral Area provides some areas of potential habitat for this species, it has not been recorded utilising this habitat within the Referral Area or in the immediate locality. Refer to **Attachment D** for the Assessment of Significance for spotted-tailed quoll.

Earps gum (*Eucalyptus parramattensis* subsp. *decadens*)

An atypical eucalypt was recorded within the Referral Area that may be Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*). This species is known to hybridise with *Eucalyptus robusta* in the Worimi Regional Park just north of the Referral Area (Bell and Driscoll 2010). Most specimens appear closest to *Eucalyptus robusta*, and this parent seems to be the more dominant, resulting in a hybrid swarm of specimens very difficult to identify to species level (Bell and Driscoll 2010). Samples from the Referral Area sent to the Royal Botanic Gardens Sydney for formal identification showed genetic influences of *Eucalyptus robusta*, *Eucalyptus parramattensis* subsp. *decadens* and *Eucalyptus tereticornis*.

Neither the OEH profile (OEH 2016) or the approved Commonwealth conservation advice (TSSC 2014) for the species discusses the inclusion of hybrids in the listed species, however in accordance with the precautionary principle, these individuals are being assessed as the threatened species. The Recovery Plan for Earp's gum (OEH 2011) outlines the importance of the potentially distinct population (i.e. hybrid form) of Earp's gum around Fern Bay. The potential Earp's gum hybrids in the Referral Area may constitute an *important population*. The Proposed Action may result in the loss of two potential Earp's gum hybrids.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of an important population of the species;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of the species;
- introduce a disease on site for the species that may cause this species to decline; or
- interfere with the recovery of the species.

The Proposed Action may result in a short-term decrease in the local distinct population and reduce the area of occupancy of potential Earp's gum hybrids. It is likely this species can be selectively retained and replanted in the post-construction landscape. Furthermore, the hybrid of the species is known to be conserved within the adjacent Worimi Regional Park. The Proposed Action is unlikely to result in a significant impact on the important population of Earp's gum. Further investigations are required to determine the conservation status and importance of the potential population occurring within the Referral Area. Refer to **Attachment D** for the Assessment of Significance for Earp's gum.

Newcastle doubletail (*Diuris praecox*)

Newcastle doubletail was subject to targeted surveys on 8 September 2016 during the known flowering period for the species. This species was not recorded within the Referral Area, despite other known populations flowering in the locality. The species has been previously recorded in Fern Bay within 2km to the northeast of the Referral Area in similar habitats (OEH 2016). It is unlikely an *important population* of Newcastle doubletail occurs within the Referral Area. The Proposed Action will result in the loss of approximately 0.8 hectares of potential habitat for the species. The Referral Area is not known as a historical or important site for the species.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of an important population of the species;
- reduce the area of occupancy of an important population of the species;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of these species;
- disrupt the breeding cycle of an important population of the species;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that these

species is likely to decline;

- introduce a disease on site for the species that may cause this species to decline; or
- interfere with the recovery of the species.

The Proposed Action is unlikely to result in a significant impact on the local population of Newcastle doubletail. Although the Referral Area provides some areas of potential habitat for this species, it has not been recorded utilising this habitat within the Referral Area or in the immediate locality. Refer to **Attachment D** for the Assessment of Significance for Newcastle doubletail.

Long-nosed potoroo (*Potorous tridactylus tridactylus*)

Records of the long-nosed potoroo are scarce within the Newcastle-Port Stephens locality, however one record occurs from Williamtown approximately 10km north of the Referral Area. The species is known to occur in greater densities in the Barrington Top National Park to the north and the Watagans National Park to the west of the Referral Area. It is not considered that an *important population* of long-nosed potoroo occurs in the Referral Area as it has not been identified as containing a key source population either for breeding or dispersal; populations that are necessary for maintaining genetic diversity, and/or populations that are near the limit of the species' range. The Proposed Action will result in the loss of approximately 15.3 hectares of potential habitat for the species. The Referral Area is not known as a historical or important site for the species.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of an important population of the species;
- reduce the area of occupancy of an important population of the species;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of these species;
- disrupt the breeding cycle of an important population of the species;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that these species is likely to decline;
- introduce a disease on site for the species that may cause this species to decline; or
- interfere with the recovery of the species.

The Proposed Action is unlikely to result in a significant impact on the long-nosed potoroo. Although the Referral Area provides some areas of potential habitat for this species, it has not been recorded utilising this habitat within the Referral Area or in the immediate locality. Refer to **Attachment D** for the Assessment of Significance for long-nosed potoroo.

Koala (*Phascolarctos cinereus*)

The koala has not been recorded within the Referral Area, however it has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park. Koalas occurring within the Port Stephens area are likely to comprise an *important population*, by being a key source for breeding or dispersal. The Referral Area is unlikely to be core habitat for the Port Stephens koala population, however individuals may occur infrequently as they move through the landscape around Fern Bay. An assessment of koala habitat identifies that the Frontal Dune Blackbutt-Apple Forest and the Mahogany-Baloskion Swamp Forest contains some feed trees for the species as per the Approved Recovery Plan for the Koala (DECC 2008). Furthermore, an assessment using the Koala Habitat Assessment Tool in the EPBC Act Referral Guidelines for the Vulnerable Koala (DoE 2014) determines that this habitat is critical for the survival of the koala. The Proposed Action will result in the loss of approximately 0.8 hectares of habitat containing feed trees for the species, however seeks to avoid the disturbance of these resources where possible.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of an important population of the species;
- reduce the area of occupancy of an important population of the species;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of these species;
- disrupt the breeding cycle of an important population of the species;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that these species is likely to decline;
- introduce a disease on site for the species that may cause this species to decline; or
- interfere with the recovery of the species.

While the Referral Area contains preferred koala feed trees and preferred and supplementary koala habitat, this area is minimal, fragmented and the species has not been recorded at this southern extremity of the potential extent of the Port Stephens koala important population. Based on the current Master Plan, the proposed rezoning is unlikely to result in a significant impact on the koala. Refer to **Attachment D** for the Assessment of Significance for koala.

New Holland mouse (*Pseudomys novaehollandiae*)

The New Holland mouse has not been recorded within the Referral Area however it is known to occur in the Worimi Conservation Lands in similar habitats to that of the Referral Area. It is associated with heathlands and vegetation sand dunes and is found to peak in abundance 3 to 5 years following a fire. The last fire to impact the Rifle Range portion of the Referral Area occurred in late 2006 and would have likely resulted in suitable habitat for the species. The coastal dune vegetation occurring in the Port Stephens area is likely to comprise an *important population* of the species. The Proposed Action will result in the loss of approximately 15.3 hectares of potential habitat for the species.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of an important population of the species;
- reduce the area of occupancy of an important population of the species;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of these species;
- disrupt the breeding cycle of an important population of the species;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that these species is likely to decline;
- introduce a disease on site for the species that may cause this species to decline; or
- interfere with the recovery of the species.

The Proposed Action is unlikely to result in a significant impact on the New Holland mouse. Although the Referral Area provides some areas of potential habitat for this species, it has not been recorded utilising this habitat within the Referral Area. Refer to **Attachment D** for the Assessment of Significance for New Holland mouse.

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

Grey-headed flying-fox has been recorded within the Referral Area. Up to five individuals were observed foraging in the forested habitats of the Referral Area in April 2007. No flying-fox camps have been recorded in the Referral Area. The closest active camp is located approximately 5 km to the southwest of the Referral Area near Carrington (DoEE 2017). It is likely that the species utilises the Project Area as foraging habitat. In accordance with the draft National Recovery Plan for the species (DECCW 2009), all foraging habitat has the potential to be productive during general food shortages and to therefore provide a resource critical to survival for the species. The Proposed Action will result in the loss of approximately 0.8 hectares of foraging habitat for the species.

The Proposed Action is considered unlikely to:

- lead to a long-term decrease in the size of an important population of the species;
- reduce the area of occupancy of an important population of the species;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of these species;
- disrupt the breeding cycle of an important population of the species;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that these species is likely to decline;
- introduce a disease on site for the species that may cause this species to decline; or
- interfere with the recovery of the species.

The Proposed Action is unlikely to result in a significant impact on the grey-headed flying-fox. Although the Referral Area provides known foraging habitat for this species, only a small area will be impacted and this resource is part of an extensive range of habitats available in Newcastle and Port Stephens. Refer to **Attachment D** for the Assessment of Significance for grey-headed flying-fox.

3.1 (e) Listed migratory species

Description

A DoEE Protected Matters Search was undertaken to identify the range of migratory species listed under international conventions (China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA), Republic of Korea-Australian Migratory Bird Agreement (ROKAMBA) and the Bonn Convention (Bonn)) that are predicted to occur within the Referral Area (refer to **Attachment B**). Records from this database search were assessed along with records derived through the ecological surveys of the Referral Area, literature reviews and professional opinion to identify the full range of recorded or potentially occurring migratory species that may occur (refer to **Attachment C**). The identification of potentially occurring threatened species and communities was then used to determine those species that would be subject to an Assessment of Significance as part of this Referral (refer to **Attachment D**).

Ecological field surveys have been carried out in the Study Area over many years and seasons including in December 2002 (Ecotone 2003), April 2007 (SMEC 2008), October 2015 (Kleinfelder 2015) and throughout 2016 (Umwelt 2016). These surveys included diurnal bird area searches and opportunistic sightings that capture the potential occurrence of migratory bird species in the Referral Area.

The following species are considered to have the potential to occur within the Referral Area based on known distribution, nearby records and/or suitable habitat:

- little tern (*Sternula albifrons*) – Bonn Convention, CAMBA, JAMBA, ROKAMBA
- crested tern (*Thalasseus bergii*) - JAMBA
- white-throated needletail (*Hirundapus caudacutus*) – CAMBA, JAMBA, ROKAMBA
- fork-tailed swift (*Apus pacificus*) – CAMBA, JAMBA, ROKAMBA
- eastern osprey (*Pandion cristatus*) – Bonn Convention

Nature and extent of likely impact

None of the migratory species listed above have been recorded within the Referral Area, however the little tern has been previously recorded nesting in mined sand dunes along the south-western edge of the Worimi Conservation Lands. Likely habitat for the species occurs in the sandy dune habitats of the Referral Area for little tern and crested tern. Potential habitat has been identified for white-throated needletail, fork-tailed swift and eastern osprey.

The Proposed Action is not considered likely to result in a significant impact on migratory species as it will not:

- substantially modify and/or destroy an area of important habitat for a migratory species
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species and/or
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

The Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015) defines important habitat for the white-throated needletail, fork-tailed swift and eastern osprey. Important habitat for white-throated needletail includes tree hollows in tall trees on ridge tops (DoE 2015). Otherwise the species is almost entirely aerial (DoE 2015). Important habitat for fork-tailed swift includes open plains to woodland areas, however the species is almost entirely aerial (DoE 2015). Important habitat for the eastern osprey includes Bays, estuaries, along tidal stretches of large coastal rivers, mangrove swamps, coral and rock reefs, terrestrial wetlands and coastal lands of tropical and temperate Australia and off shore islands (DoE 2015).

No guidelines are available for little tern or crested tern. Little terns and crested terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches (DoE 2016). The Referral Area

contains suitable sand dune habitat to the east of the site. Little tern has been previously recorded nesting in mined dunes along the south-western edge of the Worimi Conservation Lands, however this has not been recorded within the Referral Area. While this is not expected to be impacted by the proposed rezoning, the proposed rezoning may result in increased human access to the sand dunes.

The habitats within the Referral Area for migratory species listed under international conventions are not considered to meet the criteria for important habitat. Furthermore, the proposed rezoning will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species; or result in an invasive species that is harmful to migratory species becoming established within the Referral Area.

The proposed rezoning is unlikely to result in a significant impact on any migratory species listed under the EPBC Act or international conventions. Refer to **Attachment D** for the Assessment of Significance for migratory species.

3.1 (f) Commonwealth marine area

Description

The Proposed Action is not located near any Commonwealth Marine Areas. The closest Commonwealth Marine Area occurs approximately 6.5 kilometres to the east of the Referral Area, in the Tasman Sea.

Nature and extent of likely impact

The Proposed Action will not impact directly or indirectly on any Commonwealth Marine Areas.

3.1 (g) Commonwealth land

Description

The land within the Referral Area is owned by the Commonwealth and therefore the Proposed Action will be undertaken on Commonwealth land. As the Proposed Action will be undertaken on Commonwealth land by a Commonwealth Agency, the nature and extent of likely impact on the whole environment has been assessed in accordance with the Significant Impact Guidelines 1.2 – Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth Agencies. A description of the environment of Commonwealth Land is provided in **Section 3.3**.

Nature and extent of likely impact

The impacts to the of environment on Commonwealth Land have been assessed using the self-assessment process and significant impact criteria outlined in policy statement titled Significant Impact Guidelines 1.2 Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies DOE (2013) (SIG 1.2). The terms 'unlikely', 'may' and 'likely' have been adopted to describe the likelihood of impacts. **Table 3** below provides an assessment of the Proposed Action against the SIG 1.2.

Table 3 – Nature and Extent of Likely Impacts on the Whole of the Environment

Will the Action...	Likelihood of Impact	Discussion / Potential Impact
Landscapes and Soils		
substantially alter natural landscape features	Unlikely	The proposed master plan has been developed with consideration of the key natural landscape features of the Referral Area, including avoiding development on the coastal ridgetop, maintaining the majority of the Referral Area (approximately 80 per cent) for conservation and recreation land, establishment of appropriate setback from the adjoining coastal dune area and preservation of the key environmental and heritage values of the site. Building heights will be restricted to protect visual amenity and existing view corridors to the coast will be maintained from key heritage features. The master plan is in keeping with the existing built environment surrounding the Referral Area which adjoins the existing residential suburbs of Fern Bay and Stockton. Given the proposed residential development will not require significant excavation or changes to the existing landform, and having consideration to the sensitivity of the design of the master plan, it is considered unlikely that the Proposed Action will substantially alter the natural landscape features of the Referral Area.
cause subsidence, instability or substantial erosion, or	Unlikely	The soil conditions within the Referral Area predominantly comprise sand and are therefore susceptible to erosion generally caused by wind or water. However, no signs of deep seated instability are present within the Referral Area. Geotechnical investigations undertaken to support the planning proposal confirm that the site is suitable for residential development, with the implementation of an appropriate erosion and sediment controls. Erosion and sediment control measures will be implemented through a Construction Environmental Management plan (CEMP) and further geotechnical investigations will be undertaken during the detailed design phase for the future residential development to confirm the design and implementation of permanent erosion and sediment control measures.

involve medium or large-scale excavation of soil or minerals?	Likely	Medium or large-scale excavation of soils is unlikely to be required to enable the implementation of the master plan. Small-scale excavation will be required for the construction of roads, services, stormwater management structures and building footings for individual residential developments. Earthworks will be minimized through a requirement for raised buildings rather than slab design. Detailed design will include further geotechnical assessment including stability and erosion and sediment control.
Coastal Landscapes and Processes		
alter coastal processes, including wave action, sediment movement or accretion, or water circulation patterns	Unlikely	The Referral Area extends to the shoreline of Stockton Beach which is subject to coastal hazards, however no residential development is proposed to be located within the coastal dune system. A Coastal Engineering assessment was undertaken to support the planning proposal which confirms all residential development in the proposed master plan will be located landward of the 2100 'unlikely' erosion hazard line. The Proposed Action is therefore unlikely to alter coastal processes.
permanently alter tidal patterns, water flows or water quality in estuaries	Unlikely	The Referral Area is located approximately 250 metres east of the Hunter estuary, however due to the nature of the proposed residential development and that no direct or indirect impacts are likely to occur on surrounding lands, it is unlikely that the Proposed Action would permanently alter tidal patterns, water flows or water quality in the estuary.
reduce biological diversity or change species composition in estuaries, or	Unlikely	The Referral Area is located approximately 250 metres east of the Hunter estuary, however due to the nature of the proposed residential development and that no direct or indirect impacts are likely to occur on surrounding lands, it is unlikely that the Proposed Action would reduce biological diversity or change species composition in the estuary.
extract large volumes of sand or substantially destabilise sand dunes?	Unlikely	The Referral Area extends to the shoreline of Stockton Beach and incorporates the associated dune system, which is subject to coastal hazards. All residential development proposed as part of the master plan will be located landward of the 2100 'unlikely' erosion hazard line. The Proposed Action does not involve the extraction of large volumes of sand. Given the location of the proposed development landward of the 2100 'unlikely' erosion hazard line, the Proposed Action is considered unlikely to destabilise the adjoining sand dunes.
Ocean Forms, Ocean Processes and Ocean Life		
reduce biological diversity or change species composition on reefs, seamounts or in other sensitive marine environments	N/A	The proposal is not located in an ocean or marine area.

alter water circulation patterns by modification of existing landforms or the addition of artificial reefs or other large structures		
substantially damage or modify large areas of the seafloor or ocean habitat, such as sea grass		
release oil, fuel or other toxic substances into the marine environment in sufficient quantity to kill larger marine animals or alter ecosystem processes, or		
release large quantities of sewage or other waste into the marine environment?		
Water Resources		
measurably reduce the quantity, quality or availability of surface or ground water	Unlikely	Stormwater modelling undertaken indicates stormwater can be appropriately managed and treated without impacting on or reducing existing surface water or groundwater systems.
channelise, divert or impound rivers or creeks or substantially alter drainage patterns, or	Unlikely	There are no rivers, creeks or drainage channels located within the Referral Area. Stormwater modelling indicates drainage will follow existing routes following future residential development of the Referral Area and stormwater can be appropriately managed and treated without impacting existing drainage patterns.
measurably alter water table levels?	Unlikely	No alterations to groundwater levels are likely as a result of the Proposed Action.
Pollutants, Chemicals, and Toxic Substances		
generate smoke, fumes, chemicals, nutrients, or other pollutants which will substantially reduce local air quality or water quality	Unlikely	The Proposed Action may result in very minor and temporary generation of smoke/fumes from the construction machinery, which are unlikely to substantially reduce local air quality. Appropriate erosion and sediment control measures will be established as part of the CEMP process in order to protect local water quality during construction. The long term use of the site for residential, recreational and conservation land uses is unlikely to substantially reduce local air or water quality.
result in the release, leakage, spillage, or explosion of flammable, explosive, toxic, radioactive, carcinogenic, or mutagenic substances, through use, storage, transport, or disposal	Unlikely	The Proposed Action will not utilise, store, transport or dispose of flammable, explosive, toxic, radioactive, carcinogenic, or mutagenic substances.

increase atmospheric concentrations of gases which will contribute to the greenhouse effect or ozone damage, or	Unlikely	While greenhouse gases will be generated from the use of the construction vehicles, this is unlikely to increase atmospheric concentrations of greenhouse gases or ozone depleting substances.
substantially disturb contaminated or acid-sulphate soils?	Unlikely	The Referral Area has been subject to previous contamination investigations and remediation works associated with the former Defence use of the site. The Rifle Range site has been subject to a site audit processes and is considered suitable for the proposed residential, recreation and conservation land uses, subject to implementation of a Site Environmental Management Plan. Site Audit Statements for each site are provided in **Attachment A**. Given that earthworks for the Proposed Action will be undertaken in accordance with the Site Environmental Management Plan, the likelihood of substantial disturbance to contaminated soils is considered to be low. Geotechnical investigations undertaken within the Referral Area indicate that acid sulphate soil conditions are not present or expected within the Referral Area.
Impacts on Plants		
involve medium or large-scale native vegetation clearance	Unlikely	The Proposed Action may require the removal of up to approximately 15.3 ha of native vegetation, which represents approximately 14% of the total area of the site. It should be noted that where possible this vegetation will be retained particularly within the larger proposed residential lots. As the proposed rezoning has focused on the retention of as much intact vegetation as possible, the impacts to local biodiversity are expected to be minimal. It is considered unlikely that the potential redevelopment of the site for residential uses would result in a substantial impact on flora species and communities occurring within the Referral Area (refer to **Attachment A**).
involve any clearance of any vegetation containing a listed threatened species which is likely to result in a long-term decline in a population or which threatens the viability of the species	Unlikely	One threatened flora species listed under the EPBC Act has been recorded within the Referral Area, being potential Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*). The proposed action may result in the disturbance of two Earp's gum hybrids. The assessment of significance in **Attachment D** concludes that the proposed rezoning is unlikely to result in a significant impact on the species of Earp's gum across its range, however further investigations should be undertaken into the conservation status and importance of the potential distinct population occurring within the Referral Area.
introduce potentially invasive species	Unlikely	The CEMP to be implemented during the construction phase will include requirements for weed and pest management.
involve the use of chemicals which substantially stunt the growth of native vegetation, or	Unlikely	No chemical use for plant control is proposed.

involve large-scale controlled burning or any controlled burning in sensitive areas, including areas which contain listed threatened species?	Unlikely	No large-scale controlled burning is proposed across the Referral Area. Discussions are ongoing with the Rural Fire Service and the Worimi Local Aboriginal Land Council to explore the possibility of incorporating the northern area of the Rifle Range into the controlled burning regime of the adjacent Worimi Regional Park. Asset Protection Zones will be maintained around the proposed residential development and have been assessed as part of the disturbance area of the proposed action.
Impacts on Animals		
cause a long-term decrease in, or threaten the viability of, a native animal population or populations, through death, injury or other harm to individuals	Unlikely	The Proposed Action may require the removal of up to approximately 15.3 ha of native vegetated habitat, which represents approximately 14% of the total area of the site. As the proposed rezoning has focused on the retention of as much intact vegetation higher quality habitat as possible, the impacts to local biodiversity are expected to be minimal. It is considered unlikely that the potential redevelopment of the site for residential uses would result in a substantial impact on fauna species and communities occurring within the Referral Area (refer to **Attachment A**). Additionally, pre- clearance surveys for fauna within the project footprint. This should largely prevent harm to native fauna, and therefore the Proposed Action is unlikely to cause a decline in a species as a result of harm to individuals.
displace or substantially limit the movement or dispersal of native animal populations	Unlikely	The Proposed Action will result in the removal of approximately 15.3 hectares of disturbed native vegetation that currently provides habitat for fauna. The Proposed Action has however been designed to maintain substantial areas of conservation land and connectivity with surrounding vegetated land, in particular to the forested Worimi conservation lands to the north of the Rifle Range site. Connectivity from the south of the Referral Area to Stockton is currently highly fragmented as a result of previous residential and urban development and the proposed rezoning is unlikely to displace or substantially limit the movement or dispersal of native animal populations.
substantially reduce or fragment available habitat for native species;	Unlikely	The Proposed Action will result in the removal of approximately 15.3 hectares of disturbed native vegetation that currently provides habitat for fauna. The Proposed Action has been designed to maintain substantial areas of conservation land and connectivity with surrounding vegetated land both within and adjacent to the Referral Area. The Referral Area is previously disturbed and the proposed master plan incorporates the implementation of larger lots and retention of vegetation where possible, the Proposed Action is unlikely to fragment existing habitat.

reduce or fragment available habitat for listed threatened species which is likely to displace a population, result in a long-term decline in a population, or threaten the viability of the species	Unlikely	An assessment of the potential for the Proposed Action to reduce or fragment the habitat for listed threatened species has been undertaken is provided in the Assessments of Significance outlined in **Attachment D**. The assessment concluded that based on the proposed master plan the Proposed Action is unlikely to displace a population, result in a long-term decline in a population, or threaten the viability of threatened species occurring or likely to occur in the Referral Area.
introduce exotic species which will substantially reduce habitat or resources for native species, or	Unlikely	The CEMP to be implemented during the construction phase will include requirements for weed and pest management.
undertake large-scale controlled burning or any controlled burning in areas containing listed threatened species?	Unlikely	No large-scale controlled burning is proposed across the Referral Area. Discussions are ongoing with the Rural Fire Service and the Worimi Local Aboriginal Land Council to explore the possibility of incorporating the northern area of the Rifle Range into the controlled burning regime of the adjacent Worimi Regional Park. Asset Protection Zones will be maintained around the proposed residential development and have been assessed as part of the disturbance area of the proposed action.
Impacts on People and Communities		
substantially increase demand for, or reduce the availability of, community services or infrastructure which have direct or indirect impacts on the environment, including water supply, power supply, roads, waste disposal, and housing	Unlikely	Servicing investigations undertaken indicate the future residential development of the Referral Area can be adequately serviced by the surrounding infrastructure and will not impact on demand or reduce availability of services.
affect the health, safety, welfare or quality of life of the members of a community, through factors such as noise, odours, fumes, smoke, or other pollutants	Unlikely	Noise, dust and fumes are unlikely to be generated from the Proposed Action to an extent that they affect the health, safety, welfare or quality of life of members of the community.
cause physical dislocation of individuals or communities, or	Unlikely	The Referral Area is currently unoccupied. No individuals or communities will be relocated as a result of the Proposed Action.
substantially change or diminish cultural identity, social organisation or community resources?	Unlikely	The Proposed Action has been designed to be sympathetic to the existing character of the Stockton area in its scale, diversity of dwellings and landscape character. The proposed master plan will enhance public access to the coast and provide recreational opportunities for the local community and visitors to the area. The Proposed Action is therefore unlikely to adversely affect the cultural or social identity of the surrounding communities.
Impacts on Heritage		

permanently destroy, remove or substantially alter the fabric (physical material including structural elements and other components, fixtures, contents, and objects) of a heritage place	Unlikely	The Rifle Range site has no associated heritage listings however two items with some heritage significance are present on site including the Links Anti-Aircraft Battery (Links Battery) located near the northern boundary of the site and the remnants of the 1000yd Firing Range (semi cleared tracks extending south from the central track at 100 yard intervals).
involve extension, renovation, or substantial alteration of a heritage place in a manner which is inconsistent with the heritage values of the place	Unlikely	No heritage items at the Rifle Range site meet the threshold for the Commonwealth Heritage list.
involve the erection of buildings or other structures adjacent to, or within important sight lines of, a heritage place which are inconsistent with the heritage values of the place	Unlikely	No heritage items at the Rifle Range site meet the threshold for the Commonwealth Heritage list. It is also considered that the proposed zone layout and building height restrictions will ensure the future residential development of the site will not visually dominate or detract from the Stockton Beach Dune System.
substantially diminish the heritage value of a heritage place for a community or group for which it is significant	Unlikely	The Rifle Range site has no associated heritage listings however two items with some heritage significance are present on site including the Links Anti-Aircraft Battery and the remnants of the 1000yd Firing Range. The Links Battery is located within the E2 Environmental Conservation zoning which will not facilitate any further residential development than that permissible under existing planning controls. The proposed lot and access layout for the site indicated by the master plan provides for the interpretation of the original firing range markers. It is considered that the heritage interpretation in the context of future residential development within this area of the site would be more effective in communicating the sites former use than the retention of 1000yd Firing Range in its current condition.
substantially alter the setting of a heritage place in a manner which is inconsistent with the heritage values of the place, or	Unlikely	The proposed works would not alter the setting of the Rifle Range site in relation to the heritage values for which it is recognised.
substantially restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site?	Unlikely	The heritage values of the Referral Area relate to its past use for Defence purposes. The Referral Area is currently unoccupied and not utilised as a cultural or ceremonial site.

As outlined in **Table 3** above, the Proposed Action is unlikely to result in a significant impact on the whole of the environment on Commonwealth Land, or as a result of an action by a Commonwealth agency.

3.1 (h) The Great Barrier Reef Marine Park

Description

The Great Barrier Reef Marine Park is not in the vicinity of the Referral Area.

Nature and extent of likely impact

The Proposed Action will not impact directly or indirectly on the Great Barrier Marine Park.

3.1 (i) A water resource, in relation to coal seam gas development or large coal mining development

Description

The Proposed Action is not a coal seam gas or large coal mining development.

Nature and extent of likely impact

The Proposed Action is not a coal seam gas or large coal mining development and will not result in any direct or indirect impacts to any water resources under those categories of development.

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	**Is the proposed action a nuclear action?**	**X**	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (b)	**Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?**		No
		X	Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

The Proponent of the Proposed Action is DHA, a Commonwealth agency. An assessment of the nature and extent of the likely impact of the Proposed Action on the whole environment is provided in **Table 3** in **Section 3.1(g)**. A description of the environment is provided in **Section 3.3**.

As outlined in **Table 3**, the Proposed Action is unlikely to result in significant impact to the whole of environment on Commonwealth Land, or as a result of an action by a Commonwealth agency.

3.2 (c)	**Is the proposed action to be taken in a Commonwealth marine area?**	**X**	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))		

3.2 (d)	**Is the proposed action to be taken on Commonwealth land?**		No
		X	Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))		

The impacts to the whole of environment have been assessed using the self-assessment process and significant impact criteria outlined in SIG 1.2. **Table 3** in **Section 3.1(g)** provides an assessment of the Proposed Action against the SIG 1.2.

As outlined in **Table 3**, the Proposed Action is unlikely to result in significant impact to the whole of environment on Commonwealth Land, or as a result of an action by a Commonwealth agency.

3.2 (e)	**Is the proposed action to be taken in the Great Barrier Reef Marine Park?**	**X**	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))

3.3 Description of the project area and affected area for the proposed action

3.3 (a) Flora and fauna

Flora

A total of 89 flora species have been recorded across the Referral Area following floristic surveys undertaken by SMEC (2008), Kleinfelder (2015) and Umwelt. Plants were recorded from two major vascular plant classes, being flowering plants (Magnoliopsida) and ferns (Filicopsida) and included trees, shrubs, forbs, grasses, sedges, rushes, reeds and ferns. A total of 37 plant families were recorded. Poaceae (grasses) was the most well-represented family with 16 species recorded, followed by Myrtaceae (myrtles and eucalypts) with 10 species, Fabaceae (Faboideae) (pea flowers) with 9 species recorded.

Of the 89 species recorded, 22 (25 per cent) were introduced species. Dominant introduced species recorded include bitou bush (*Chrysanthemoides monilifera*), cotton bush (*Gomphocarpus fruticosus*), prickly pear (*Opuntia stricta*), lantana (*Lantana camara*), pampas grass (*Cortaderia selloana*) and kidney weed (*Hydrocotyle bonariensis*).

Floristic diversity of the Referral Area is regarded as low to moderate. It is considered likely that floristic diversity is representative of similar disturbed coastal vegetation occurring widely across the Newcastle and Port Stephens coastline.

One EPBC Act-listed threatened flora species, potential Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*) was recorded in habitats adjacent the Rifle Range portion of the Referral Area during the surveys undertaken by Umwelt in 2016.

Fauna

Several general fauna habitat types occur in the Referral Area. Each of these broad habitat types has a range of characteristics which influence the habitat value, and the range of fauna species that are likely to be identified within each type. The broad habitat types recorded within the Referral Area consist of forest, shrubland and dune spinifex/wetland habitat.

A total of 51 fauna species have been recorded in the Referral Area and surrounds during the surveys undertaken for this assessment. This included 37 bird species, 2 reptile species, 2 amphibian species and 10 mammal species. Of these recorded species, 5 (10%) were introduced species (mammals and birds). Commonly recorded species observed in the forest and shrubland habitats include laughing kookaburra (*Dacelo novaeguineae*), grey butcherbird (*Cracticus torquatus*), red-browed finch (*Neochmia temporalis*), red wattlebird (*Anthochaera carunculata*) and swamp wallaby (Wallabia bicolor). Introduced fauna species observed within the Study Area include feral cat (*Felix catus*), red fox (*Vulpes vulpes*) and the European rabbit (*Oryctolagus cuniculus*).

No EPBC Act-listed threatened fauna species have been recorded in the habitats of the Referral Area during the surveys.

3.3 (b) Hydrology, including water flows

Surface Water

The Referral Area is located on a sand spit between the Pacific Ocean and the south arm of the Hunter River. No rivers, creeks or drainage channels are located within the referral area. The Rifle Range site has a gentle fall from east to west with a slight tilt to the north. Site runoff from the southern area of the site currently drains north towards low lying areas located between the dune system to the north east of the site and to the north of the site and infiltrates the sand substrate. The site is underlain by an unconfined aquifer, which the site recharges through infiltration.

Future residential development of the Referral Area has the potential to increase the impervious area and rate of stormwater discharge. A Stormwater Management Plan has been prepared for the Rifle Range site by ADW Johnson (2016) (see **Attachment A**) to support the planning proposal. Specifically the stormwater management plan addresses stormwater quantity and quality applicable to future residential development. The plan assesses the impacts of the residential development on the existing drainage regime, determine the stormwater discharge constraints and identify proposed stormwater device measures to adequately treat the stormwater prior to discharging to receiving waters.

The proposed master plan has been designed to achieve water cycle management objectives. This process is known as Water Sensitive Urban Design (WSUD) with the protection of the waterways and management of stormwater within the landscape being key design principles.

The conceptual stormwater system designed for the Proposed Action will not change the existing drainage patterns for the site. Following development, runoff from the Rifle Range site will continue to drain to the low lying areas of the site to the north and infiltrate into the existing sand substrate within the site limits. Stormwater modelling indicates there is sufficient available infiltration zone within the Rifle Range site to cater for the area proposed for residential development as per the master plan (ADW Johnson 2016).

A MUSIC model was used to simulate pollutant source elements for the concept master plan to confirm that stormwater could be adequately treated within the limits of the Referral Area. The results from this study demonstrate that there is adequate capacity within the Referral Area to achieve the required performance objectives for stormwater management (ADW Johnson 2016).

Groundwater

Geotechnical assessments undertaken within the Referral Area included the establishment of test pits and bores across the Referral Area. No groundwater was observed within any of the geotechnical pits or bores while they remained open within the Referral Area. Two existing piezometers at the Rifle Range site were dipped for groundwater, the results indicate that free groundwater was present at Well A at 1.3m depth, with a well depth of 2.25m (Douglas Partners 2016). It is noted that groundwater levels are affected by factors such as climatic conditions and soil permeability and detailed assessment based on the level of excavation proposed for future residential development will be undertaken.

3.3 (c) Soil and Vegetation characteristics

Soil Characteristics

The Referral Area is located within the Stockton Coastal Dune system and underlain by Quaternary coastal sand soil type identified by the NSW Coalfields 1:100 000 geology map. Soils are predominantly rudosols and tenosols (siliceous or calcareous sands), podosols and organosols. Test pits across the Referral Area generally observed medium dense to dense sand across the site, with some observations of fill material present in some locations.

The Referral Area has been subject to previous contamination assessment and remediation works associated with the previous Defence land uses, including the excavation and/or removal of Defence waste (spent bullets), asbestos, building waste and illegally dumped general waste. Following the completion of remediation works, Site Audit Statements have been prepared for the site under the *NSW Contaminated Land Management Act 1997* (refer to **Attachment A**). A Site Audit Statement confirm that the site is suitable for the residential and recreational land uses proposed under the master plan, subject to implementation of a Site Environmental Management Plan.

Acid sulphate soil testing within the Referral Area undertaken by Douglas Partners (refer to **Attachment A**), indicate the absence of acid sulphate soils within the Referral Area.

Vegetation Characteristics

Five native vegetation community types have been mapped within the Referral Area, being:

- Frontal Dune Blackbutt-Apple Forest
- Coastal Tea-tree – Banksia Scrub
- Mahogany-Baloskion Swamp Forest
- Foredune Spinifex and
- Beach Wetlands

One exotic vegetation community type has been mapped within the Referral Area, being:

- Bitou Bush-dominated Scrub.

These vegetation communities are mapped on **Figure 6**, and described further below.

Frontal Dune Blackbutt-Apple Forest

This vegetation community occurs on the Holocene sands along the Stockton Bight coastline where there is protection from direct coastal winds. This vegetation community is primarily located in the northern and southern portions of the Referral Area (refer to **Figure 6**). The community extends into the north within Worimi Regional Park and within the Worimi Conservation Lands. The canopy is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis*) with occasional occurrences swamp mahogany (*Eucalyptus robusta*) (refer to **Plate 1**). The midstorey was dominated by old man banksia (*Banksia serrata*), Sydney golden wattle (*Acacia longifolia*) and coastal tea-tree (*Leptospermum laevigatum*), with occasional coast banksia (*B. integrifolia*). The ground cover consisted primarily of bracken fern (*Pteridium esculentum*) with raspwort (*Gonocarpus teucrioides*), blady grass (*Imperata cylindrica*) and kangaroo grass (*Themeda triandra*) also present. The exotic bitou bush (*Chrysanthemoides monilifera*) and lantana (*Lantana camara*) also occur in this community.

Plate 1

Frontal Dune Apple-Blackbutt Forest in the Referral Area.

Coastal Tea-tree – Banksia Scrub

This vegetation community occurs as a shrubland and is likely to be derived from the Frontal Dune Blackbutt-Apple Forest occurring in the Referral Area (refer to **Figure 6**). Historical disturbances from the former use of the Rifle Range have modified this community with groundcovers and shrubs now dominating at the Referral Area. The vegetation in this community is relatively young, with historic aerial photography indicating that this community was majority cleared and sparse in 2004 (13 years ago) (refer to **Figure 7**). Clearance activities in this community have also occurred as recently as 2010 (refer to **Figure 7**).

This community is primarily dominated by coastal tea-tree with occurrences of coastal wattle (*Acacia longifolia* subsp. *sophorae*) and coast banksia. The native groundcover consisted primarily of pig face (*Carpobrotus glaucescens*), spiny-headed mat-rush (*Lomandra longifolia*) and dune fan flower (*Scaevola calendulacea*). The exotic bitou bush and lantana also occur in this community. Disturbance of this community is varied with some areas recently cleared with sparse vegetation cover and other areas presenting dense coastal tea-tree stands (refer to **Plate 2**).

Plate 2

Coastal Tea-tree – Banksia Scrub in the Referral Area.

Mahogany-Baloskion Swamp Forest

This vegetation community occurs on a low lying area in the west of the Referral Area (refer to **Figure 6**), and is located either side of the Frontal Dune Blackbutt-Apple Forest resulting in ecotonal influences. This community is characterised by a canopy of swamp mahogany with occurrences of likely hybrids of swamp mahogany and Earp's gum (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*). Common midstorey species include coast teatree, tantoon (*Leptospermum polygalifolium*), tree broom-heath (*Monotoca elliptica*) and common fringe-myrtle (*Calytrix tetragona*). The native groundcover is dominated by pomax (*Pomax umbellata*), spiny-headed mat-rush, blue flax-lily (*Dianella caerulea*) and bracken fern (refer to **Plate 3**).

Plate 3

Mahogany-Baloskion Swamp Forest in the Referral Area.

Foredune Spinifex

This vegetation community occurs on the incipient foredunes on the far eastern sections of the Referral Area (refer to **Figure 6**). This community occurs sporadically along the mobile sands of Stockton Bight, and is characterised by the colonising, sand-stabilising grass *Spinifex sericeus*. These are often temporary communities found growing on mobile sand deposits such as beach foredunes and dune blowouts. Beach spinifex grassland is found across beach strands in New South Wales. The dominant species in this community is hairy spinifex (*Spinifex sericeus*) with patches of bitou bush (refer to **Plate 4**). In some patches, bitou bush appears to be threatening the persistence of the spinifex community.

Plate 4

Foredune Spinifex in the Referral Area.

Beach Wetlands

This community occurs within depressions along the dune system within the Referral Area (refer to **Figure 6**). Beach wetlands form where fresh groundwater meets the surface, typically at the foot of larger sand dunes, and allows simple ecosystems of perennial and ephemeral wetland species to survive (refer to **Plate 5**). A range of floristic variations of this community are known to occur along Stockton Beach. This vegetation community occurs as two variants within the Referral Area, the first being *Carex* meadows, which is dominated by *Carex pumila*, occasional *Ficinia nodosa* and the exotic *Hydrocotyle bonariensis*. The second variant includes *Ficinia* reedlands, dominated by *Ficinia nodosa*, *Juncus pallidus*, *Hydrocotyle bonariensis* with wetland margins containing coast banksia and bitou bush.

Plate 5

Beach Wetlands in the Referral Area.

3.3 (d) Outstanding natural features

There are no outstanding natural features within the Referral Area or in its immediate vicinity.

3.3 (e) Remnant native vegetation

The Referral Area is surrounded by residential development and conservation lands including housing to the west of Popplewell Road, coastal dunes to the east and the Worimi Regional Park adjoining the northern portion of the Referral Area. The Worimi Regional Park constitutes part of the wider Worimi Conservation Lands that provide an important habitat link within a broader wildlife corridor from the Hunter Wetlands National Park in the northwest, Tomaree National Park and Tilligerry State Conservation Area in the north. The majority of the Worimi Conservation Lands are dominated by blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*) forests (OEH 2015). Connectivity from the Worimi Conservation Lands to the south of the Referral Area is currently severed by urban development and historic disturbances.

Vegetation in the Referral Area has been subjected to several human disturbances including activities associated with the active use of the Rifle Range, vehicle recreation, illegal dumping and activities associated with the use of the site in World War II and Defence training activities. These disturbances have led to a reduction in vegetation condition, particularly within the former firing mounds and on the dune system. Retained vegetation in the Referral Area adjoins the Worimi Regional Park and represents the highest quality vegetation and habitats on the site. Fauna habitats in the locality include forests, coastal sand scrub and sand dunes.

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

The Referral Area ranges in elevation from approximately RL2.0m AHD to approximately 7.0m AHD with the dune system to the east extending up to approximately 16m AHD.

3.3 (g) Current state of the environment

The Referral Area has been subject to significant clearing and disturbance associated with previous Defence use and is located on a sand spit which is particularly susceptible to erosion.

Erosion

Geotechnical investigations were undertaken by Douglas Partners to support the planning proposal for the Referral Area (see **Attachment A**). The subsurface conditions present predominately comprise sand, which is susceptible to erosion from wind and water. There are, however, no obvious signs of deep seated instability within the Referral Area.

Coastal Erosion

The Referral Area extends to the shoreline of Stockton Beach which is subject to coastal hazards including erosion, dune stability and reduced foundation capacity, wave overtopping and sand drift.

Changes to the coastal system to the east of the Rifle Range site has been investigated to assess the potential impacts of short and long term erosion, sea level rise, and ongoing recession. The Rifle Range site residential development footprint indicated on the master plan is at least 200m from the 2100 'unlikely' coastal erosion hazard line, with habitable buildings within the residential zones even further westward at least 350 from this hazard line.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

The Rifle Range site has no associated heritage listings however two items with some heritage significance are present on site including the Links Anti-Aircraft Battery (Links Battery) located near the northern boundary of the site and the remnants of the 1000yd Firing Range (semi cleared tracks extending south from the central track at 100 yard intervals). The site is also located in the general vicinity of the Stockton Beach Dune System (item 34) identified in the Port Stephens LEP 2013.

An HIS was prepared by Urbis (see **Attachment A**) to assess the heritage impact of the Proposed Action on the identified heritage values associated with the site.

The Links Battery is located within the E2 Environmental Conservation zoning which will not facilitate any further residential development than that permissible under existing planning controls. The HIS considers the Links Battery to constitute the only remnant built fabric with a connection to the sites historic use, and the application of the proposed zoning across the site and the proposed maximum building height will ensure that the Proposed Action does not visually dominate or detract from the remnant of the Links Battery.

The Proposed Action will facilitate the future development of the 1000yd Firing Range area for residential purposes. The 1000yd Firing Range consists of a series of semi cleared tracks at 100 yard intervals across the site (there is no built fabric remnant such as original target mantlets and stop butts). This element of the site is therefore identified as having little conservation value and

is constantly deteriorating as tracks continue to become overgrown. The proposed lot and access layout for the site indicated by the master plan provides for the interpretation of the original firing range markers. The HIS considers that the heritage interpretation in the context of future residential development within this area of the site would be more effective in communicating the sites former use than the retention of 1000yd Firing Range in its current condition.

It is also considered that the proposed zone layout and building height restrictions will ensure the future residential development of the site will not visually dominate or detract from the Stockton Beach Dune System.

The HIS supports the rezoning of the site and considers the Proposed Action will not impact on the heritage significance of the site. The HIS includes some recommendations to guide the detailed design for the future residential development of the site, refer to **Section 5**.

3.3 (i) Indigenous heritage values

The Referral Area is situated within a large dual barrier formation known as Stockton Bight, an area that would have provided access to a range of very rich resource zones that would have made this area attractive to Aboriginal occupation, and/or a suitable place for the procurement of resources. The Rifle Range site has been subject to significant disturbance, which in turn has the potential to impact on the distribution and integrity of archaeological material within the site. However, due to the nature of soil landscapes within the area, there remains the potential for archaeological deposits with varying degrees of integrity to remain present within portions of the Referral Area. Umwelt (Australia) Pty Limited (Umwelt) was commissioned by DHA to prepare an Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) (see **Attachment A**) in consultation with the Registered Aboriginal Parties regarding the Aboriginal Cultural Heritage values of the site to support the planning proposal for the Rifle Range site.

The eastern side of the Rifle Range site is included within the Fern Bay Site Complex and contains a number of previously recorded archaeological sites consisting of deposits of stone artefacts and shell (refer to **Figure 8**). There are also a number of previously recorded archaeological sites (isolated finds and artefact scatter) across the remainder of the Rifle Range site (refer to **Figure 8**)

It is also considered likely that additional archaeological evidence may be present within the Rifle Range site, particularly given the dynamic nature of the environment. The area of the Rifle Range site proposed to be zoned E2 Environmental Conservation as part of the Proposed Action has been subject to lower levels of disturbance, particularly within the heavily vegetated sections of stabilised dune at the northern and southern boundaries of the site. In contrast, the establishment, ongoing use and decommissioning of the former Rifle Range within the portion of the site proposed to be zoned R1 General Residential has resulted in significant disturbance, however it is possible that this disturbance has not extended to the depth of archaeological deposits and that intact or partially intact deposits may be present.

Eleven new site areas (nine within 38-4-0895 - Fern Bay Complex) were identified during the survey in areas of exposure across the Rifle Range site (refer to **Figure 8**) including artefact scatters and isolated finds. The northern side of the site and known burial areas near Popplewell and Braid Roads were areas of significance identified by the registered Aboriginal parties involved in the ACHAA (refer to **Figure 9**).

The previous disturbance of the Rifle Range site is a major factor in the archaeological potential and significance of the various portions of the site. The central disturbed portion within the footprint of the Rifle Range is of low archaeological significance due to the low integrity and research potential of the area. The vegetated areas to the north and south of the former Rifle Range have higher archaeological potential due to the lack of disturbance within these areas. Due to the typical site distribution within the greater Fern Bay area it is likely that Aboriginal objects occur within these areas and there is potential for undisturbed deposits. Therefore the vegetated areas of intact or semi-intact dunes to the north and south of the proposed development area have moderate to high archaeological significance.

The Proposed Action will involve ground disturbance for earthworks, construction of roads, services and residential development at the Referral Area. The ACHAA acknowledges that these works have the potential to harm Aboriginal objects. The ACHAA recommends a number of management and mitigation measures developed with consideration of the cultural and archaeological landscape in consultation with the registered Aboriginal parties. These management and mitigation measures include removal and salvage of artefacts during construction works and further excavation of test pits across the referral area, the management and mitigation measures are provided in full in **Section 5**.

Specific areas of significance across the Referral Area have been identified in consultation with the registered Aboriginal parties (refer to **Figure 9**) which have applicable management and mitigation measures, refer to **Section 5**. No development should occur on the north side of the current access road that runs through the site including no establishment of roads. The only residential construction that may be permissible in this area should occur on the current Popplewell Road frontage. The south

western corner of the site is the location of previously recorded burials and the reburial of artefacts collected during Defence remediation works no further impact as a result of this Proposed Action should occur within this area.

3.3 (j) Other important or unique values of the environment

The Referral Area adjoins the Worimi National Park and Conservation lands and is located approximately 2 km from the southern end of the Hunter Wetlands National Park. Given the nature of the development and separation distance, the Proposed Action is unlikely to have any impact on these conservation areas.

3.3 (k) Tenure of the action area (e.g. freehold, leasehold)

DHA own the Rifle Range site freehold. The site was purchased from the Department of Defence in 2015.

3.3 (l) Existing uses of area of proposed action

The Rifle Range was originally constructed in 1939-1940 and was used as a rifle range until 1997 when it was no longer required by the military and was closed. In 2015, DHA purchased the site. The site is currently vacant, non-operational and secured.

3.3 (m) Any proposed uses of area of proposed action

The Proposed Action involves the rezoning of the Rifle Range site to provide for a mix of residential, recreational and conservation land uses, generally in accordance with the concept master plan developed for the site (refer to **Figure 3**). It is anticipated that approximately 50 per cent of the residential housing will be sold to the private market, with the remainder retained for Defence housing.

4 Environmental outcomes

As discussed in **Section 3.0**, the Proposed Action is not predicted to result in a significant impact on matters protected under the EPBC Act. Assessments of Significance were undertaken for MNES that have been recorded within or adjacent to the Referral Area or have the potential to occur within the Referral Area (refer to **Attachment D**), and for relevant aspects of the whole of the environment (refer to **Section 3.1(g)**). It was determined that the Proposed Action is unlikely to have a significant impact on all of these MNES or on the whole of the environment.

This outcome has been achieved in part by the significant design refinement undertaken during the development of the master plan. Detailed constraints studies have guided the master plan design and enabled avoidance of key ecological, heritage, archaeological and erosion hazard features. In addition, the master plan proposes the retention and protection of the majority of the Referral Area (approximately 80 per cent) within land zoned for environmental conservation and recreation. This land, which will be protected from future development, incorporates the areas of highest quality habitat and most significant cultural heritage values within the referral area.

The Proposed Action incorporates a range of avoidance and mitigation measures to ensure that the potential for environmental impact is minimised (refer to **Section 5** and **Attachment A**). **Table 3** below outlines a range of environmental outcomes from these measures and why they are beneficial for the MNES relevant to the Proposed Action.

Table 3 – Environmental Outcomes for Protected Matters

Measure	Environmental Outcome	Protected Matters Benefited
Avoidance of areas of high conservation value	Avoidance of impacts within higher conservation value areas and concentration of impacts within areas of lower ecological value.	• *Eucalyptus parramattensis* subsp. *decadens* • koala
Provision for large lots with minimal building envelopes	Retention of vegetation surrounding and within the residential lots which in turn will allow continued connectivity in a north/south direction across the site following the completion of construction. This was considered to provide an important mechanism particularly for the movement of species such as the koala, which is known to occur to the north of the Referral Area, and also allows for the targeted selected retention of important habitat features such as hollow-bearing trees.	• *Eucalyptus parramattensis* subsp. *decadens* • koala
Clearly defined disturbance area	Avoidance of impact on areas outside disturbance area assessed in this Referral	• *Eucalyptus parramattensis* subsp. *decadens* • koala
Pre-clearance surveys and clearance supervision	Minimisation of fauna death and injury as a result of vegetation clearance.	• *Eucalyptus parramattensis* subsp. *decadens* • koala
Weed control	Minimisation of weed spread into native vegetation communities and habitats.	• *Eucalyptus parramattensis* subsp. *decadens* • koala

Measure	Environmental Outcome	Protected Matters Benefited
Targeted feral animal control programs	Reduction in predation and competition for resources with native species.	• koala •
Site management for flora and fauna protection including: • **traffic control/speed limits** • **suitable fencing** • **pet management** • **targeted planting of koala feed trees**	Minimisation of impacts on local flora and fauna, with particular focus on koala. Increase of environmental stewardship of the site.	• koala
Dune rehabilitation	Re-establishment of native vegetation communities and fauna habitats.	• koala •

5 Measures to avoid or reduce impacts

Table 5 provides a summary of mitigation measures to be implemented for the Proposed Action to ensure that the potential for environmental impact is minimised.

It is considered that the proposed zone boundaries on the Rifle Range site avoid and reduce impacts to the existing ecological, historic and Aboriginal Cultural values. The detailed assessments undertaken to support the planning proposal include a number of design measures, mitigation measures and recommendations to be incorporated as part of the detailed design of the proposed residential development. These are summarised in **Table 5** below.

Table 5 - Mitigation and Management Measures

Environmental Assessment	Mitigation / Management Measures
Flora and Fauna	DHA has sought to avoid and minimise potential impacts on the ecological values of the Referral Area throughout the design and planning process. This has included avoidance and minimisation of disturbance of key vegetation communities and fauna habitats. The following mitigation strategies are designed to minimise impacts on important ecological features known to occur in the areas to be disturbed as part of any residential development that would result from the rezoning: o Pre-clearance surveys and clearance supervision o Weed control measures o Traffic control measures (reduced speed limits, signage, restricted access to dunes) o Dog and cat ownership policies o Vegetation and dune rehabilitation o Biodiversity buffers (retention of vegetation to buffer into surrounding lands)
Heritage	The Rifle Range site contains no listed heritage items. Of the two elements of heritage significance identified within the site, the Links Battery will be retained and protected from development within a conservation zoning. The 1000yd Firing Range will be impacted by development, however does not contain any built elements, is of little conservation value and is in constantly deteriorating condition as tracks become overgrown. The following recommendations have been set down to guide the detailed design stage of the proposed master plan: o Vegetation to be completely cleared from the Links Battery and a detailed Schedule of Conservation Works and Maintenance Schedule to be completed such that the item is stabilised, repaired where necessary and appropriately conserved. Clearing the vegetation will allow for the identification of opportunities to heritage list the item in the future and/or incorporate the item into a future Master Plan and Interpretation Plan for the site; and o An Interpretation Strategy be prepared. The site of the battery could be considered for the location of interpretative devices which communicate the historic values associated with the site.
Aboriginal Cultural Heritage	The following archaeological recommendations were developed by Umwelt in light of the archaeological context of the region, the findings of the survey, the archaeological assessment of the project area , the potential impacts of the proposed residential development and current cultural heritage legislation and will be applied to guide the detailed design of the proposed residential development. o Further consultation be undertaken with registered Aboriginal party representatives in relation to the integration of recommendations provided by registered Aboriginal party representatives for the proposal, including: • No development should occur on the north side of the current access road that runs through the project area including no establishment of roads. The only residential construction that may be permissible in this area should occur on the current Popplewell Road frontage.

	• The south western corner of the project area is the location of previously recorded burials and the reburial of artefacts collected during Defence remediation works. No impact should occur in this area. • Surface collection of all sites to be impacted should be undertaken. • Due to the dense vegetation during the survey the vegetation should be removed with rubber tracked machinery and further survey and recording and collection of any sites discovered should occur. • Excavation of test pits to investigate the sites identified. • Full salvage excavation of the development footprint where excavations to the natural ground surface will occur including structural supports and drainage. • The artefacts could be potentially stored at Worimi LALC with the artefacts to be reburied when works are completed. o DHA employees and contractors will be made aware that it is an offence under Section 86 of the NPW Act to harm or desecrate an Aboriginal object unless that harm or desecration is the subject of an AHIP. o An AHIP will be sought from the Director-General of OEH in accordance with Section 90 of the NPW Act, with this AHIP to cover the entirety of the impact area of the finalised master plan. The need to cover the entirety of the impact area is in recognition that archaeological material has been identified and/or predicted throughout the project area as a result of the disturbance of former dunes throughout the site. The AHIP should include provision for the completion of salvage works (both surface collection and sub-surface investigation), which should be conducted in accordance with the methodology specified in the ACHAA. The AHIP will specifically exclude impacts to recorded burial sites. In the event that suspected human skeletal material is identified within the other portions of the project area, all works will cease immediately and the NSW Police Department, OEH and the registered Aboriginal parties will be contacted so that appropriate management strategies can be identified.
Coastal Erosion	Dune Rehabilitation to Maintenance: o Rehabilitation and ongoing maintenance of the dune system on the Rifle Range site will be conducted. Dune rehabilitation will be limited to the area of existing (but in areas patchy) dune vegetation immediately adjacent (seaward) on the Rifle Range site. Extending dune revegetation activities seaward of this should be avoided, and careful maintenance of dune vegetation within this boundary is required. Provided that the full hierarchy of dune vegetation structure (i.e. a hierarchy of vegetation types and heights from primary species to secondary species then tertiary species that includes small trees) is used within this footprint, sand drift issues shall be effectively managed. An appropriate dune maintenance program will be developed to ensure the establishment and maintenance of dune vegetation to maintain appropriate dune heights and support the rebuilding of dunes after storms. Coastal Erosion: o All development will be established well landward of the 'unlikely' 2100 erosion hazard line.
Erosion and Sediment Control	Erosion and Sediment control devices will be utilised to contain the pollutants generated from the site during construction. These include but are not limited to: o Sediment Basins; o Silt Fencing;

	o Hay bale and Geotextile Fencing; o Kerb Inlet Controls; o Sandbag Kerb Inlet Sediment traps; o Shaker Ramp; and o Diversion Drains. Any clean water entering the site from upstream catchments will be diverted around the construction site where possible hence remaining clean. Runoff generated from within the site is to be treated and managed using a combination of the above stated treatment devices. Due to the extent of disturbed areas, the use of sediment basins will be required (Landcom, 2004). During construction, the proposed Biofiltration basins will be utilised as temporary sediment basins. Refer to Appendix A of Stormwater Management Plan for a typical Erosion and Sediment Control Plan.

6 Conclusion on the likelihood of significant impacts

6.1 Do you THINK your proposed action is a controlled action?

X	No, complete section 5.2
	Yes, complete section 5.3

6.2 Proposed action IS NOT a controlled action.

The Proposed Action has been determined to be unlikely to result in a significant impact on relevant matters protected under the EPBC Act due to the range of factors outlined in this Referral, including the minimal impacts on intact native vegetation/habitat and the retention of significant heritage items with appropriate buffers from development.

This assessment has been made with reference to the Significant Impact Guidelines 1.1 for MNES and Significant Impact Guidelines 1.2 for actions on Commonwealth land and actions by Commonwealth agencies. The assessment considered the significance of potential impacts on both MNES protected under the EPBC Act and the environment more broadly due to the Proposed Action being undertaken on Commonwealth land by a Commonwealth agency.

MNES - Ecological matters

As discussed in **Section 3** and **Attachment D**, the Proposed Action is highly unlikely to have a significant impact on the following MNES recorded or considered to potentially occur within the Referral Area:

- swift parrot (*Lathamus discolor*) – not recorded in the Referral Area, only minimal potential habitat impacted.
- regent honeyeater (*Anthochaera phrygia*) – not recorded in the Referral Area, only minimal potential habitat impacted.
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) SE mainland population – not recorded in the Referral Area, only minimal potential habitat impacted.
- potential Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*) – recorded in the Referral Area as a potential hybrid species, likely able to be avoided
- Newcastle doubletail (*Diuris praecox*) – not recorded in the Referral Area, only minimal potential habitat impacted.
- long-nosed potoroo (*Potorous tridactylus tridactylus*) – not recorded in the Referral Area, only minimal potential habitat impacted.
- koala (*Phascolarctos cinereus*) combined populations of Qld, NSW and the ACT – not recorded in the Referral Area, only minimal potential habitat impacted.
- New Holland mouse (*Pseudomys novaehollandiae*) – not recorded in the Referral Area, only minimal potential habitat impacted.
- grey-headed flying-fox (*Pteropus poliocephalus*) –recorded in the Referral Area, only minimal habitat impacted.
- Migratory species listed under international conventions – not recorded in the Referral Area, only minimal potential habitat impacted.

Whole of the Environment of Commonwealth Land/ Action undertaken by a Commonwealth Agency

Landscapes and Soils

- The Proposed Action has been designed with consideration of the key natural landscape features of the Referral Area, including avoiding development on the coastal ridgetop, maintaining the majority of the Referral Area (approximately 80 per cent) for conservation and recreation land, establishment of appropriate setback from the adjoining coastal dune area and preservation of the key environmental and heritage values of the site.

- The Proposed Action has set back all residential development to the landward side of the 'unlikely' 2100 erosion hazard line.

- The Proposed Action does not involve medium or large scale excavation of soils to enable implementation of the master plan, with building design controls proposed to limit the extent of excavation required for building footings.

Coastal Landscapes and Processes

- All residential development proposed as part of the master plan will be located landward of the 2100 'unlikely' erosion hazard line. No works are proposed that would result in the extraction of large volumes of sand or destabilisation of sand dunes.

Water Resources

- There are no rivers, creeks or drainage channels located within the Referral Area and the Proposed Action will not change existing drainage patterns.

- Modelling indicates that stormwater from the proposed residential development can be appropriately managed and treated without impacting on or reducing existing surface water or ground water systems.

Pollutants, Chemicals and Toxic Substances

- The Proposed Action does not involve the storage or handling of large amounts of hazardous substances and will not result in the substantial release of pollutants to the atmosphere or water. Construction will be managed in accordance with a Construction Environmental Management Plan.

- Assessments of potential contamination indicate the site is suitable for the proposed land uses.

- Acid sulphate soils have not been identified, nor are they expected to occur within the Referral Area.

Plants and Animals

- The Proposed Action may require the removal of up to approximately 15.3 ha of native vegetation, which represents approximately 14% of the total area of the site.

- The proposed rezoning has focused on the retention of as much intact vegetation as possible and therefore the impacts to local biodiversity are expected to be minimal.

People and Communities

- The proposed residential development is sympathetic to the existing character of the surrounding residential areas in its scale, diversity of dwellings and landscape character. The action will enhance public access to the coast and provide recreational opportunities for the local community through the provision of recreational facilities, walking and cycle paths and access to and interpretation of heritage items.

- The proposed residential development can be adequately serviced by the surrounding infrastructure and will not impact on demand or reduce availability of services.

Heritage

- No heritage items at the Rifle Range site meet the threshold for the Commonwealth Heritage list.

6.3 Proposed action IS a controlled action

N/A

7 Environmental record of the person proposing to take the action

		Yes	No
7.1	**Does the party taking the action have a satisfactory record of responsible environmental management?** **Provide details** DHA has fulfilled its requirements under previous controlled activities prescribed by the EPBC Act: • Former UTS Kur-Ring-Gai campus, NSW- Darwinia Bifora offset and ongoing management. • Muirhead Residential Development, NT Water Quality improvement. And undertaken numerous environmentally sensitive projects- • HMAS Creswell Benson Road Redevelopment and Heritage upgrades • Gunners Cottages Freemantle, WA Heritage restoration. • Ermington NSW, Wilsonia Backhousei protection and recovery plan	Yes	
7.2	**Provide details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:** **(a) the person proposing to take the action, or** **(b) if a permit has been applied for in relation to the action - the person making the application.** **If yes, provide details**		N/A
7.3	**If the person taking the action is a corporation, please provide details of the corporation's environmental policy and planning framework and if and how the framework applies to the action.** The referral of the developments at Stockton NSW is in keeping with the DHA Environmental Management Guidelines intent to ensure that all statutory environmental requirements are adhered to throughout DHA's property development activities.	Yes	
7.4	**Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?** **Provide name of proposal and EPBC reference number (if known)** • Former UTS Ku-Ring-Gai - EPBC 2008/4083 • Muirhead Residential Development, NT – EPBC 2010/5525	Yes	

8 Information sources and attachments

(For the information provided above)

8.1 References

ADW Johnson (2016) Stormwater Management Plan Rifle Range Planning Proposal.

Australian Wetlands Database (2016) *Hunter Estuary Wetlands*. http://www.environment.gov.au/water/topics/wetlands/database/ Accessed September 2016.

Bell, S. and Driscoll, C (2010) Vegetation of the Worimi Conservation Lands Port Stephens, NSW: Worimi NP, Worimi SCA and Worimi RP, Eastcoast Flora Survey, report to the Department of Environment, Climate Change and Water Hunter Region, November 2010.

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Department of Environment, Land, Water and Planning. (DELWP) (2016) National Recovery Plan for the Spotted-tailed Quoll *Dasyurus maculatus*. Australian Government, Canberra.

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Douglas Partners (2016) Report on Geotechnical Investigation Proposed Defence Housing Development Rifle Range, Fern Bay

Ecotone Ecological Consultants Pty Ltd (Ecotone) (2003) Preliminary Flora and Fauna Constraints Assessment for the Department of Defence Land at Stockton Rifle Range.

Newcastle City Council (2015) Newcastle Local Planning Strategy

Office of Environment and Heritage (OEH) (2010) Aboriginal Cultural Heritage Consultation Requirements for Proponents.

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Office of Environment and Heritage (OEH) (2016) Threatened Species Profile Database (TSPD), accessed September 2016.

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Office of Environments and Heritage (OEH) (2011) Draft National Recovery Plan for Earp's Dirty Gum *Eucalyptus parramattensis* subsp. *decadens*, September 2011.

Threatened Species Scientific Committee (TSSC) (2014) Approved Conservation Advice for *Eucalyptus parramattensis* subsp. *decadens* (Earp's gum). Canberra: Department of the Environment.

Umwelt (2016) Aboriginal Cultural Heritage and Archaeological Assessment.

Umwelt (2016) Rifle Range Defence Housing Project Ecological Assessment Report.

Urbis (2016) Heritage Impact Statement Rifle Range

8.2 Reliability and date of information

The sources of all information contained within Section 3 have been referenced within Section 3 and all references are listed in Section 8.1 above. The dates of all information sources have been listed within Section 3. Any uncertainties in the information in Section 3 have been listed and discussed within Section 3.

8.3 Attachments

Attachment A: Former Rifle Range, Popplewell Road, Fern Bay Planning Proposal
Attachment B: Protected Matters Search
Attachment C: MNES Assessment
Attachment D: Assessments of Significance under the EPBC Act
Attachment E: Assessment of Koala Habitat in the Referral Area

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the locality of the proposed action (section 1)	✓	Figures 1- 4
	GIS file delineating the boundary of the referral area (section 1)		
	figures, maps or aerial photographs showing the location of the proposed action in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Figures 5-9
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)	NA	
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)	✓	Attachment A
	copies of any flora and fauna investigations and surveys (section 3)	✓	Attachment A
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3) conclusions in the referral (section 3 and 4)	✓	Attachments A, B, C, D, E
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)	✓	Attachment A

9 Contacts, signatures and declarations

Proposed action title:

9.1 Person proposing to take action

Name and Title:	Gully Coote on behalf of Defence Housing Australia, Development Manager
Organisation:	Defence Housing Australia
Trust deed:	not applicable
ACN / ABN:	72968504934
Postal address:	Level 2/287 Elizabeth Street Sydney NSW 2001
Telephone:	(02) 97625612
Email:	gully.coote@dha.gov.au

COMPLETE THIS SECTION ONLY IF YOU QUALIFY FOR EXEMPTION FROM THE FEE(S) THAT WOULD OTHERWISE BE PAYABLE

I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

- □ an individual; OR
- □ a small business entity – aggregated turnover is less than $2million for the previous income year (as prescribed within section 328-110 (other than subsection 328-119 (4)) of the *Income Tax Assessment Act 1997*); OR
- □ a small business entity – aggregated turnover for the current financial year is likely to be less than $2million (note that aggregated turnover for one of the previous two income years must also be less than $2million) (as prescribed within section 328-110 (other than subsection 328-119 (4)) of the *Income Tax Assessment Act 1997*) (Cth)).
- ✓ not applicable.

If you are small business entity you must provide the Date/Income Year that you became a small business entity:

COMPLETE THIS SECTION ONLY IF YOU WOULD LIKE TO APPLY FOR A WAIVER

I would like to apply for a waiver of full or partial

- ✓ not applicable.

fees under regulation 5.21A of the EPBC Regulations. Under regulation 5.21A(5), you must include information about the applicant (if not you) the grounds on which the waiver is sought and the reasons why it should be made:

Declaration:

I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct.
I understand that giving false or misleading information is a serious offence.
I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.

Signature: **Date:** 6/07/2017

9.2 Designated proponent

Name of proposed proponent:	Defence Housing Australia
ACN / ABN:	As above
Postal address:	As above
Telephone:	As above
Email:	As above

Declaration by the proposed proponent:

I ....., the proposed proponent, consent to the proposed designation of myself as the proponent for the purposes of the action described in this referral.

Signature : **Date:**

Declaration by the person proposing to take the action:

I ....., the person proposing to take the action, consent to the proposed designation of..... as proponent for the purposes of the action described in this referral.

Signature : **Date:**

9.3 Person preparing the referral information (if different from section 9.1)

Name:	Gabrielle Allan
Title:	Principal Environmental Consultant
Organisation:	Umwelt (Australia) Pty Limited
ACN / ABN:	18 0595 19041
Postal address:	75 York Street Teralba NSW 2284
Telephone:	02 4950 5322
Email:	gallan@umwelt.com.au
Declaration:	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence.

Signature: **Date**:20 July 2017

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Former Rifle Range, Popplewell Road, Fern Bay

Planning Proposal

For: Defence Housing Australia
Date: **June 2017**

Architectus Group Pty Ltd
Architectus Sydney
Level 18 MLC Centre 19 Martin Place
Sydney NSW 2000
Australia
T +61 2 8252 8400
F +61 2 2852 8600
sydney@architectus.com.au

Architectus Melbourne
Level 7 250 Victoria Parade
East Melbourne VIC 3002
T +61 3 9429 5733
F +61 3 9429 8480
melbourne@architectus.com.au

ABN 90 131 245 684
Managing Director:
Ray Brown
Nominated Architect
NSWARB 6359

architectus™

This report is considered a draft unless signed by a Director or Quality Assurance Manager

June 2017

Jane Freeman, Senior Associate Urban Design and Planning

Revision history

Issue Reference	Issue Date	Issue Status
A	17 January 1017	75% Draft for internal use only
B	16 June 2017	Draft for internal review
C	22 June 2017	Draft for client review
D	28 June 2017	Final

File reference	

Report contact:

Rachael Nesbitt
Associate
Rachael.Nesbitt@architectus.com.au

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Attachments

Attachment A Proposed Mapping Amendments, Architectus, June 2017

Attachment B Urban Design and Landscape Report, Architectus and Spackman Mossop Michaels, June 2017

Attachment C Transport Study Report, Better Transport Futures, May 2017

Attachment D Rifle Range Bushfire Assessment, Kleinfelder, May 2017

Attachment E Stormwater Management Plan, ADW Johnson, June 2017

Attachment F Coastal Engineering Assessment, BMT WBM, Dec 2016

Attachment G Site Audit Statement – Stockton Rifle Range, Department of Environment and Climate Change NSW, March 2009

Attachment H Defence Housing Project Ecological Assessment Report, Umwelt, June 2017

Attachment I Heritage Impact Statement, Urbis, June 2017

Attachment J Draft Aboriginal Cultural Heritage and Archaeological Assessment Report, January 2017

Attachment K Servicing Report, ADW Johnson, June 2017

Attachment L Consultation Report, Elton, December 2016

Attachment M Site Environmental Management Plan, SMEC, May 2010

Executive summary

This Planning Proposal is prepared by Architectus on behalf of Defence Housing Australia for the former rifle range site at Popplewell Road, Fern Bay. The site is legally known as Lot 5, DP233358. The Rifle Range Site is located to the north of the Stockton Centre and south of Worimi Lands, approximately 4km north of Stockton and 6km from Newcastle.

To achieve the intended outcomes, the rezoning request seeks to amend the following provisions in the Port Stephens LEP 2013:

- *Land zoning map – Sheet LZN_004A,* to show part of the subject site appropriate for residential development as R2 Low Density Residential while retaining the existing E2 Environmental Conservation on the remainder of the site;
- *Height of Buildings map – Sheet HOB_004A*, to show part of the subject site as 9m; and
- *Lot size map – Sheet LSZ_004A*, to show part of the subject site with a minimum lot size of 500sqm and a small portion with a minimum lot size of 200sqm.

It is intended that these legislative amendments would be supported by a site specific DCP, to be developed with Council concurrent to the Planning Proposal process. The key principles of this DCP are set out in this report.

The site is a disused rifle range, with a central road dividing the relatively disturbed area of vegetation to the south and the intact vegetation area adjoining Worimi lands to the north. A significant portion of the site to the east comprises coastal dune system, approximately 600m from the proposed area of residential zoning.

The former Rifle Range site is a unique and sensitive coastal setting that has the opportunity to offer high amenity of the bushland, access to Stockton Beach and walking opportunities both north and south to Stockton, and accommodate new homes and open space that will contribute to the vitality of the area.

The site is currently zoned E2 Environmental Conservation under the Port Stephens LEP 2013, allowing a range of land uses including dwelling houses, dual occupancies, and bed and breakfast accommodation. The site has no maximum height of buildings control, but is subject to a minimum lot size of 40ha.

DHA have a responsibility to provide housing for members of the defence force and their families in proximity to army bases and amenity. In 2015, the site was transferred from Defence to DHA as it was no longer needed for defence purposes. The proximity of the site to the Williamtown base and the amenity of Stockton and Newcastle CBD make it an excellent site for development of housing.

Strategic and technical assessments of the site were undertaken to consider the potential of the site to deliver housing, including urban design and planning; landscape; ecological; indigenous heritage; bushfire; European heritage; coastal engineering; civil engineering; and traffic and transport. This consultant team has consulted with local Council, State Government, the community, RMS, and local aboriginal groups in the preparation of these assessments.

A concept master plan was developed to demonstrate how a sensitive residential development could be achieved in the context of the rezoning, facilitating approximately 200 lots and associated infrastructure such as green space, roads and footpaths. To facilitate the delivery of the master plan and deliver approximately 50% of housing to

defence members and 50% to the private market, a rezoning is required.

The site offers an opportunity to deliver a sensitive, socially sustainable and diverse community in a high amenity ecological setting. The Planning Proposal is strongly supported and recommended to Council for endorsement.

Figure 1 Artists illustration of the Concept Master Plan, David Wardman

Figure 2 The indicative master plan and landscape concept

1.0 Introduction

1.1 Preliminary

This Planning Proposal explains the extent of, and justification for, proposed amendments to Port Stephens Local Environmental Plan 2013 (Port Stephens LEP 2013). The report has been prepared in accordance with Section 55 of the Environmental Planning and Assessment Act 1979 (the Act) and guidelines published by the Department of Planning and Environment including 'A guide to preparing planning proposals' and 'A guide to preparing local environmental plans'.

This Planning Proposal has been prepared by Architectus on behalf of Defence Housing Australia (DHA) to demonstrate the strategic merit of amending the Port Stephens LEP 2013 to facilitate the use of land on Popplewell Drive, Fern Bay, also known as the former Rifle Range site, for a mixed defence and private housing development.

Specifically, this rezoning request seeks to amend the land use zoning, maximum height of building control, and minimum lot size control for the subject site.

This Planning Proposal should be read in conjunction with the Urban Design and Landscape Report provided at **Attachment B**, prepared by Architectus and Spackman Mossop Michaels.

1.2 Defence Housing Australia

DHA was established as a Statutory Agency in 1988 and became a Government Business Enterprise in 1992 whose principal role is housing Defence members. DHA manages around 18,500 residences nationally, representing approximately $10 billion worth of housing stock.

DHA currently manages 1,200 dwellings in Newcastle providing housing for Defence Members posted to the Williamstown RAAF base. DHA has an ongoing requirement for additional housing in the Newcastle and Port Stephens area to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards.

DHA is currently seeking to provide more accommodation on sites that are:

- Within close proximity to the Williamtown RAAF base;
- Not affected by the airport ANEF contours or other unworkable site or environmental constraints; and
- Within close proximity to services and community infrastructure.

1.3 The site

The site is legally known as Lot 5, DP233358. The Rifle Range Site is located to the north of the Stockton Centre and south of Worimi Lands, approximately 4km north of Stockton and 6km from Newcastle. The site is approximately 111 hectares in area.

Figure 3 The subject site

The site is part of the Stockton Peninsula, with the town centre of Stockton sitting on the headland located approximately 4km to the south. Stockton town centre is a small community of low and medium density residential, with a mix of uses that serves the day to day needs of residents such as newsagencies, hairdressers and grocers, as well as services such as hardware and real estate agents. The community enjoys amenity from green spaces around the water and the beach, which stretch north to the subject site and on to Port Stephens. Access to the Newcastle City Centre is available via ferry from Stockton, a trip of approximately ten minutes.

The site is located in the suburb of Fern Bay, which accommodates a number of small communities in distinct pockets of residential development separated by Nelson Bay Road, the Newcastle Golf Club, and Worimi lands. The site lies immediately to the east of the existing community of Fern Bay, comprising six streets of low density residential development, some small scale retail including the Fern Bay Store, and social infrastructure including the Fern Bay Public School and Fern Bay Reserve. The Newcastle Golf Club and Worimi lands lie to the north, with the developments 'Bayway Village' (an over 50s community), 'The Cove Village' and 'Seaside' beyond.

The site forms part of a special uses area that sits between the two residential communities of Stockton and Fern Bay. These uses include the Stockton Cemetery and the Stockton Centre immediately adjoining the site to the south. Fort Wallace, a former defence site also currently owned by DHA, lies to the south of the Stockton Centre. A redundant Hunter Water wastewater treatment works and an oval separates Fort Wallace from the Stockton Town Centre. Some small pockets of private residential uses are interspersed.

Figure 4 Local Site Context (site outlined in red)

Figure 6 The existing main track

Figure 5 Stockton Beach from the site

1.4 History and current use of the site

Consultation with Aboriginal stakeholders has concluded that the Stockton Peninsula, including the subject site, is considered to have very high Aboriginal cultural value to the Worimi people. A number of artefact scatterings in the form of shell middens and open campsites are located on the site that demonstrate the historical use of the site by the Aboriginal people.

From the early 1900s until 1940, rifle shooting in the area was undertaken at the Adamstown Rifle Range. In 1939-1940, construction of the Rifle Range at Fern Bay began in order to meet extra local demand from the Adamstown facility. The range was officially opened for use on 28 January 1941, although the government did not formally acquire the site until 1942.

An anti-aircraft battery, known as the Links Battery, was established on the site to the north of the classification range.

From 1953 the site was a training facility for all shooting in the region and was utilised by the police force, military, school cadets and civilian rifle clubs.

The site was no longer required by the military and was closed in December 1997. In 2015, DHA purchased the Rifle Range land holding from the Department of Defence. The site is currently vacant, non-operational and secured.

1.5 Land use zoning history

The subject site was zoned 7(a) Environmental Protection under the Port Stephens LEP 2000. The objective of the zone was to encourage the conservation and proper management of environmentally sensitive land. Development for the purposes of dwelling houses, dual occupancy housing, tourist facilities, recreation facilities, and clearing native vegetation were permissible with consent.

The Port Stephens LEP was revised in 2012 in accordance with the Standard Instrument LEP. The draft Port Stephens LEP 2012 showed the subject site as an E2 Environmental Conservation zone.

During exhibition of the draft LEP (on the 12th of December 2012), Defence, owners of the subject site at the time, made a submission that requested all Defence owned lands be zoned SP2 Infrastructure in accordance with the directions of the Standard Instrument. This reflects Defence land not being subject to planning instruments under NSW legislation and clearly distinguish the planning and management of the land. Relevant sites were mapped and listed in an attachment to the submission. The subject site was identified as one such piece of land (Lot 5 DP233358).

Council's response to the Department of Defence submission recommends *'amend[ing] Draft LEP to reflect all DoD lands as SP2 Infrastructure'* and notes that *'the request to rezone all DoD land has been complied with'*. A Planning Proposal recently implemented by Council has rezoned a number of Defence sites to the north of the subject site that were mistakenly zoned, and has referenced Defence's submission and the intention of Council in its response.

However, when the Port Stephens LEP 2013 was gazetted, land zone mapping identified the subject site as E2 Environmental Conservation. The site is currently zoned E2 Environmental Conservation.

1.6 The vision

The vision for the former Rifle Range site is for a sensitively designed residential community providing housing diversity, best practice design and the creation of new open space and connections, together with the preservation of European and Indigenous heritage and environmental assets for the wider community. The DHA team hopes to use this master planning process to explore opportunities to plan for new types of housing for DHA and exemplar open space and conservation projects.

Figure 7 Artist illustration of the concept master plan

1.7 Authorship

This report has been prepared by Rachael Nesbitt, Associate, Architectus, and has been reviewed by Jane Freeman, Senior Associate Urban Planning, Architectus.

2.0 Objectives and intended outcomes

2.1 Objectives of the proposed controls

This planning proposal seeks to amend the Port Stephens LEP 2013 to enable the redevelopment of the former Rifle Range site at Popplewell Road, Fern Bay, for a diversity of residential uses while maintaining the environmental values of the site.

2.2 The master plan

The indicative master plan for Rifle Range demonstrates a best practice outcome within the proposed LEP controls. The master plan responds to the site's natural and historic constraints, proposes a diverse mix of housing to accommodate a real community and includes high quality public open space and streets.

Figure 8 The indicative master plan and landscape concept

The master plan respects the site's unique history and environmental character by reducing the development footprint to areas of the site with relatively few constraints.

Rather than covering the site with low density development, the master plan proposes more energy efficient, environmentally-sensitive and higher density development with a smaller development footprint. Significant vegetation communities and historic elements will be retained and opened to the public for their use and enjoyment.

The development will feel distinctly public, with access for all to streets, open space and the beach, as opposed to a gated or themed community.

2.3 Intended outcomes

The intended outcomes of this proposal are to:

1. Maintain the areas of high ecological value to by retaining the northern part of the existing E2 Environmental Conservation zone;
2. Facilitate the sensitive renewal and ongoing management of a currently underutilised site in disturbed areas;
3. Deliver a diversity of housing through a mixture of densities and housing typologies on the site, including townhouses, single dwellings, and multi-dwelling housing; and
4. Open the site to the community through the delivery of public open space and landscaping;
5. Ensure orderly development and the clear delineation in the ownership and ongoing management of the site.

3.0 Explanation of provisions

3.1 Amendments to planning provisions

This Planning Proposal seeks the following amendments to the Port Stephens LEP 2013:

- *Land Zoning Map – Sheet LZN_004A*, to show part of the subject site as R2 Low Density Residential while retaining an E2 Environmental Conservation zoning on the remainder of the site;
- *Height of Buildings Map – Sheet HOB_004A*, to show the subject site as J 9m, including both the R2 Low Density Residential zone and the E2 Environmental Conservation zone; and
- *Lot Size Map – Sheet LSZ_004A*, to show the part of the site zoned R2 Low Density Residential as I 500sqm with a small portion of the site zoned B 200sqm, while retaining the AB3 40ha minimum lot size zoning on the remainder of the site.

It is intended that these legislative amendments would be supported by a site specific DCP, to be developed with the Planning Proposal with Port Stephens Council, the Fern Bay community, DHA and the NSW Department of Planning and Environment. The principles of this DCP have been set out in the following sections of this report.

3.2 Land zoning

The site is currently zoned E2 Environmental Conservation under the Port Stephens LEP 2013. The objectives of the E2 Environmental Conservation zone are:

- *To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.*
- *To prevent development that could destroy, damage or otherwise have an adverse effect on those values.*

The following land uses are permitted without consent:

> *Bee keeping; Environmental protection works; Home occupations.*

The following land uses are permitted with consent:

> *Bed and breakfast accommodation; Building identification signs; Business identification signs; Dual occupancies; Dwelling houses; Eco-tourist facilities; Environmental facilities; Flood mitigation works; Home-based child care; Home businesses; Information and education facilities; Recreation areas; Research stations; Roads; Water recreation structures; Water supply systems.*

The following land uses are prohibited:

> *Business premises; Hotel or motel accommodation; Industries; Multi dwelling housing; Recreation facilities (major); Residential flat buildings; Restricted premises; Retail premises; Seniors housing; Service stations; Warehouse or*

distribution centres; Water treatment facilities; Any other development not specified in item 2 or 3.

It is proposed that the land zoning for part of the site be amended to R2 Low Density Residential. The objectives of the R2 Low Density Residential zone are:

- *To provide for the housing needs of the community within a low density residential environment.*
- *To enable other land uses that provide facilities or services to meet the day to day needs of residents.*
- *To protect and enhance the existing residential amenity and character of the area.*
- *To ensure that development is carried out in a way that is compatible with the flood risk of the area.*

The following land uses are permitted without consent:

Home occupations.

The following land uses are permitted with consent:

Attached dwellings; Bed and breakfast accommodation; Boarding houses; Building identification signs; Business identification signs; Child care centres; Community facilities; Dual occupancies; Dwelling houses; Environmental protection works; Exhibition homes; Exhibition villages; Flood mitigation works; Group homes; Health consulting rooms; Home-based child care; Home businesses; Home industries; Multi dwelling housing; Neighbourhood shops; Places of public worship; Recreation areas; Respite day care centres; Roads; Secondary dwellings; Semi-detached dwellings; Seniors housing; Water reticulation systems.

The following land uses are prohibited:

Any development not specified in item 2 or 3.

We note that residential flat buildings are not permissible within the zone.

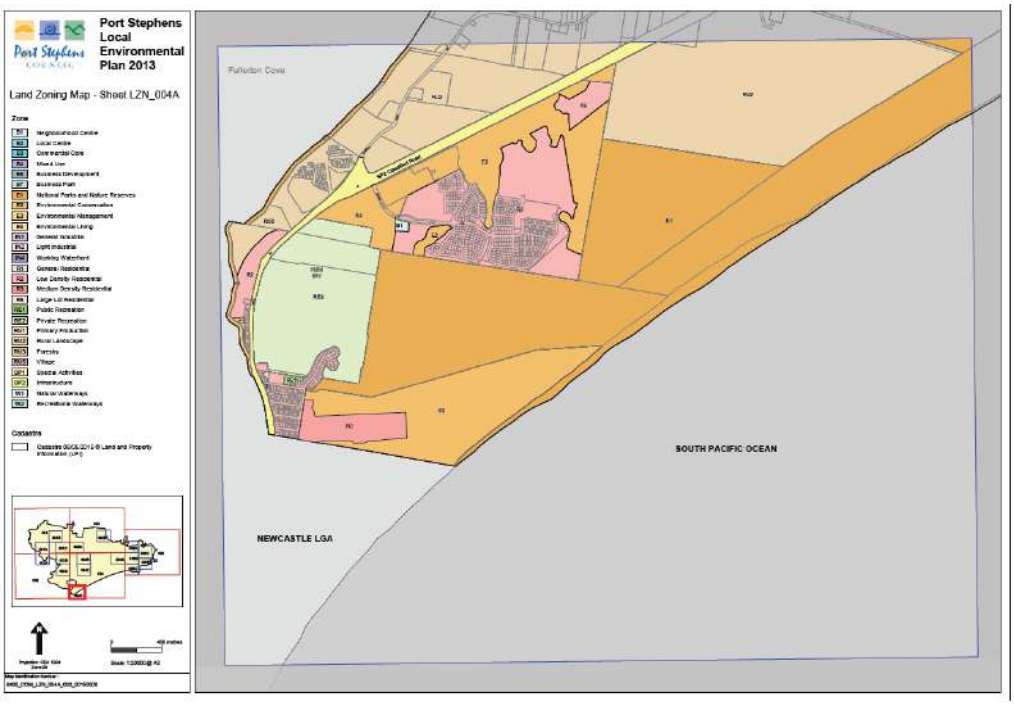


Figure 9 Proposed Land Use Zoning Map

Attachment B, the Urban Design and Landscape Report prepared by Architectus and Spackman Mossop Michaels, sets out an indicative master plan for the site that could be achieved through the rezoning. Architectural concepts for dwelling types that respond to the unique coastal environment have been developed. The relationship between these dwelling types and the Port Stephens Local Environmental Plan 2013 are summarised in the following table.

Table 1 Dwelling types and classifications

Dwelling type (Indicative Master Plan)	Port Stephens Local Environmental Plan 2013
Single eco-homes	Dwelling houses
Cluster homes	Multi-dwelling housing
Courtyard homes	Semi-detached dwellings
Townhouses	Attached dwellings

The proposed land zoning change will facilitate the development of the land for a range of residential uses beyond those currently permitted under the E2 Environmental Conservation zoning, specifically multi-dwelling housing, semi-detached dwellings and attached dwellings. This is intended to facilitate capacity for dwelling diversity in accordance with Council's objectives and the needs of DHA for housing defence staff.

Direction 2.1 Environmental Protection Zones of the Section 117 Directions requires that a planning proposal must include provisions that facilitate the protection and conservation of environmentally sensitive areas, and that a planning proposal must not reduce the environmental protection standards that apply to land. A planning proposal may only be inconsistent with the Direction if:

> *'the relevant planning authority can satisfy the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) that the provisions of the planning proposal that are inconsistent are:*
>
> *[a]. justified by a strategy which:*
>
> > *i. gives consideration to the objectives of this direction,*
> >
> > *ii. identifies the land which is the subject of the planning proposal (if the planning proposal relates to a particular site or sites), and*
> >
> > *iii. is approved by the Director-General of the Department of Planning, or*
>
> *(b) justified by a study prepared in support of the planning proposal which gives consideration to the objectives of this direction, or*
>
> *(c) in accordance with the relevant Regional Strategy or Sub-Regional Strategy prepared by the Department of Planning which gives consideration to the objective of this direction, or*
>
> *(d) is of minor significance.'*

The Ecological Assessment Report, prepared by Umwelt to inform the Planning Proposal, has given consideration to the objectives of the Direction and the objectives and requirements of the *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act), and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Consideration was given to the primary objectives for the land and the appropriate zoning to respond to the environmental sensitives of the coast and its ecology. In NSW, there are four environmental protection zoned use specifically for land where the primary focus is the conservation and / or management of environmental values. These zones are as follows:

- E1 National Parks and Nature Reserves. This zone is used for existing national parks, nature reserves and conservation areas, or new areas proposed for reservation that have been agreed with the NSW government.
- E2 Environmental Conversation. This zone is used for areas with high ecological, scientific, cultural or aesthetic values outside national parks and nature reserves.
- E3 Environmental Management. This zone is for land where there are special ecological, scientific, cultural or aesthetic attributes or environmental hazards / processes that require careful consideration and management.
- E4 Environmental Living. This zone is for land with special environmental or scenic values, and accommodates low impact residential development. Under the Port Stephens LEP 2013, this zone permits dual occupancies, dwelling houses, and roads with consent.

A detailed ecological assessment of the site's flora and fauna has been undertaken by Umwelt to determine the ecological significance and value of the site (full report provided in **Attachment H**). The assessment has concluded that, while parts of the site are ecologically significant, a significant proportion is of low value and is suitable for residential development.

The site is structured by the former rifle range use, specifically the main shooting straight and the 100 yard markers. The use of the site for shooting practice has degraded the vegetation. Areas outside of the main structure were rarely used and are significantly more intact than the main range.

Importantly, the former rifle range and proposed development area is to the south-west of the site, adjoining sites that are already developed including the Fern Bay community, Stockton Centre and the cemetery site. The highest value ecological parts of the site adjoin the Worimi lands to the north. The proposed zoning ensures that high value ecological communities are not isolated within the site. The objectives of this proposed zoning are:

1. To preserve the high quality parts of the site adjoining the Wormi lands, avoiding the isolation of vegetation communities;
2. To maximise the development potential of a site significantly located in proximity to social and physical services and the Williamtown base; and
3. To facilitate better outcomes for the site as a whole by enabling sensitive development that will ensure the ongoing management of the site.

3.3 Height of buildings

The site is not affected by a maximum height of buildings control under the current LEP. In order to control the development capacity on this sensitive site, and manage potential for visual impact from surrounding areas, a maximum height of buildings of 9m is proposed to be applied to the site as a whole.

Figure 10 Proposed Height of Buildings Map

Clause 4.3 Height of buildings of the Port Stephens LEP 2013 controls the maximum height of buildings on land to which it applies. The objectives of this clause are as follows:

> *'(a) to ensure the height of buildings is appropriate for the context and character of the area,*
>
> *(b) to ensure building heights reflect the hierarchy of centres and land use structure.'*

The proposed maximum height of buildings control is consistent with the maximum height of buildings control applied to the adjoining residential area to the west of the site and will maintain a consistent approach to height in the area.

3.4 Lot size

The site is currently affected by a minimum lot size of AB3, which restricts any lot to a minimum of 40 hectares in area.

Where the site is proposed to be zoned R2 Low Density Residential, it is proposed that the minimum lot size requirement be reduced to facilitate lots of 500sqm, with a small portion of lots of 200sqm.

It is noted that Clause 4.1C of the Port Stephens LEP 2013 currently allows for development consent to be granted to the subdivision and development of attached dwellings, dwelling houses or semi-detached dwellings on land in the R2 Low Density Residential zone to a minimum of 200sqm. Due to the testing undertaken and site specific DCP, it is proposed that the base minimum lot size facilitate 200sqm lots, rather than relying on Clause 4.1C.

Figure 11 Proposed Lot Size Map

4.0 Justification and process

4.1 Planning process

Methodology

This Planning Proposal is supported by a suite of specialist assessments of the site that have informed consideration of the site's potential for redevelopment, including coastal engineering, ecology, heritage, landscape, transport, stormwater, bushfire and servicing assessments.

These assessments have been used as the basis of master plan options and the development of a recommended master plan, which has subsequently informed proposed revised planning controls for the site with respect to land use and height of buildings.

The concept master plan has been used as a demonstration of how the site could appropriately accommodate residential uses in response to best practice urban design and planning principles.

Proposed Planning Framework

A rezoning process is considered to be the most appropriate process to achieve the objectives for the site and orderly planning. The intended planning framework would be as follows:

- An amended LEP, controlling the permissible land uses and height of buildings on the site;
- A site specific DCP, providing guidance on the development of the site to ensure that it is sensitively managed; and
- A voluntary planning agreement.

As set out in this report, the Newcastle LEP 2012 would be amended to include changed land use and height of buildings controls for the site.

It is intended that the Planning Proposal be accompanied by a site specific development control plan (DCP) that sets out the key objectives for the development of the site and urban design and planning guidelines to achieve these objectives in order to provide more certainty around built form outcomes, ensure sensitive parts of the site are adequately managed, and complement zoning controls. The DCP is expected to be set out as follows:

a) Objectives;

b) Site history;

c) A vision for the Rifle Range;

d) Urban structure; and

e) Site planning and built form.

The aims of the DCP are to:

a) Provide appropriate development control principles for the development of the site;

b) Guide the delivery of a diversity of housing on the site to serve the needs of the community;

c) Ensure that development of the site is sensitive to the heritage and ecological significance of the site.

4.2 Need for the Planning Proposal

Is the proposal a result of any strategic study or report?

The proposed rezoning achieves the goals of the Hunter Regional Plan 2036, released November 2016, including supporting the leading regional economy in Australia, a biodiversity-rich natural environment, thriving communities and greater housing choice and jobs. The Hunter Regional Plan seeks to deliver more housing and better housing choice in well serviced areas with high amenity, supporting the renewal of the strategically placed site. The directions of the Hunter Regional Plan are discussed in further detail in the next section.

The Port Stephens Planning Strategy 2011 applies to the site. Areas identified as Fern Bay - Fullerton Cove, to the north and west of the Rifle Range, have been identified as future growth areas within the Strategy. This area, including the subject sites, comprise the Eastern Growth Corridor identified within strategic planning for Port Stephens. The area has been recommended to increase in density over the next 15-20 years since the Strategy's release, with potential for:

- 42 infill residential dwellings; and
- 1,396 dwellings within green field residential zoned land.

The Strategy also recommends the opportunity to maximise access to existing infrastructure through density increases. As the suburb (of Stockton or Fern Bay) is among the LGA's small centres with no available commercial floorspace, the need for commercial rezoning has also been identified. The Strategy predicts a need for an indicative 14,441 additional dwellings throughout the LGA, including infill and within rural areas.

This Planning Proposal has been prepared to provide greater certainty and clarity on future development on the Rifle Range site, and to continue to implement the aims of the Port Stephens LEP 2013. The need for the planning proposal has resulted from consideration of specialist assessments prepared to assess the site's potential to deliver housing for defence members, including the following reports:

- Urban Design and Landscape Report, Architectus and Spackman Mossop Michaels, June 2017, Attachment B;
- Transport Study Report, Better Transport Futures, May 2017, Attachment C;
- Rifle Range Bushfire Assessment, Klienfielder, May 2017, Attachment D;
- Stormwater Management Plan, ADW Johnson, June 2017, Attachment E;
- DHA Stockton Rifle Range Stockton Beach Coastal Engineering Assessment, BMT WBM, December 2016, Attachment F;
- Rifle Range Defence Housing Project, Ecological Assessment Report, Umwelt, November 2016, Attachment H;
- Heritage Impact Statement, Stockton Rifle Range, Urbis, June 2017, Attachment I;
- Draft Aboriginal Cultural Heritage and Archaeological Assessment Report, Umwelt, Attachment J;
- Rifle Range Servicing Report, ADW Johnson, June 2017, Attachment K; and
- Consultation Report, Elton, December 2016, Attachment L.

The site comprises a significant land area of approximately 111ha. While the E2 Environmental

Conservation zoning recognises the ecological significance of parts of the site, detailed investigation of the site has demonstrated that some areas are appropriate for more significant residential development. Such development would respond to the sites sensitivities while maximising its potential to deliver housing in close proximity to existing services, amenities and infrastructure such as the Williamtown RAAF base.

The Planning Proposal responds to the site opportunities and constraints identified in the technical specialist reports, and seeks to enable the recommended development scenario. Each report is discussed in detail in relevant sections of this report.

Is the Planning Proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

There is potential under the site's current land use zoning to develop the site for a range of uses with consent including residential, limited to bed and breakfast accommodation, dual occupancies, dwelling houses, and eco-tourist facilities. Under the E2 Environmental Conservation zoning, the site is considered appropriate for some residential uses so long as they meet the objectives of protecting areas of high ecological, scientific, cultural or aesthetic values. Semi-detached dwellings and multi-dwelling housing are among the uses not permitted under the current zoning, which this planning proposal seeks to allow.

The current minimum lot size of 40ha would allow for a maximum of 2 lots on the approximately 111ha site. Under Clauses 4.1AA *Minimum subdivision lot size for community title schemes* and 4.1A *Minimum subdivision lot size for strata plan schemes in certain rural, residential and environment protection zones* of the Port Stephens LEP 2013, the 40ha minimum lot size would be applicable to community title schemes and strata plan schemes while the site was zoned E2 Environmental Conservation.

Accordingly, the maximum residential development of the site under the current zoning would be two dwellings. It is considered that this does not achieve the best use of the site considering the low ecological value of the disturbed range area, the strategic location of the site, and the financial realities of maintaining the parts of the site with high ecological value.

There is no maximum height of buildings control applicable to the site. It is considered that a maximum height of buildings control would be appropriately applied to the site in conjunction with an amended land use and lot size zoning to control potential visual impacts and scale of development.

A Planning Proposal to amend the land use zoning, ensuring that it responds appropriately to the different parts of the large site, the minimum lot size and maximum height of buildings is considered to be the best way to achieve the objectives for the site.

a. Relationship to strategic planning framework

Is the planning proposal consistent with the objectives and actions of the applicable regional, sub-regional or district plan or strategy (including any exhibited draft plans or strategies)?

This section provides a summary of the strategic planning framework within which the Planning Proposal outcomes for the site have been considered. It should be noted that only those relevant to the subject site have been identified below.

Hunter Regional Plan 2036

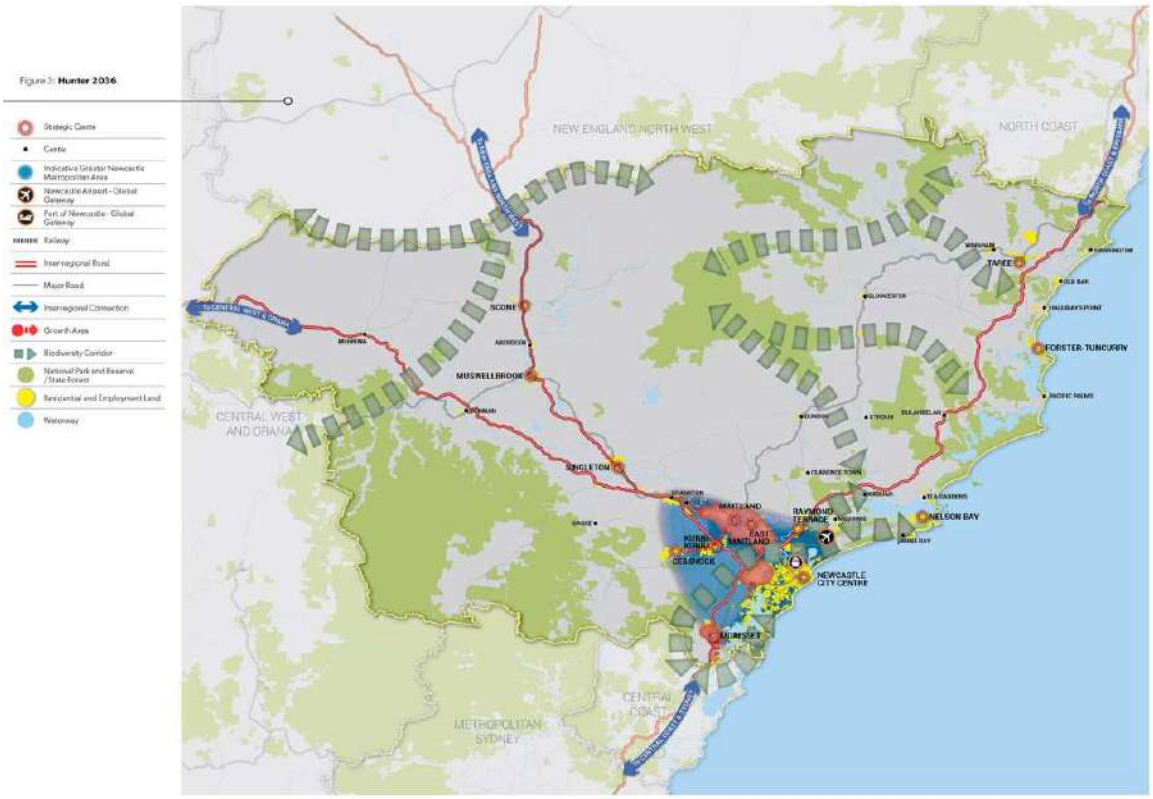
Overall, the growth strategy in the Hunter Regional Plan supports the renewal of the site to deliver a diversity of housing, serving the housing needs of the local population and supporting the defence base while making the most efficient use of existing social and physical infrastructure.

The Planning Proposal would achieve the goals of the Hunter Regional Plan 2036 by:

2. Supporting strategically important local employment through a relationship with DHA and the Williamtown RAAF base, and contributing to the Hunter region being the leading regional economy in Australia;
3. Protecting a biodiversity-rich natural environment by increasing the sustainability of funding sources for site management and introducing a zoning which would protect the ecological value of the site;
4. Increasing the diversity and sustainability of the local community by increasing the population and accommodating a broad range of age groups, supporting local retail and services such as the local school at Fern Bay; and
5. Allowing the renewal of the site with controls that facilitate a diverse range of housing typologies, supporting greater housing choice in the region.

However, there are several mapping inconsistencies in the Regional Plan with relation to the site, which create difficulties in interpreting the strategic direction particularly when considering the DPE's position on residential and employment uses on the site as part of a strategy for the region. Specifically, the Hunter Regional Plan includes seven maps showing conflicting/inconsistent information for the Stockton area, as follows:

6. Figure 3: Hunter 2036, showing the overall strategy for the Hunter region including growth areas, transport corridors, and biodiversity corridors. The Rifle Range site is shown as part of the Indicative Greater Newcastle Metropolitan Area. Part of the site appears to be considered residential and employment land.



7. Figure 4: Greater Newcastle 2036, showing the overall strategy for the Greater Newcastle region. The Rifle Range site is shown as part of the Indicative Greater Newcastle Metropolitan Area and is not identified as a national park and reserve or state forest.

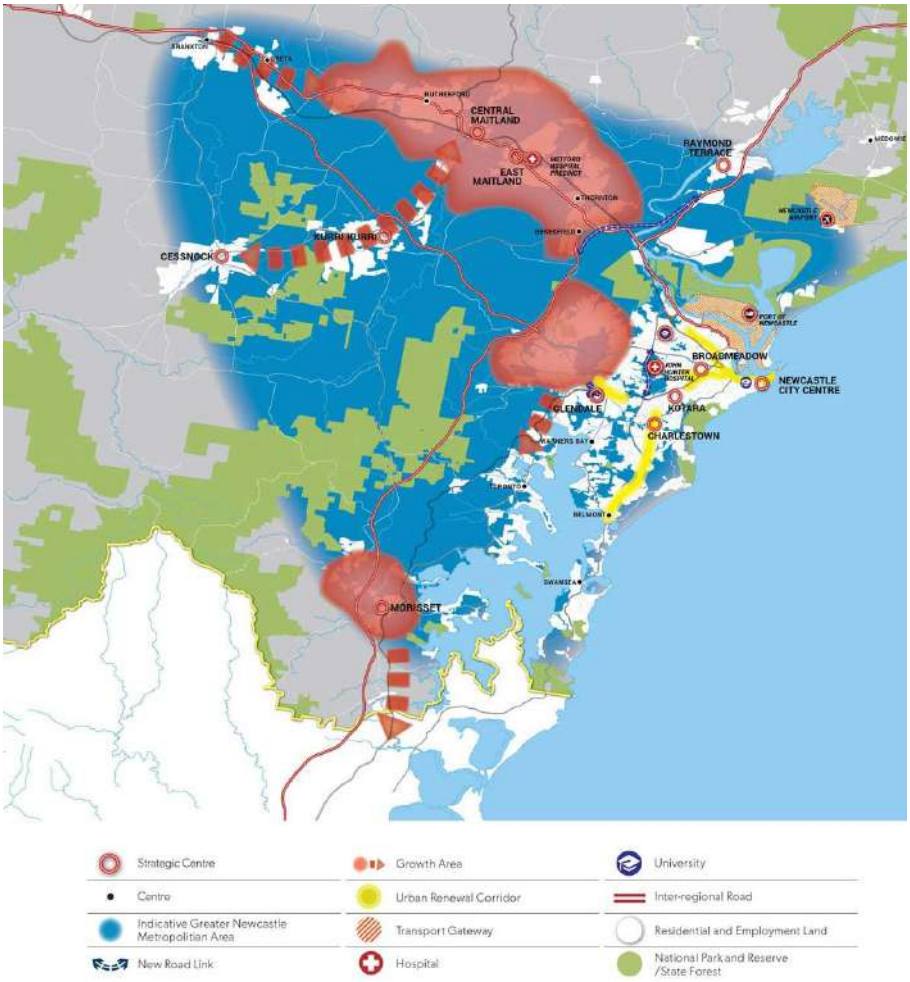


Figure 13 Excerpt from Hunter Regional Plan 2036, Figure 4: Greater Newcastle 2036

8. Figure 5: Greater Newcastle Strategic Centre Connectivity, showing the intended transport connectivity improvements. It is shown that the Rifle Range site is in the path identified to be strengthened, which runs from Newcastle City Centre north to the airport.

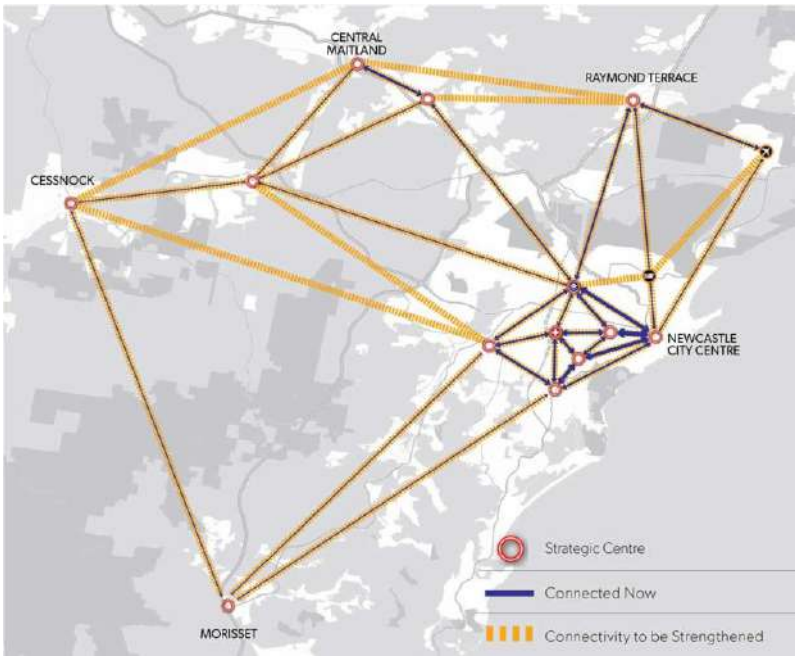


Figure 14 Excerpt from Hunter Regional Plan 2036, Figure 5: Greater Newcastle Strategic Centre Connectivity

9. Figure 9: Coal Mining and Renewable Energy, showing the locations of existing energy centres and potential areas to collect solar energy. The Rifle Range site is indistinguishable as the water is not shown.

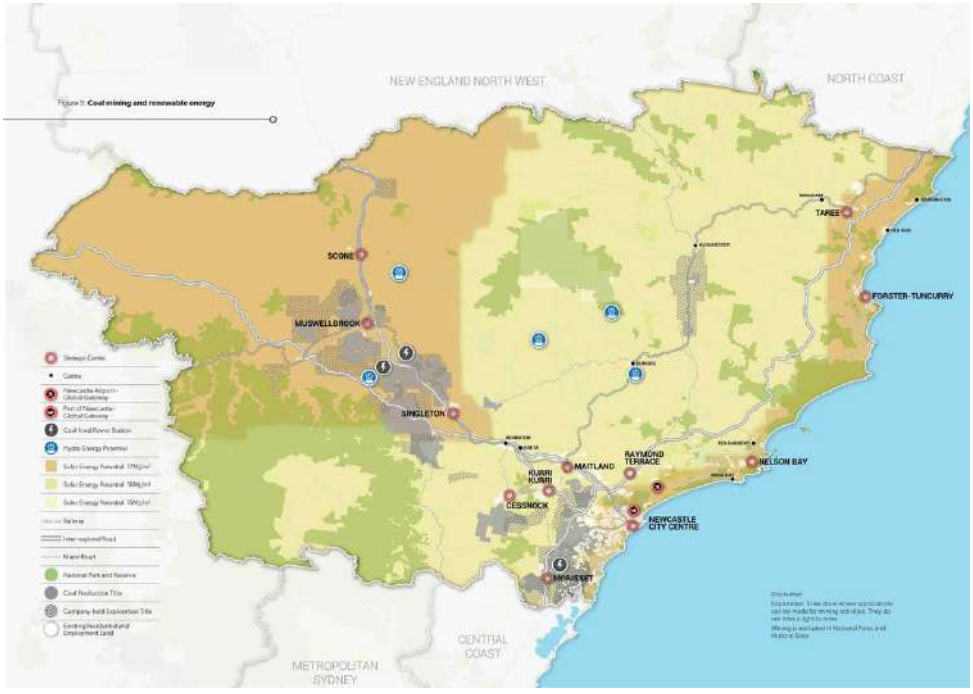


Figure 15 Excerpt from Hunter Regional Plan 2036, Figure 9: Coal Mining and Renewable Energy

10. Figure 10: Proposed Biodiversity Corridors, showing the proposed biodiversity corridors. The direction for the Rifle Range site is not clearly specified.

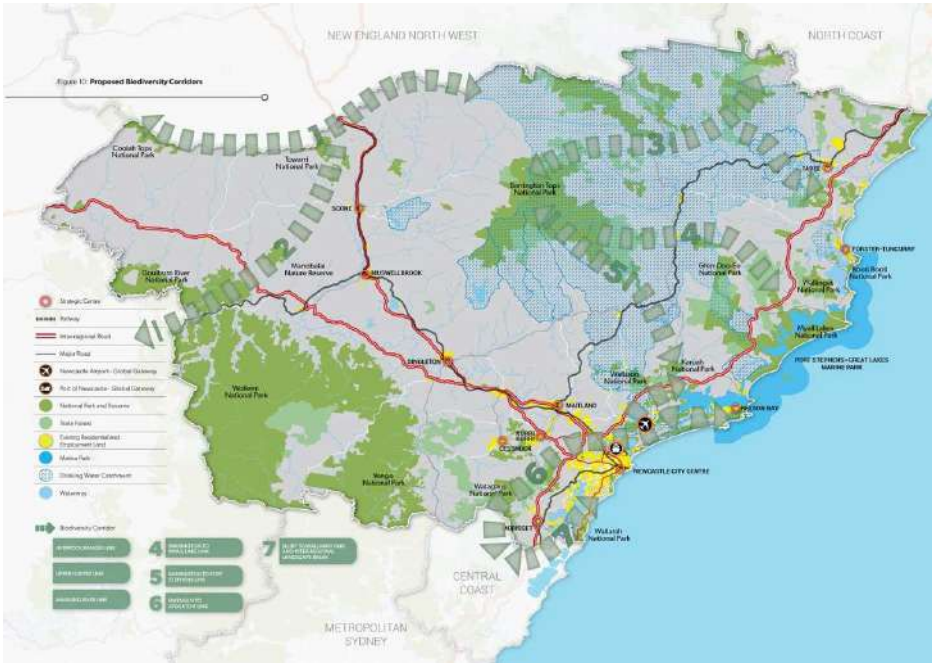


Figure 16 Excerpt from the Hunter Regional Plan 2036, Figure 10: Proposed Biodiversity Corridors

11. Figure 11: Greater Newcastle Settlement Pattern, showing the intended urban release and settlement areas. The direction for the Rifle Range site is unspecified.

Figure 17 Excerpt from Hunter Regional Plan 2036, Figure 11: Greater Newcastle Settlement Pattern

12. Figure 14: Inner Newcastle, showing the settlement pattern in Newcastle. The Rifle Range site appears to be identified as open space.

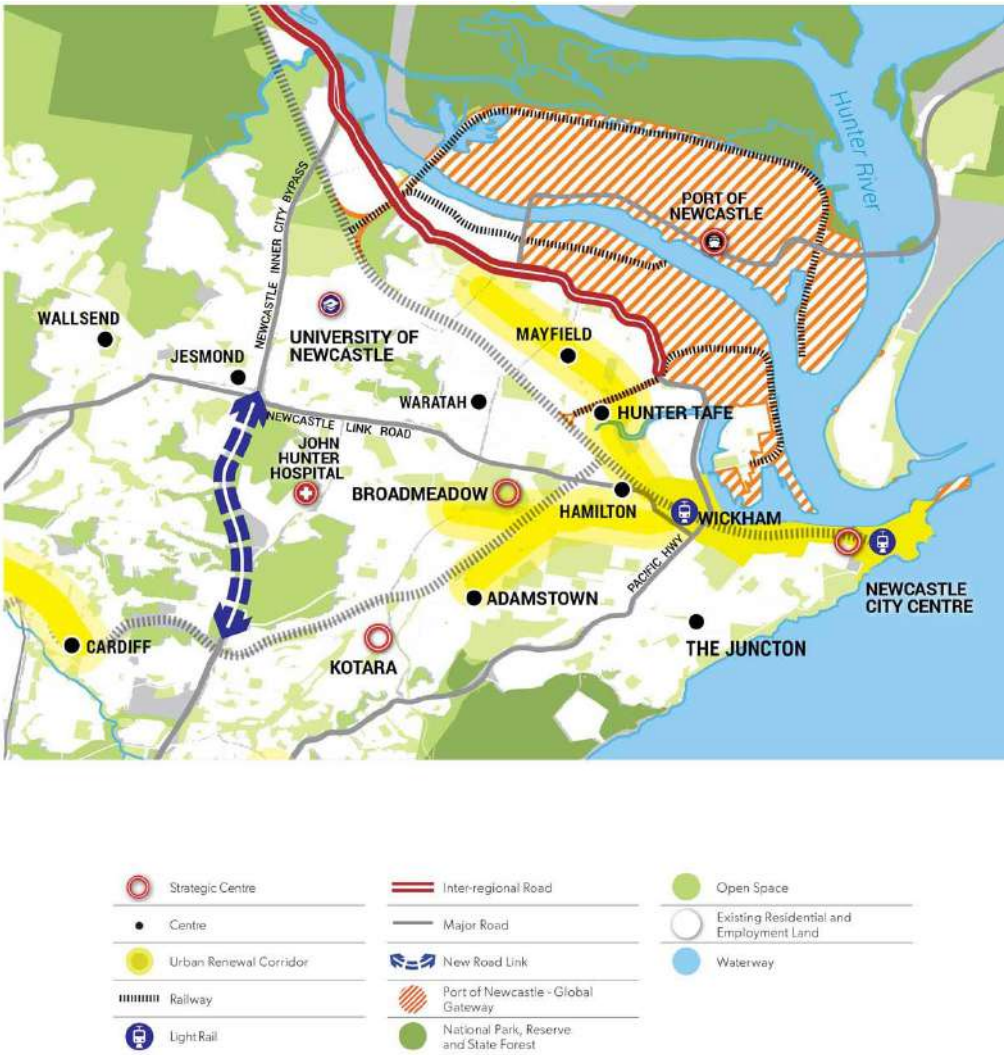


Figure 18 Excerpt from the Hunter Regional Plan 2036, Figure 14: Inner Newcastle

Preliminary consultation with the DPE indicates that the mapping was based on existing zoning and is intended to provide a high level strategic framework, and does not provide direction in relation to particular sites. The DPE advised that the Regional Plan will be supported by local planning in order to provide direction on a site specific basis. There is nothing in the plan, in the view of Architectus, which would preclude the merit assessment of a planning proposal to rezone the site for residential uses.

It is understood that the DPE, in briefing councils on the Regional Plan, has indicated that planning proposals should be assessed with particular consideration of Directions 20 – 24. The Planning Proposal would contribute to achieving the objectives of the plan as summarised below.

Table 2 Response to Hunter Regional Plan 2036 Directions

Direction	Consistent	Comment
Direction 20: Revitalise existing communities. This direction relates to the concentration of development in existing areas to revitalise	Yes	The Rifle Range site lies adjacent the Fern Bay Town Centre and in close proximity to the Stockton Town Centre, both of which provide a range of social and physical

communities and focus social and physical infrastructure.		infrastructure which would efficiently service the residential development of the Rifle Range site. Key infrastructure includes the Fern Bay public school and the ferry between Stockton and Newcastle CBD. Newcastle CBD, approximately 4km south of the site, also offers amenity and regional infrastructure and services. The proposal would accommodate growth in population to support local shops, schools, and services in Fern Bay and Stockton.
Direction 21: Create a compact settlement. This direction seeks to focus development in locations with established services and infrastructure. One identified action is for Councils to identify opportunities for urban redevelopment or renewal in urban locations with access to public transport and services in the Greater Newcastle metropolitan area and where there may no longer be a need for employment land.	Yes	The renewal of the Rifle Range site for residential uses would support an alignment of infrastructure delivery in the area by permitting residential uses on a well located site in close proximity to both the Fern Bay and Stockton communities. It is important also for DHA to provide housing for defence members in close proximity to the Williamtown Base. When compared to other sites in the 30km radius of the Williamtown Base, the subject site is very well serviced and the most appropriate location for additional housing in the Port Stephens LGA. While the master plan achieves a range of dwelling types, it is not considered to be a high density development. The number of dwellings delivered for the site area could be achieved with a traditional subdivision model, which would be unlikely to achieve dwelling diversity. A key principle of the master plan has been to appropriately balance the environmental values of the site with the delivery of housing. By reducing the footprint of development and increasing the height, the master plan has minimised impact on sensitive areas of the site and achieved a range of dwelling types.
Direction 22: Promote housing diversity. This direction relates to the need to provide diverse housing to accommodate the diverse needs of the community, including housing for older people, adaptable housing, and social and affordable housing. A key action is to respond to the demand for housing for resource industry personnel, and encourage housing diversity, including studios and one and two bedroom dwellings.	Yes	Housing diversity is a key objective of the master plan for the site, which has informed the planning proposal. The R1 General Residential zoning in the Port Stephens LEP permits a broad range of housing to be delivered on the site. It is intended that housing diversity in accordance with the master plan and residential typologies developed in the Urban Design and Landscape Report (**Attachment B**) would be promoted as an objective for the site in the site-specific DCP. In addition, the delivery of housing for defence personnel would support social diversity and affordability for these key workers in the region. The residential typologies that would be

		accommodated on site would allow for a diverse community, including defence members with families and single defence members. The indicative master plan accommodates a broad range of dwelling types such as freestanding houses, semi-detached terrace dwellings with private open spaces that could support single people and smaller families, and multi-dwelling cluster housing that encourages flexibility and households at all stages of life. This is a good social outcome compared to the typical options for housing around the base and in the local area. The DHA model also seeks to provide 50% defence housing on the site and 50% of housing available for private sale to members of the public. This again encourages a diverse community.
Direction 23: Grow centres and renewal corridors. Concentration of development in strategic centres, urban renewal corridors and locally significant centres.	Yes	Fern Bay is identified as a locally significant centre under the Hunter Regional Plan 2036. The proposal would contribute to the Fern Bay centre by opening the site to the community including access to the coast, a diverse and cohesive community to support local retail and services, and through the interpretation of the heritage elements of the site. The proposal would also accommodate growth in population to support local shops, schools, and services in Stockton.
Direction 24: Protect the economic functions of employment land. This direction encourages the promotion and protection of industry through land use and infrastructure planning.	Yes	The proposed rezoning would support the function of the nearby Williamtown RAAF base and the sustainability of the Defence force in the region by delivering housing stock for Defence personnel and contributing to financial outcomes for DHA. The site has not been required by Defence for defence purposes in some time and the use of the site in its current situation does not contribute to employment in the region. The site and proposed concept plan is sufficiently separated from nearby employment so as not to have an impact on the viability of existing industrial areas.

The Hunter Regional Plan 2036 also includes Local Government Narratives which are intended to guide councils in investigation and implementation of the plan in order to achieve outcomes on the ground. The alignment of the planning proposal with key priorities of relevance to the Rifle Range site are discussed below.

Table 3 Response to Hunter Regional Plan 2036 Local Priorities

Local Priority	Consistent	Comment
Provide a buffer to the Port of Newcastle operations through appropriate zoning to safeguard its future.	Yes	The Port of Newcastle is an increasingly important global gateway to the region. The Planning Proposal would not impact the sustainability of the Port of Newcastle in its continued operations. The site is located in an existing residential and special use area and is considered suitable for residential uses. Land buffers to the Port of Newcastle are appropriately zoned (IN1 and IN2). The subject site is not within the identified buffer zone.
Provide small-scale renewal and redevelopment of larger sites for infill housing.	Yes	The Planning Proposal would enable renewal of a currently underutilised site in a key location, with strong links to Newcastle and the airport, and provide increased, diverse housing to meet the needs of the community.

The Planning Proposal is considered to align with the Hunter Regional Plan 2036.

Is the Planning Proposal consistent with a council's local strategy or other local strategic plan?

The Port Stephens Planning Strategy (PSPS) was adopted by Council on 20 December 2011. The primary purpose of the PSPS is to guide land use planning and decision making for development and environmental outcomes.

The PSPS is a comprehensive document that identifies key trends and risks for future growth and development in the LGA. The strategy supports residential development primarily in existing centres to accommodate future demand for housing fuelled by broader population trends. Increased density in existing centres is intended to make the most effective use of infrastructure and promote the feasibility of increasing services, including retail and commercial uses.

Fern Bay is identified as one of the smaller village centres in the LGA, acting as urban support along with the centres of Kings Hill, Medowie, Anna Bay, Tanilba Bay and Karuah to the regional centre of Raymond Terrace. Fern Bay is also identified as part of the Eastern Growth Corridor that stretches from Medowie in the north to Fern Bay in the south.

The declining supply of land with urban potential in the LGA is a key challenge identified for future growth and development, responding to the risks of sea level rise and coastal erosion, flooding, bushfire and aircraft noise that affect large portions of the LGA. The loss of sites with urban potential to rural residential development, and subsequently underutilised well-serviced and located sites, is acknowledged. The PSPS seeks to ensure that land with urban potential is identified and maximised while responding appropriately to its context.

This planning proposal achieves the objectives of the PSPS by considering the subject site in detail to identify areas of development potential and maximising the delivery of a diversity of dwellings while protecting areas of high environmental significance and responding to the sites constraints. The delivery of housing for defence members and their families will also support the function of the Williamtown RAAF base, identified as a key economic driver in the region.

Part 6.4.3 of the PSPS sets out principles to guide the location of medium density housing

areas in the LGA. These have been addressed below to demonstrate how the planning proposal achieves the key objectives for residential development.

1. *Residential densities should be highest near the centre and lowest at the outer edge of the urban area.*

The planning proposal seeks to impose a height and minimum lot size control that generally corresponds with the adjoining Fern Bay residential area.

A small part of the subject site is proposed to have a minimum lot size of 200sqm. The proposed minimum lot size of 200sqm is a result of detailed site testing to accommodate semi-detached dwellings along the main street, delivering a range of dwelling typologies and minimising the footprint of the development area while maximising the urban potential of the site. The 200sqm lot size is necessary to accommodate this dwelling form within the existing structure of the range (between the 100 yard markers), which is being retained as part of the site's heritage interpretation.

While the master plan achieves a range of dwelling types, it is not considered to be a high density development. The number of dwellings delivered for the site area could be achieved with a traditional subdivision model, which would be unlikely to achieve dwelling diversity. A key principle of the master plan has been to appropriately balance the environmental values of the site with the delivery of housing. By reducing the footprint of development and increasing the height, the master plan has minimised impact on sensitive areas of the site and achieved a range of dwelling types.

Under the Port Stephens LEP 2013, semi-detached dwellings may be approved on lots of a minimum of 250sqm if the subdivision is considered with a development application. The PSPS envisages infill development utilising this clause in the Fern Bay residential area. It is considered that the proposed combined approach of 200sqm and 500sqm minimum lot sizes on the subject site appropriately responds to the character of permissible and expected densities in the area.

2. *Medium density housing should be generally within:*
    a. *a five minute walk (400m) of a centre, or;*
    b. *five minute (400m) walk of bus stops with frequent services to major centres, or;*
    c. *ten minute walk (800m) of the regional centre and other town centres, or;*
    d. *selected areas of high amenity or suitable topography for such development, with adequate social and physical infrastructure and an acceptable level of visual or amenity impact.*

The planning proposal focuses urban growth around centres. The subject site adjoins the existing Fern Bay community and is within 400m of the Fern Bay Store, public school, and bus services. The increased residential population is likely to support growth of retail services in the centre to the benefit of the existing community. This is consistent with the principles set out for medium density housing in Part 6.4.3 of the PSPS.

The concept master plan developed for the site also demonstrates how the site topography would appropriately accommodate residential development and minimise the visual impact, particularly when viewing the site from Popplewell road.

3. *Not identified on a Flood Planning Area map.*

The PSPS notes that substantial portions of the LGA are limited in their potential to contribute to housing targets by flooding hazards. The subject site is not identified as flood prone land under the Port Stephens LEP 2013, as shown in the following figure.

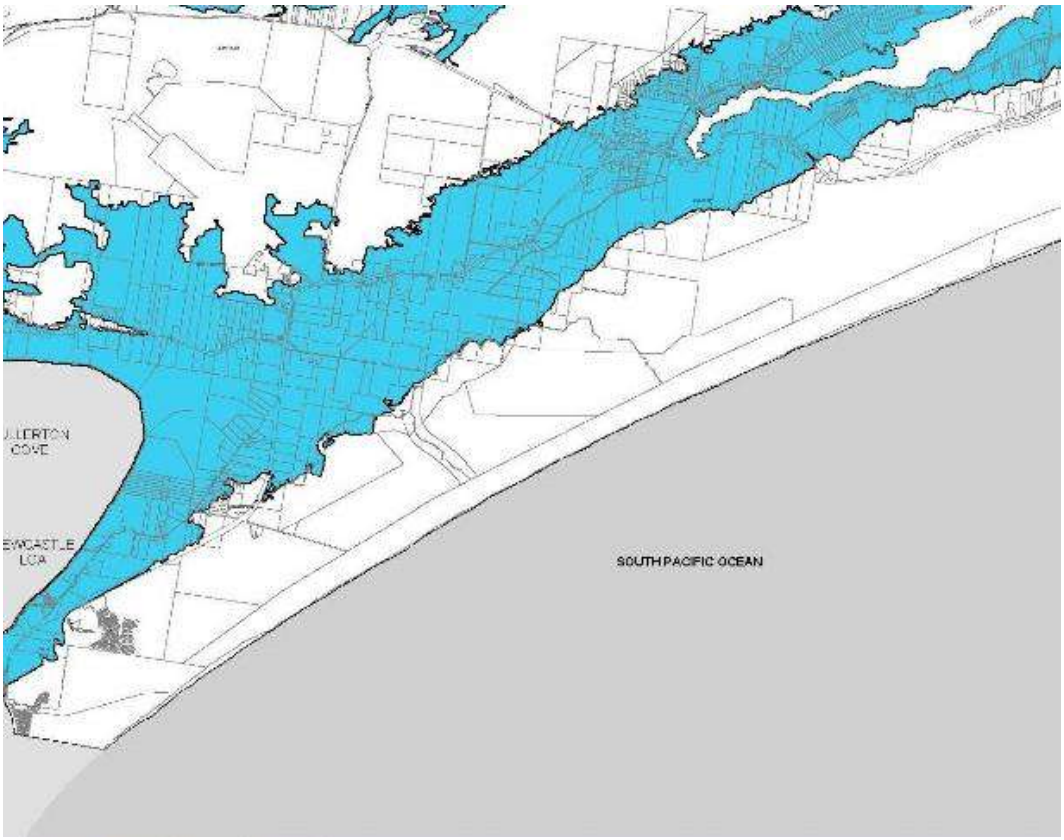


Figure 19 Flood Planning Map, Port Stephens LEP 2013

4. *Not adversely affected by aircraft noise.*

The site is not adversely impacted by aircraft noise, as demonstrated in the following figure, showing the ANEF contour forecasts prepared by the Department of Defence for the Williamtown base.

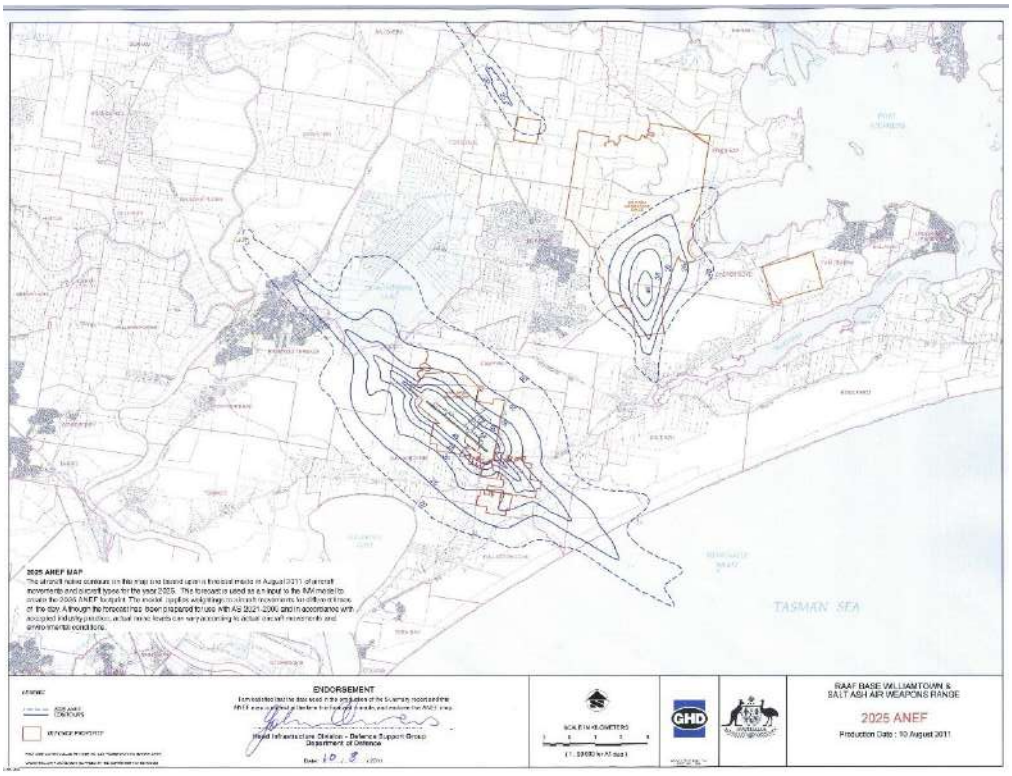


Figure 20 2025 ANEF Mapping, Department of Defence, 2011

5. *Not adversely impacted by sea level rise.*

A coastal engineering assessment was prepared by BMT WBM to inform the development of the concept master plan and this planning proposal, provided in full at Attachment F. The assessment concludes that, even considering the worst case scenario of coastal erosion and sea level rise to 2100, the site could accommodate residential development in line with coastal hazard and management policies.

Is the planning proposal consistent with applicable State Environmental Planning Policies?

The consistency of this Planning Proposal with current State Environmental Planning Policies (SEPPs) considered applicable to the Planning Proposal are outlined in the table below. SEPPs which have been repealed or were not finalised are not included in this table.

Table 4 Response to State Environmental Planning Policies

State Environmental Planning Policy	Consistency	Comment
SEPP 1 – Development Standards	Yes	Clause 1.9 of the Port Stephens LEP 2013 excludes the application of SEPP 1. Clause 4.6 of the LEP 2012 is the alternative mechanism, for varying development standards. Clause 4.6 provides a comprehensive merit test to ensure design excellence is achieved. The Planning Proposal will not contradict or hinder the application of this SEPP.
SEPP 14 – Coastal Wetlands	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP.
SEPP 26 – Littoral Rainforests	Yes	The consistency of the Planning Proposal with SEPP 26 has been assessed by the Ecological Assessment prepared by Umwelt, provided in

		Attachment H. The assessment concludes that no littoral rainforest communities were recorded or are likely to occur within the study area, and there is no potential for these communities to be impacted by the proposal.
SEPP 44 – Koala Habitat Protection	Yes	The SEPP applies to land in the Port Stephens LGA. The Port Stephens Comprehensive Koala Plan of Management also applies to the site. The consistency of the Planning Proposal with SEPP 44 and the Port Stephens Comprehensive Koala Plan of Management has been considered in detail in the Ecological Assessment prepared by Umwelt, provided in **Attachment H**. The assessment concludes that preferred koala habitat, including suitable koala feed trees, are present on the site. A preliminary Koala Plan of Management has been submitted with the Planning Proposal to demonstrate how the concept master plan facilitates appropriate management of koala habitat. The current indicative Master Plan indicates potential disturbance to 2 koala feed trees. Where possible, koala feed trees will be selectively retained within the development footprint. This will be assessed in detail at DA stage. The planning proposal is therefore considered to be consistent with SEPP 44.
SEPP 55 – Remediation of Land	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP. A Site Audit Statement has been prepared and provided at **Attachment G** that demonstrates that the site is considered to be suitable for the uses set out in the Planning Proposal. Application of the SEPP at DA stage and further work will ensure that the land is developed in accordance with the SEPP.
SEPP 64 – Advertising and Signage	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP if and when signage is proposed under future development.
SEPP 65 – Design Quality of Residential Flat Development	Yes	The Urban Design and Landscape Study for the site, provided in **Attachment B**, has been informed by SEPP 65 Principles. The Planning Proposal is not considered to hinder the application of this SEPP or the accompanying Apartment Design Guide.
SEPP 71 – Coastal Protection	Yes	SEPP 71 requires that a master plan be prepared and adopted by the Minister prior to the subdivision of land within the coastal zone. The Minister may waive the need to adopt a master plan if it is considered unnecessary due to the nature of the development, due to the adequacy of other planning controls, or for other reasons that the Minister considers sufficient. The concept master plan that has been prepared to support this planning proposal, set out in detail in the Urban Design and Landscape Report provided in **Attachment B**, illustrates the master plan for the site in accordance with the principles set out in Clause 20 of the SEPP. It is intended that this master plan be adopted after refinement through the planning proposal process, or that the requirement for a master plan be waived following the approval of a Stage 1 DA for the streets, public spaces and infrastructure for the site at a later stage. The Planning Proposal will not contradict or hinder the application of this SEPP.

SEPP (Building Sustainability Index: BASIX) 2004	Yes	The Planning Proposal will be consistent with the application of this SEPP. Future residential use on the site will be required to achieve minimum BASIX requirements (lighting, heating, cooling, and ventilation) to qualify for a BASIX Certificate and compliance with SEPP BASIX.
SEPP (Exempt and Complying Development Codes) 2008	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP.
SEPP (Infrastructure) 2007	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP.
SEPP (Rural Lands) 2008	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP.

Is the planning proposal consistent with applicable Ministerial Directions (s.117 directions)?

The consistency of the Planning Proposal with the applicable State Environmental Planning Policies is discussed below.

Table 5 Response to Section 117 Directions

No.	Direction	Application / Controls	Consistency	Comment
1	**Employment and Resources**			
1.1	Business and Industrial Zones	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed business or industrial zone (including the alteration of any existing business or industrial zone boundary).	N/A	The planning proposal does not seek to affect land within an existing or proposed business or industrial zone.
1.2	Rural Zones	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed rural zone (including the alteration of any existing rural zone boundary).	N/A	The Planning Proposal does not affect land within an existing or proposed rural zone.
1.3	Mining, Petroleum Production and Extractive Industries	*Application* This direction applies when a relevant planning authority prepares a planning proposal that would have the effect of: (a) prohibiting the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials, or (b) restricting the potential development of resources of coal, other minerals, petroleum or extractive materials which are of State or regional significance by permitting a land use that is likely to be incompatible with such development.	N/A	The Planning Proposal does not relate to the mining of coal or other materials, production of petroleum or extractive materials.
1.4	Oyster Aquaculture	*Application* This direction applies to Priority Oyster Aquaculture Areas and oyster aquaculture outside such an area as identified in the NSW Oyster Industry Sustainable Aquaculture Strategy (2006) ("the Strategy"). The planning authority must consider the potential impacts of the planning proposal on the oyster aquaculture areas consult with the Director General of the Department of Primary Industries (DPI).	N/A	The Planning Proposal does not affect land in proximity to a Priority Oyster Aquaculture Area.

No.	Direction	Application / Controls	Consistency	Comment
1.5	Rural Lands	*Application* This direction applies when: (a) a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed rural or environment protection zone (including the alteration of any existing rural or environment protection zone boundary) or (b) a relevant planning authority prepares a planning proposal that changes the existing minimum lot size on land within a rural or environment protection zone.	Yes	The objectives of this direction are to: (a) protect the agricultural production value of rural land, (b) facilitate the orderly and economic development of rural lands for rural and related purposes. Planning Proposals to which the Direction applies must be consistent with the Rural Planning Principles and Rural Subdivision Principles set out in the State Environmental Planning Policy (Rural Lands) 2008. The Rural Planning Principles are as follows: (a) the promotion and protection of opportunities for current and potential productive and sustainable economic activities in rural areas, (b) recognition of the importance of rural lands and agriculture and the changing nature of agriculture and of trends, demands and issues in agriculture in the area, region or State, (c) recognition of the significance of rural land uses to the State and rural communities, including the social and economic benefits of rural land use and development, (d) in planning for rural lands, to balance the social, economic and environmental interests of the community, (e) the identification and protection of natural resources, having regard to maintaining biodiversity, the protection of native vegetation, the importance of water resources and avoiding constrained land, (f) the provision of opportunities for rural lifestyle, settlement and housing that contribute to the social and economic welfare of rural communities, (g) the consideration of impacts on services and infrastructure and appropriate location when providing for rural housing, (h) ensuring consistency with any applicable regional strategy of the Department of Planning or any applicable local strategy endorsed by the Director-General.
2	**Environment and Heritage**			
2.1	Environmental Protection Zones	*Controls* 4) A planning proposal must include provisions that facilitate the protection and conservation of environmentally sensitive areas. 5) A planning proposal that applies to land within an environment protection zone or land otherwise identified for environment protection purposes in a LEP must not reduce the environmental protection standards that apply to the land (including by modifying development standards that apply to the land). This requirement does not apply to a change to a development standard for minimum lot size for a dwelling in accordance with clause (5) of Direction 1.5 “Rural Lands”.	Yes	The planning proposal relates to land that is currently zoned E2 Environmental Conservation, with a portion of this land considered suitable for residential development proposed to be rezoned to R2 Low Density Residential. A planning proposal may be inconsistent with the terms of the Direction if the planning proposal is justified by a strategy prepared in support of the planning proposal which gives consideration to the objectives of the Direction. The Umwelt Ecological Assessment, provided at **Attachment H**, gives consideration to this Direction and has concluded that the planning proposal seeks to appropriately protect and conserve

No.	Direction	Application / Controls	Consistency	Comment
				environmentally sensitive areas. In addition, it is noted that the site was identified by both Defence and Council for a SP2 Infrastructure (Defence) zoning. This is discussed in Section 1.5 of this report.
2.2	Coastal Protection	*Application* This direction applies when a relevant planning authority prepares a planning proposal that applies to land in the coastal zone.	Yes	The consistency of the Planning Proposal with key coastal planning policies has been assessed in detail in the Coastal Engineering Report, provided at **Attachment F**. The Planning Proposal gives effect to the relevant legislation and guidelines.
2.3	Heritage Conservation	*Controls* A planning proposal must contain provisions that facilitate the conservation of: (a) items, places, buildings, works, relics, moveable objects or precincts of environmental heritage significance to an area, in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item, area, object or place, identified in a study of the environmental heritage of the area, (b) Aboriginal objects or Aboriginal places that are protected under the National Parks and Wildlife Act 1974, and (c) Aboriginal areas, Aboriginal objects, Aboriginal places or landscapes identified by an Aboriginal heritage survey prepared by or on behalf of an Aboriginal Land Council, Aboriginal body or public authority and provided to the relevant planning authority, which identifies the area, object, place or landscape as being of heritage significance to Aboriginal culture and people.	Yes	The assessment of European heritage conservation has been undertaken in detail in the attached Heritage Impact Assessment, provided at **Attachment I**. The assessment concludes that the Planning Proposal appropriately manages the heritage value of the site. An Aboriginal Cultural Heritage and Archaeological Assessment Report has also been prepared to inform this Planning Proposal, provided at **Attachment J**. The assessment concludes that the planning proposal appropriately manages the aboriginal cultural heritage value of the site.
2.4	Recreation Vehicle Areas	*Controls* A planning proposal must not enable land to be developed for the purpose of a recreation vehicle area (within the meaning of the Recreation Vehicles Act 1983): (a) where the land is within an environmental protection zone, (b) where the land comprises a beach or a dune adjacent to or adjoining a beach, (c) where the land is not within an area or zone referred to in paragraphs (4)(a) or (4)(b) unless the relevant planning authority has taken into consideration: (i) the provisions of the guidelines entitled Guidelines for Selection, Establishment and Maintenance of Recreation Vehicle Areas, Soil Conservation Service of New South Wales, September, 1985, and (ii) the provisions of the guidelines entitled Recreation Vehicles Act, 1983, Guidelines for Selection, Design, and Operation of Recreation Vehicle Areas, State Pollution Control Commission, September 1985.	Yes	The Planning Proposal does not seek to enable land to be developed for the purposes of a recreation vehicle area. In its current situation, the site is often illegally accessed by recreational vehicles, primarily by quad bikes. The proposed rezoning and concept master plan would facilitate increased passive surveillance through appropriate development, landscaping and management.
3	**Housing, Infrastructure and Urban Development**			
3.1	Residential Zones	*Controls* A planning proposal must include provisions that encourage the provision of	Yes	The Planning Proposal is consistent with this Direction. Housing diversity is a key objective of the master plan for the site, which has informed the planning proposal.

No.	Direction	Application / Controls	Consistency	Comment
		housing that will: (a) broaden the choice of building types and locations available in the housing market, and (b) make more efficient use of existing infrastructure and services, and (c) reduce the consumption of land for housing and associated urban development on the urban fringe, and (d) be of good design. (5) A planning proposal must, in relation to land to which this direction applies: (a) contain a requirement that residential development is not permitted until land is adequately serviced (or arrangements satisfactory to the council, or other appropriate authority, have been made to service it), and (b) not contain provisions which will reduce the permissible residential density of land.		The R1 General Residential zoning in the Port Stephens LEP 2013 permits a broad range of housing to be delivered on the site. In addition, the delivery of housing for defence personnel would support social diversity and affordability for these key workers in the region. The location of the site, in close proximity to the Stockton Centre and Newcastle CBD, will ensure that residential development is well serviced and contributes to the efficient use of existing infrastructure. This Planning Proposal does not contain provisions which would reduce the permissible residential density of land.
3.2	Caravan Parks and Manufactured Home Estates	*Controls* In identifying suitable zones, locations and provisions for caravan parks in a planning proposal, the relevant planning authority must: (a) retain provisions that permit development for the purposes of a caravan park to be carried out on land, and (b) retain the zonings of existing caravan parks, or in the case of a new principal LEP zone the land in accordance with an appropriate zone under the Standard Instrument (Local Environmental Plans) Order 2006 that would facilitate the retention of the existing caravan park.	N/A	The Planning Proposal does not relate to the location or provision for caravan parks or manufactured homes.
3.3	Home Occupations	*Controls* Planning proposals must permit home occupations to be carried out in dwelling houses without the need for development consent.	Yes	The Planning Proposal does not seek to change the permissibility of home occupations in dwelling houses.
3.4	Integrated Land Use and Transport	*Controls* A planning proposal must locate zones for urban purposes and include provisions that give effect to and are consistent with the aims, objectives and principles of: (a) Improving Transport Choice – Guidelines for planning and development (DUAP 2001), and (b) The Right Place for Business and Services – Planning Policy (DUAP 2001).	Yes	The Planning Proposal is informed by a Transport Study undertaken by Better Transport Futures, provided at **Attachment C**. The study considers how a residential development of the site under the proposed planning controls would impact the surrounding transport network. The study concludes that the site is well serviced by public transport infrastructure and that local roads have the capacity to accommodate the additional vehicles that may result from a residential land use and is appropriate for residential development under the relevant transport legislation and guidelines.
3.5	Development Near Licenced Aerodromes	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will create, alter or remove a zone or a provision relating to land in the vicinity of a licensed aerodrome.	N/A	The Planning Proposal does not relate to land in proximity to an aerodrome. ANEF contours for the Williamtown base were assessed as part of the environmental assessment of the introduction of F-35A aircraft (Coffey, 2014). The diagram to the left demonstrates the extent of the ANEF contours, which do not impact the site. It is important to note that a substantial portion of land that could facilitate dwellings for defence staff in proximity to the base is affected, constraining the land available for these uses.

No.	Direction	Application / Controls	Consistency	Comment
3.6	Shooting Ranges	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will affect, create, alter or remove a zone or a provision relating to land adjacent to and/ or adjoining an existing shooting range.	N/A	The Planning Proposal does not seek to affect, create, alter or remove a zone or provision relating to land adjacent to or adjoining an existing shooting range.
4	**Hazard and Risk**			
4.1	Acid Sulfate Soils	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will apply to land having a probability of containing acid sulfate soils as shown on the Acid Sulfate Soils Planning Maps.	Yes	The Planning Proposal relates to land with an Acid Sulfate Soil Class of 3, 4 and 5. The site is predominately Class 4, with the whole of the proposed land use zoning change in the Class 4 Acid Sulfate Soils area. This planning proposal does not contradict or hinder application of acid sulphate soils provisions in the NLEP 2012.
4.2	Mine Subsidence and Unstable Land	*Application* This direction applies to land that: (a) is within a Mine Subsidence District proclaimed pursuant to section 15 of the Mine Subsidence Compensation Act 1961, or (b) has been identified as unstable land.	N/A	The Planning Proposal does not apply to land that is within a mine subsidence district or that has been identified as being unstable.
4.3	Flood Prone Land	*Application* This direction applies when a relevant planning authority prepares a planning proposal that creates, removes or alters a zone or a provision that affects flood prone land.	N/A	The land is not flood prone land, as shown in the Port Stephens Local Environmental Plan 2013 Flood Planning Map, Figure 19.
4.4	Planning for Bushfire Protection	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will affect, or is in proximity to land mapped as bushfire prone land.	Yes	The Planning Proposal is consistent with this Direction. The proposal has been assessed for its compliance with bushfire protection legislation and policy in detail in the Bushfire Risk Assessment Report, provided at **Attachment D**. The report concludes that the planning proposal does not preclude development that meets bushfire protection standards.
5	**Regional Planning**			
5.1	Implementation of Regional Strategies	This direction applies to land to which the following regional strategies apply: (a) Far North Coast Regional Strategy (b) Lower Hunter Regional Strategy (c) Illawarra Regional Strategy (d) South Coast Regional Strategy (e) Sydney–Canberra Corridor Regional Strategy (f) Central Coast Regional Strategy, and (g) Mid North Coast Regional Strategy.	N/A	The Hunter Regional Plan 2036 applies to the site. While the Hunter Strategy is ambiguous in its recommendations for the site specifically, generally the planning proposal is considered to be consistent with the Directions of the plan. The consistency of the Planning Proposal with the Hunter Regional Plan 2036 is addressed in Tables 1 and 2 of this report.
5.2	Sydney Drinking Water Catchment	*Application* This Direction applies to the Sydney drinking water catchment in the following local government areas: - Blue Mountains - Campbelltown - Cooma Monaro - Eurobodalla - Goulburn Mulwaree - Kiama - Lithgow - Oberon	N/A	The Planning Proposal does not apply to land in the Sydney drinking water catchment.

No.	Direction	Application / Controls	Consistency	Comment
		- Palerang - Shoalhaven - Sutherland - Upper Lachlan - Wingecarribee - Wollondilly - Wollongong.		
5.3	Farmland of State and Regional Significance on the NSW Far North Coast	*Application* This direction applies to: (a) Ballina Shire Council, (b) Byron Shire Council, (c) Kyogle Shire Council, (d) Lismore City Council, (e) Richmond Valley Council, and (f) Tweed Shire Council, except within areas contained by a "town and village growth boundary" in the Far North Coast Regional Strategy.	N/A	The planning proposal does not apply to land in the nominated Council areas.
5.4	Commercial and Retail Development along the Pacific Highway, North Coast	*Application* This Direction applies to those council areas on the North Coast that the Pacific Highway traverses, being those council areas between Port Stephens Shire Council and Tweed Shire Council, inclusive, when the relevant planning authority prepares a planning proposal for land in the vicinity of the existing or proposal alignment of the Pacific Highway.	N/A	The planning proposal does not apply to land in the vicinity of the Pacific Highway.
5.8	Second Sydney Airport: Badgerys Creek	*Application* This direction applies to land shown within the boundaries of the proposed airport site and within the 20 ANEF contour as shown on the map entitled "Badgerys Creek–Australian Noise Exposure Forecast–Proposed Alignment–Worst Case Assumptions", this being found in Appendix U of the Second Sydney Airport Site Selection Program Draft Environmental Impact Statement within Fairfield City Council, Liverpool City Council, Penrith City Council and Wollondilly Shire Council local government areas.	N/A	The planning proposal does not apply to land in the vicinity of Badgerys Creek.
5.9	North West Rail Link Corridor Strategy	*Application* This Direction applies to Hornsby Shire Council, The Hills Shire Council and Blacktown City Council.	N/A	The Planning Proposal does not apply to land within the Hornsby Shire, Hills Shire or Blacktown Council areas.
6	**Local Plan Making**			
6.1	Approval and Referral Requirements	Controls A planning proposal must: (a) minimise the inclusion of provisions that require the concurrence, consultation or referral of development applications to a Minister or public authority, and (b) not contain provisions requiring concurrence, consultation or referral of a Minister or public authority unless the relevant planning authority has obtained the approval of: (i) the appropriate Minister or public authority, and (ii) the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-	Yes	This is a matter for consideration by Council during the assessment of the Planning Proposal. This Planning Proposal does not contravene the objectives of this Direction.

No.	Direction	Application / Controls	Consistency	Comment
		General), prior to undertaking community consultation in satisfaction of section 57 of the Act, and (c) not identify development as designated development unless the relevant planning authority: (i) can satisfy the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) that the class of development is likely to have a significant impact on the environment, and (ii) has obtained the approval of the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) prior to undertaking community consultation in satisfaction of section 57 of the Act.		
6.2	Reserving Land for Public Purposes	*Controls* A Planning Proposal must not create, alter or reduce existing zonings or reservations of land for public purposes without the approval of the relevant public authority and the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General). (5) When a Minister or public authority requests a relevant planning authority to reserve land for a public purpose in a planning proposal and the land would be required to be acquired under Division 3 of Part 2 of the Land Acquisition (Just Terms Compensation) Act 1991, the relevant planning authority must: (a) reserve the land in accordance with the request, and (b) include the land in a zone appropriate to its intended future use or a zone advised by the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General), and (c) identify the relevant acquiring authority for the land. (6) When a Minister or public authority requests a relevant planning authority to include provisions in a planning proposal relating to the use of any land reserved for a public purpose before that land is acquired, the relevant planning authority must: (a) include the requested provisions, or (b) take such other action as advised by the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) with respect to the use of the land before it is acquired. (7) When a Minister or public authority requests a relevant planning authority to include provisions in a planning proposal to rezone and/or remove a reservation of any land that is reserved for public purposes because the land is no longer designated by that public authority for acquisition, the relevant planning authority must rezone and/or remove the relevant	Subject to discussion	The purpose of this Direction is to ensure that any land to be dedicated for public use is the result of proper consultation and approved by the relevant authorities. The master plan presents an opportunity to return significant coastal area back to the people, as well as a new park which could be dedicated to Council. DHA has undertaken preliminary design work for areas to be dedicated and undertaken preliminary consultation with Port Stephens Council. At this stage, it is proposed that the coastal area and new open spaces be dedicated to Council. Council have expressed in principle support for this approach, subject to further design work and consultation as part of the planning proposal process.

No.	Direction	Application / Controls	Consistency	Comment
		reservation in accordance with the request.		
6.3	Site Specific Provisions	*Controls* A planning proposal that will amend another environmental planning instrument in order to allow a particular development proposal to be carried out must either: (a) allow that land use to be carried out in the zone the land is situated on, or (b) rezone the site to an existing zone already applying in the environmental planning instrument that allows that land use without imposing any development standards or requirements in addition to those already contained in that zone, or (c) allow that land use on the relevant land without imposing any development standards or requirements in addition to those already contained in the principal environmental planning instrument being amended. (5) A planning proposal must not contain or refer to drawings that show details of the development proposal.	Yes	The planning proposal does not propose any unnecessarily restrictive site specific planning controls.
7	**Metropolitan Planning**			
7.1	Implementation of the Metropolitan Plan for Sydney.	*Controls* Planning proposals shall be consistent with: (a) the NSW Government's A Plan for Growing Sydney published in December 2014.	N/A	The planning proposal does not relate to land within the area of Metropolitan Sydney.

4.3 Environmental, social and economic impact

Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

The Planning Proposal has been informed by an ecological assessment undertaken by Umwelt, provided in full at **Attachment A**.

Overall, the assessment concludes that the disturbed areas of the Rifle Range (the land to the south of the main cleared track, which was used as the shooting range) and a small pocket of land to the north of the main cleared track are low quality ecological communities. The vegetation primarily to the north of the main track is of a higher quality and should be preserved, as shown in Figure 21.

Five native vegetation community types have been mapped within the subject site, being Frontal Dune Blackbutt-Apple Forest, Mahogany-Balosion Swamp Forest, Coastal Tea-tree – Banksia Scrub, Foredune Spinifex, and Beach Wetlands. The following figure shows the distribution of the identified vegetation communities across the site.

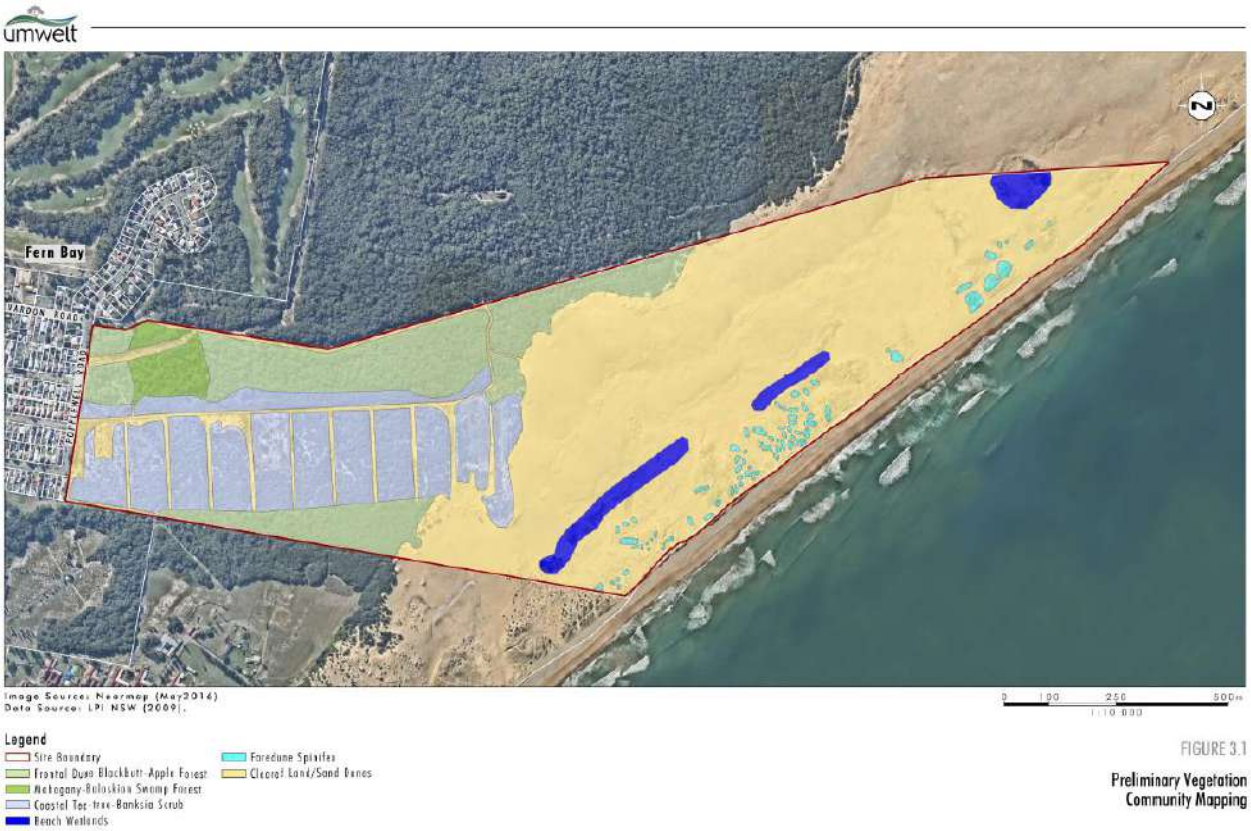


Figure 21 Vegetation Community Mapping, Umwelt, September 2016

Only one ecological community has been identified as likely to confirm to a threatened ecological community, being the Mahogany-Baloskion Swamp Forest occurring in a small part of the site to the north-west.

This Planning Proposal proposed to rezone part of the site from E2 Environmental Conservation to R1 General Residential zoning. The proposed residential zone would generally include a small area to the north and the land to the south of the main cleared track, which has been assessed to be disturbed and low value ecological communities. This approach retains the E2 Environmental Conservation zoning in the high value, intact ecological communities to the north.

Four threatened fauna species listed under the TSC or EPBC Acts have previously been recorded in the subject site, being:

- The grey-headed flying-fox (Pteropus poliocephalus), listed as vulnerable under the TSC and EPBC Acts;
- little bentwing-bat (Miniopterus australis), listed as vulnerable under the TSC Act;
- eastern bentwing-bat (Miniopterus schreibersii oceanensis), listed as vulnerable under the TSC Act;
- east coast freetail-bat (Mormopterus norfolkensis), listed as vulnerable under the TSC Act.

No endangered populations listed under the TSC or EPBC Acts have been recorded within the subject site.

Pre-lodgement consultation with Council identified concerns relating to koala habitat, movement and feed trees. The current Master Plan indicates potential disturbance to 2 koala feed trees. Where possible, koala feed trees will be selectively retained within the development footprint. Furthermore, a Preliminary Koala Plan of Management is included in the Ecological Assessment. There are also no hollow bearing trees are within the current Master Plan

development footprint. This would be further assessed at DA stage, and it is noted that the planning proposal does not seek approval for the removal of any trees or works to the site.

Council also noted the potential for habitat for the New Holland Mouse. An assessment of significance has been undertaken for this species in the Ecological Assessment, noting that 'coastal dune vegetation occurring in the Port Stephens LGA is likely to comprise an important population of the species'. However, the species has not been recorded on the site. The species is known to occur in the Worimi Conservation Lands, with the closest record on the NSW BioNet Atlas (from 2013) being within 2 km north of the site. The more detailed assessment in the EPBC Act Referral notes that the species 'is associated with heathlands and vegetation sand dunes and is found to peak in abundance 3 to 5 years following a fire. The last fire to impact the Rifle Range occurred in late 2006 and would have likely resulted in suitable habitat for the species'.

While the development site is not known as a historical or important foraging site for this species, 15.3 hectares of potential forest and shrub habitat is proposed to be impacted by the current Master Plan. However, this has been assessed as not having a significant impact on the species. 29.6 hectares of suitable habitat for the New Holland Mouse will be retained based on the current Master Plan. Avoidance and mitigation measures outlined in the Ecological Assessment would be undertaken to minimise any substantial impacts. Further survey work for the species may be required if determined by the Commonwealth Department of the Environment and Energy after the review of the EPBC Act Referral and/or required under a BAM assessment at the DA stage.

Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

The Planning Proposal is not likely to result in development that will create any significant adverse environmental effects.

A range of technical assessment have been undertaken to ensure that potential impacts of the rezoning are acceptable, including the ecological assessment summarised in the previous section of this report.

Urban design and landscape character impacts

Coastal impacts

Changes to the coastal system to the east of the Rifle Range site have been investigated to assess the potential impacts of short and long term erosion, sea level rise, and ongoing recession. The assessment, prepared by BMT WBM, demonstrates three scenarios for erosion by 2100 and the impact of each scenario on the Rifle Range site, considering specifically the concept master plan as an example of a potential residential development of the site.

The three scenarios are as follows:

- an 'almost certain' erosion scenario including short and medium term erosion, ongoing recession (due to the Newcastle Harbour breakwaters), but excluding the impacts of sea level rise;
- a 'likely' erosion scenario including short and medium term erosion, ongoing recession, and future recession due to sea level rise of 0.4 m by 2100 (equivalent to the current rate of sea level rise); and
- an 'unlikely' erosion scenario including short and medium term erosion, ongoing recession, and future recession due to sea level rise of 0.9 m by 2100 (equivalent to highest emission scenario along which we are tracking). The 'unlikely' scenario is the typical conservative estimate used for planning purposes in NSW.

In accordance with Council policy and best practice planning for residential subdivision and development potentially at risk from coastal hazards, all residential development in the concept

master plan is located well landward of the 2100 'unlikely' hazard line. The report recommends that the proposed rezoning be supported.

Heritage impacts

An assessment of heritage impact was undertaken by Urbis, informing the development of a concept master plan for the site. The site has no associated heritage listings, but does comprise two items which have been assessed to have some heritage significance, being the Anti-Aircraft battery which is located near to the northern boundary of the site, and the remnants of the 1,000 yard rifle range, being the clear access ways from the central road at 100 yards.

The planning proposal is generally supported in principle; with the sympathetic integration of the Links Battery a key element of future works to the site. It is not considered that the site meets the requisite threshold for significance for Commonwealth Heritage listing and is unlikely to meet the criteria for local listing.

Aboriginal cultural heritage and archaeological impacts

Consultation regarding the Aboriginal cultural values associated with the subject site has been undertaken to inform the master planning for the site and this planning proposal by Umwelt (Draft Aboriginal Cultural Heritage and Archaeological Assessment Report, November 2016). Notifications of work on the site were developed and publicly displayed, with four parties registering their interest in ongoing consultation, being:

- Kuruah Indigenous Corporation;
- Mur-Roo-Ma Inc;
- Nur-Run-Gee Pty Ltd;
- Worimi Local Aboriginal Land Council; and
- Wonn1.

Karuah Indigenous Corporation, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd and Worimi Local Aboriginal Land Council undertook a pedestrian survey of the site late 2016. The registered parties then had the opportunity to provide feedback as a group, provided in full in the report. A key point raised with regard to significance was the importance of the northern side of the current access road, which has storylines attached to it. Key recommendations from this consultation was no development to the northern side of the access road; no impact at the intersection of Braid Road and Popplewell Road due to known burials in the area and no impact in the southwestern corner of the rifle range due to known burials. The planning proposal and indicative master plan is considered to adequately address these recommendations.

The assessment concludes that from an aboriginal cultural heritage and archaeological standpoint, there are no factors that should prevent the rezoning of the site.

Consideration has been given to the ownership and management of land, given the land to the north of the site is owned by the Worimi and managed by NSW Parks. Discussions have been held regarding the potential to dedicate land to the north of the main road, which is intended to remain undisturbed, to the Worimi. The proposed rezoning would support this outcome.

Bushfire risk

An assessment of bushfire risk with respect to the development of the site for residential uses was undertaken by Kleinfelder, demonstrating how the concept master plan could implement appropriate bushfire risk mitigation measures (Rifle Range Bushfire Assessment, Kleinfelder, September 2016). The report found that the predominant bushfire hazard is located to the north and south of the subject site.

The assessment concludes that the master plan and associated design principles can comply with all performance criteria's outlined for integrated (residential subdivision) development and

minimum construction requirements at detailed design stages. The assessment also finds that the proposed design provides for suitable access and water provisions for emergency management.

Traffic and transport impacts

A transport study was prepared by Better Transport Futures to assess the high level potential of the transport network to accommodate residential development of the site (Transport Study Report, Better Transport Futures, November 2016). In order to understand what the impacts of the development might be and what development levels may be possible, a notional development yield of 220 lots, as shown in the concept master plan, has been assumed. The assessment has also considered the cumulative impacts of the potential rezoning of the Fort Wallace site (in Newcastle LGA and subject to a separate planning proposal).

Forecast traffic flows would be in the order of 156 trips AM and 172 trips PM for the Rifle range site. It is concluded that the external road network is more than capable of absorbing these levels of additional trips, while remaining at a very good operational level of service.

It is noted that, with the site intended to provide housing for defence members, trips north towards the Williamtown base are expected to be higher than a usual site, with local traffic from the site expected to be split evenly between north and south bound trips. The performance of right turn movements from the local Fern Bay network to Nelson Bay road under existing access arrangements would be poor and it is recommended that one intersection (either Taylor Road or Vardon Road) be provided with improvements to facilitate safe right run movements, and that the relevant road be upgraded to meet current council standards.

Safe right run movements could be facilitated in a range of ways that should align with the broader work being undertaken by RMS on Nelson Bay Road. These improvements would also benefit the Newcastle Golf Course and Fern Bay primary school. Preliminary engagement has been undertaken with RMS to ensure that they are aware of the planning proposal, but further investigation of the appropriate upgrade response for right run movements should be confirmed during engagement with authorities during the planning proposal process. Improvement works should be aligned with the subdivision and development of the site at a later stage.

Stormwater impacts

The Stormwater Management Plan specifically addresses stormwater quantity and quality. It has addressed the impacts of the development of the site on the existing drainage regime, determined the stormwater discharge constraints and identified proposed stormwater device measures to adequately treat the stormwater prior to discharging to receiving waters (Stormwater Management Plan, ADW Johnson, October 2016).

Based on review of the existing site topography and geotechnical conditions, it has been identified that any surface runoff will infiltrate into the existing sand substrate within the site limits. Stormwater management principles were considered in the development of the concept master plan, resulting in a proposed development footprint, built form typologies, and drainage strategy that will manage stormwater prior to discharging into the natural drainage system.

A MUSIC model was used to simulate pollutant source elements for the proposed development to confirm that the stormwater can be adequately treated within the limits of the development. The results from this study demonstrate that there is adequate capacity within the site to achieve the required performance objectives of the stormwater management.

Servicing impacts

ADW Johnson was commissioned to investigate the capacity of civil services in the area to support a residential use of the site (Servicing Report, Rifle Range, ADW Johnson, June 2017). Conclusions have been drawn using information from Dial Before You Dig (DBYD) services and consultation with Hunter Water Corporation. Potable water supply, sewer, electricity, telecommunications, and gas have been investigated.

The report concludes that:

- **Water.** There is sufficient capacity in the surrounding water mains for potable water supply. At the development design and application stage, security of supply will need to be addressed in accordance with Hunter Water's design guidelines;
- **Sewer.** There are multiple locations in the neighbourhood where sewer connections could be made to service a residential development of the site and the Fern Bay 1 Waste Water Pump Station has sufficient capacity to receive waste water from a residential development of the site. It is likely that a small pump will be required on the site to enable the waste water to be transported;
- **Electricity.** Popplewell Road currently has a high voltage transfer main running north south. It is envisaged that a high voltage connection will be made from the transfer main, with input from an electrical engineer at design stage to confirm the number and location of substations required;
- **Telecommunications.** Upgrades will be required to the network in line with future NBN roll outs to make services available on the site.
- **Gas.** There are no domestic gas services in the neighbourhood, although a gas main runs along Nelson Bay Road. It is expected that extensions to the network may be made by providers for commercial reasons.

The site could support residential development with adequate civil services.

Has the planning proposal adequately addressed any social and economic effects?

The Planning Proposal is expected to deliver a range of social and economic benefits to the existing and future community in the area, including:

1. **Opening the site to the public**. No access to the site is currently available to the public, including access from the beach. The Planning Proposal would enable the site to be opened to the public with a particular focus on access to the beach for the Fern Bay community, as well as the intended provision of public open space on the site;
2. **Employment through construction and maintenance of residential development.** The Planning Proposal would facilitate increased residential development opportunity on the site, which would contribute to local employment opportunities and may result in investment in the local economy through both construction and ongoing services (in services such as handiwork, bush and garden care, etc). However, it is noted that development of the site also has the potential to result in impacts to local residents such as noise and dust. Conditions of development consent should be applied to any future development approvals on the site to manage such potential impacts;
3. **Increased demand for local shops and services.** Preliminary community consultation indicates that neighbourhood shops and services, such as the Fern Bay Primary School and the Fern Bay Store, would benefit from the increased residential density and development of the site with increased demand. Increased demand resulting from more local residents may result in healthier local business and services and allow a broader range of services to be provided in the local area.
4. **Housing for Defence staff.** DHA provides housing and services to staff members of the Defence Force and their families. The two sites are located close to the Royal Australian Air Force (RAAF) Base Williamtown which lies 11 to 12 kilometres to the north of the sites. The Planning Proposal will provide essential housing for DHA through delivery of a range of dwelling types, and allow for private housing to subsidise the housing to be developed and delivered to Defence staff and their families. The Planning Proposal will also provide for a range of key workers to be accommodated in the area close to their employment, with excellent amenity.

Social and community infrastructure in the area has been reviewed and mapped as shown in the following figures. The site is in proximity to essential emergency services, including a fire

station and police station, in Stockton Town Centre, and also benefits from local services such as the Fern Bay Store and Primary School.

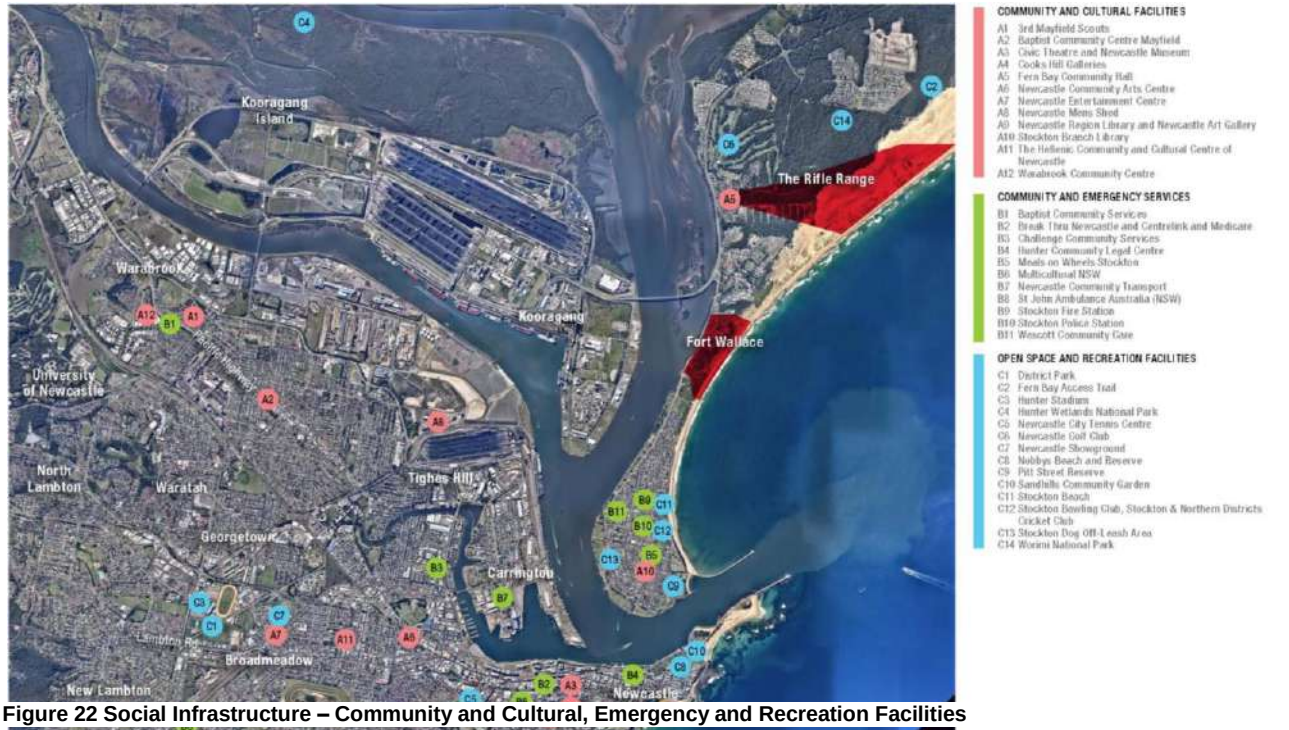


Figure 22 Social Infrastructure – Community and Cultural, Emergency and Recreation Facilities

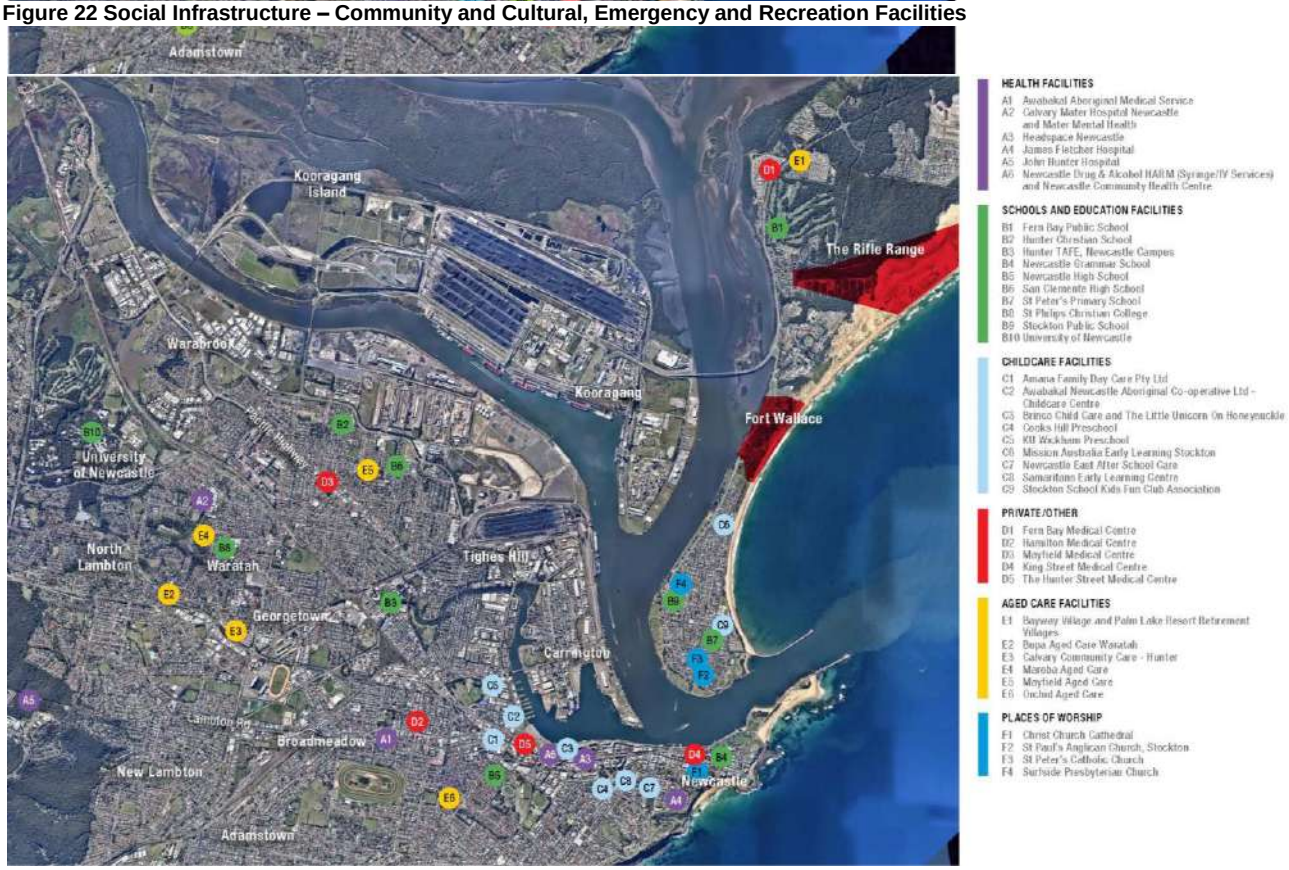


Figure 23 Social Infrastructure – Health, Education, Care and other Facilities

4.4 State and commonwealth interests

Is there adequate public infrastructure for the planning proposal?

It is considered that the planning proposal will be well serviced by public infrastructure. We note that the planning proposal will seeks to enable increased residential uses on a portion of the site, with a land use zone that allows for detached, semi-detached and attached dwellings. An indicative site master plan has been developed to demonstrate the site's potential, illustrating how approximately 200 dwellings could be facilitated.

This master plan has been used to undertake a preliminary assessment of civil infrastructure, including water, sewer, electricity, telecommunications and gas services, as summarised in Part 4.1. This report, provided in full at **Attachment K**, has concluded that there is capacity in the essential civil services to provide for a residential development of the site. While gas services are not currently available to the Fern Bay community, it is considered that the residential development of the site may increase the feasibility for the providers to extend this service.

The availability of public transport infrastructure has been considered. Newcastle Buses bus route 118 serves Fern Bay and Stockton, while buses to Williamtown are available through Port Stephens Coaches. The Newcastle to Stockton Ferry provides access to Newcastle CBD from Stockton centre.

The Stockton Cycle way, which runs parallel to Fullerton Street from near the Stockton Bridge, was opened by Council in 2013, connecting the peninsula from Stockton Bridge in the north to the Stockton Ferry terminal in the south. It is constructed as high standard concrete pavement dual use path.

What are the views of State and Commonwealth public authorities consulted in accordance with the Gateway determination?

The Gateway Determination will identify the public authorities to be consulted as part of the planning proposal process and any views expressed will be included in this planning proposal following consultation.

Preliminary consultation has been undertaken with Roads and Maritime Services (RMS), as summarised in the Transport Study.

The applicant is a commonwealth authority. As such, a referrals process to the Department of the Environment and Energy in relation to the site heritage and ecology has been initiated. This referral is expected to run concurrently to the Planning Proposal.

5.0 Mapping

5.1 Land zoning

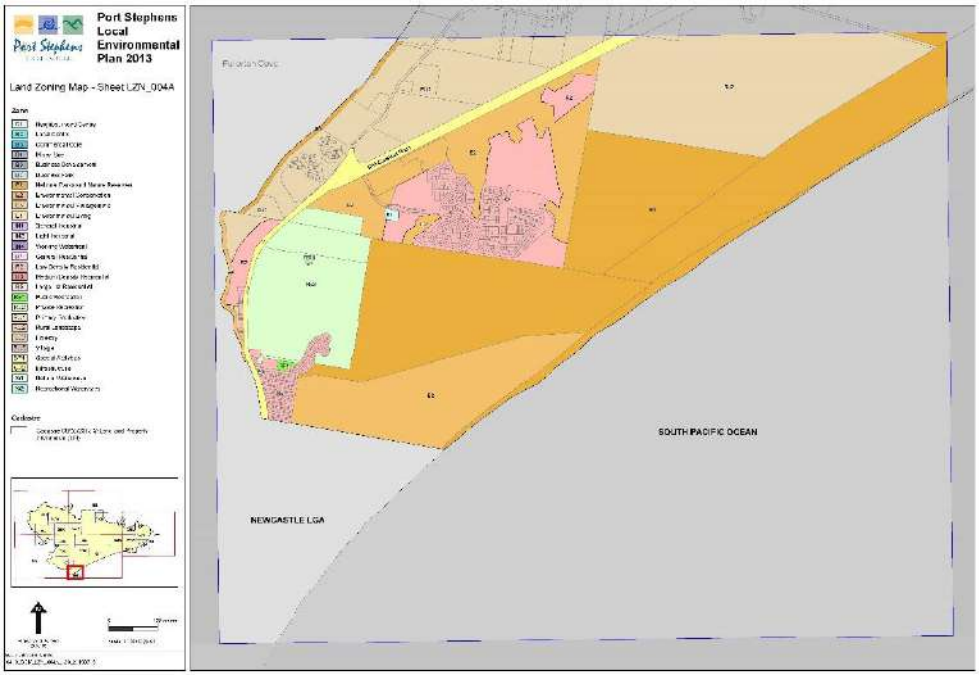


Figure 24 Existing Land Zoning Map

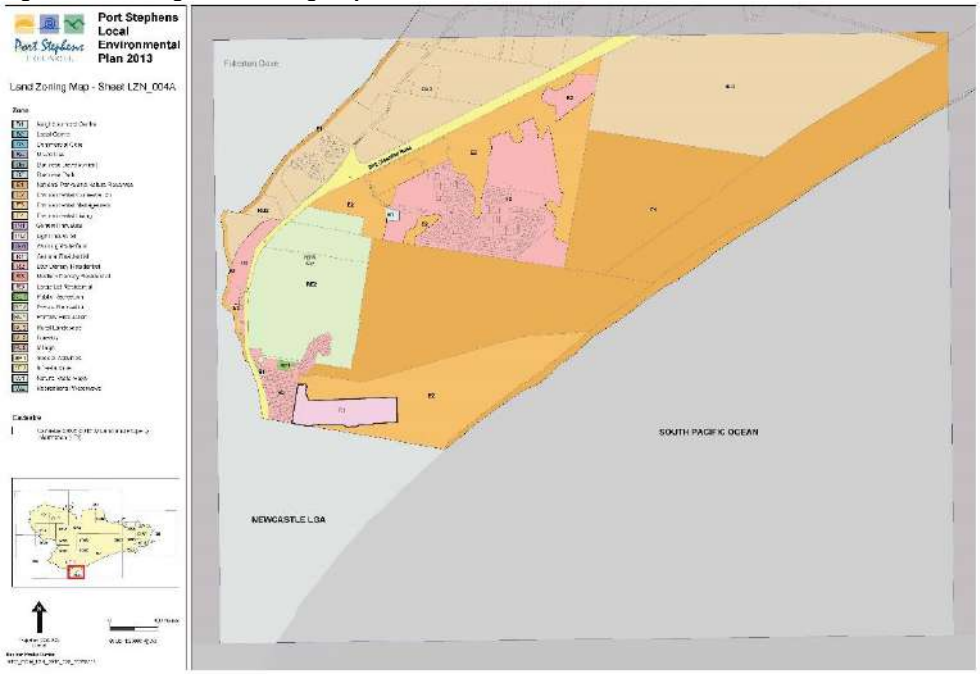


Figure 25 Proposed Land Zoning Map

5.2 Height of buildings

Figure 26 Existing Height of Buildings Map

Figure 27 Proposed Height of Buildings Map

5.3 Lot size

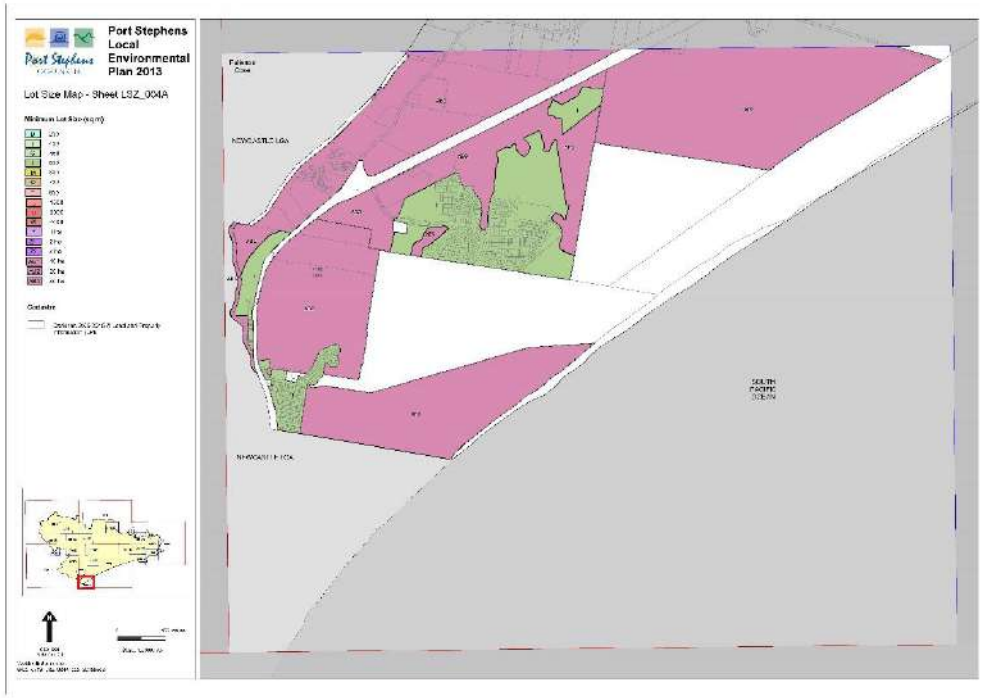


Figure 28 Existing Lot Size Map

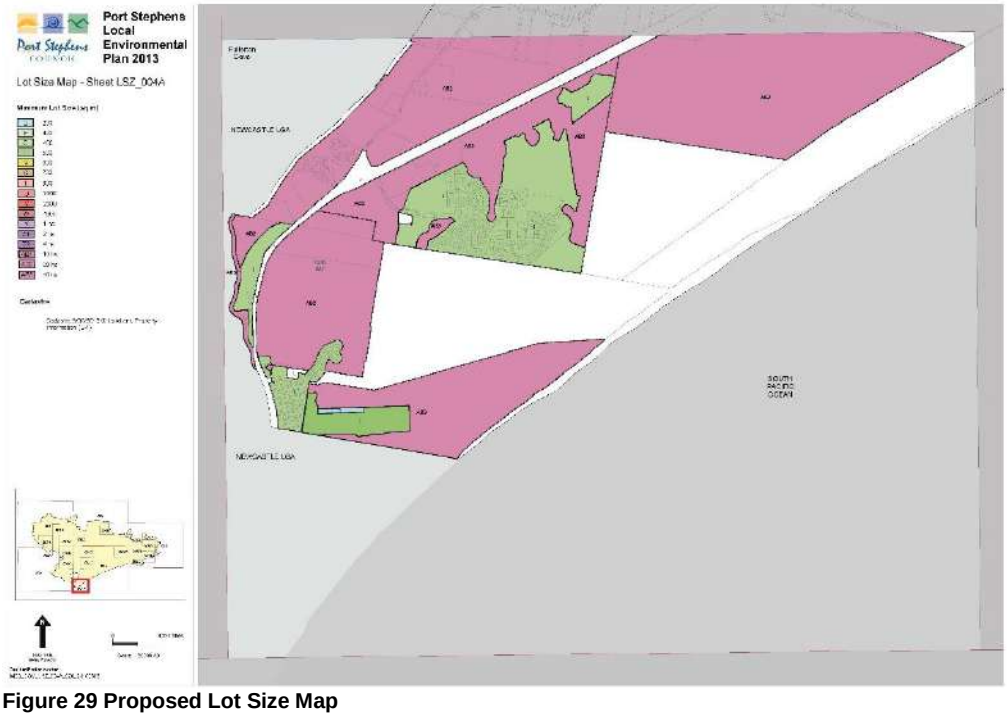


Figure 29 Proposed Lot Size Map

6.0 Consultation

6.1 Community engagement

Initial community engagement on the master planning and planning proposal for the site was undertaken between July 2016 and December 2016.

During this period, a number of different consultation activities were undertaken, including in person meetings, distribution of newsletters, online activities, a dedicated phone and email.

Two key community information and feedback sessions were run in the area, with one at Newcastle Golf Course, Vardon Road, Fern Bay on Thursday 28th of July and one at Stockton IGA, 53 Mitchell Street, Stockton, on Thursday 11th August 2016. Staff from DHA, Elton, and Architectus attended the sessions to engage with the community.

The aims of consultation activities at this stage were to inform the community about DHA, the site history, the investigation of the site, the planning stage and process, and to encourage people to engagement with the project team at later stages.

Generally, feedback was positive, with most people appreciating the proactive approach to engagement. Many people felt that the developments would create positive benefits for the local area such as improved public amenity, improved employment, and economic growth as well as making the site more accessible to the public.

Feedback was also received about community concerns such as traffic management along Fullerton Street and Nelson Bay Road, parking and the status of a sea wall proposed at Stockton.

A further information and consultation session was undertaken on the 8th of December at Newcastle Golf Course. The aim of this session was to open the draft master plans for the site to feedback, including the residential typologies and landscape strategy. Staff from DHA, Elton, Spackman Mossop Michaels and Architectus attended the session to engage with the community.

A range of questions were received by staff about the plans for the site, generally focused around the sites heritage and access for the public. Feedback was received around a broad range of issues including traffic and parking and erosion.

Further public consultation will be undertaken in accordance with the requirements of the Gateway Determination. Consultation with relevant NSW agencies and authorities and other relevant organisations will be undertaken in accordance with the Gateway Determination.

6.2 Port Stephens Council

The project team, including representatives from DHA, Architectus, Spackman Mossop Michaels, Better Transport Futures, Umwelt and Kleinfelder met with Port Stephens Council officers on the 11th October 2016 to informally discuss the preliminary request to amend the Port Stephens LEP 2013 for the Rifle Range site. Draft documentation from the technical consultants had been provided to Council prior to the meeting for consideration.

Subsequently, a presentation was made to Port Stephens Council at a Council briefing

session on Tuesday 22nd November 2016. The briefing documentation consisted an introduction of DHA and the subject site, an overview of constraints and opportunities, and the concept master plan and landscape strategies. Questions were received around the housing typologies, DHA's housing model and ecology. These issues have been addressed in various sections of this report and attachments.

A pre-lodgement meeting was held with Port Stephens Council on the 25th May 2017, with representatives from across Council including social and strategic planning, traffic and transport, and environmental. Key issues discussed included local area traffic management, stormwater and drainage, and koala management.

6.3 Aboriginal parties

Consultation regarding the Aboriginal cultural values associated with the subject site has been undertaken to inform the master planning for the site and this planning proposal. Notifications of work on the site were developed and publicly displayed, with four parties registering their interest in ongoing consultation, being:

- Kuruah Indigenous Corporation;
- Mur-Roo-Ma Inc;
- Nur-Run-Gee Pty Ltd; and
- Worimi Local Aboriginal Land Council.

Karuah Indigenous Corporation, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd and Worimi Local Aboriginal Land Council undertook a pedestrian survey of the site late 2016. Subsequently, feedback was prepared by the group with key recommendations.

The draft Aboriginal Cultural Heritage and Archaeological Report was reviewed by the registered parties before finalisation.

7.0 Project timeline

The following project timeline is intended to assist with tracking the progress of the planning proposal through its various stages of consultation and approval. It is estimated that this amendment to Port Stephens LEP 2013 would be completed by March 2018.

Table 6 Project timeline

Stage	Timeframe
Assessment of the rezoning request by Council officers and preparation of planning proposal	July - August 2017
Resolution of Council to proceed to Gateway	September 2017
Submit planning proposal to Department of Planning and Environment seeking a Gateway Determination	September 2017
Receive Gateway Determination	October 2017
Public exhibition and public authority consultation of planning proposal and DCP Amendment	November 2017
Review of submissions received during public exhibition and public authority consultation	December 2017 – January 2018
Drafting of instrument and finalisation of mapping	February 2018
Amendment to Port Stephens Local Environmental Plan 2013 legally drafted and made	March 2018

8.0 Conclusion

The Planning Proposal facilitates a sensitive, high quality and responsible development of in line with the changing nature of the site.

In its current situation, the site is a disused rifle range, with a central road dividing relatively disturbed area of vegetation to the south and intact vegetation area adjoining Worimi lands to the north. A significant portion of the site to the east comprises coastal dune system, approximately 600m from the proposed area of residential zoning. The site is subject to illegal access by recreational vehicles, while not facilitating appropriate access to the beach and bushland for the public. Being one of the few vacant, developable areas within range of the Williamstown RAAF base and centres such as Newcastle CBD, Stockton, and Fern Bay, the site is significantly underutilised.

Strategic and technical assessments of the site were undertaken to consider the potential of the site to deliver housing, including urban design and planning; landscape; ecological; indigenous heritage; bushfire; European heritage; coastal engineering; civil engineering; and traffic and transport. This consultant team has consulted with local Council, State Government, the community, RMS, and local aboriginal groups in the preparation of these assessments.

A concept master plan was developed to demonstrate how a sensitive residential development could be achieved in the context of the rezoning, facilitating approximately 200 lots and associated infrastructure such as green space, roads and footpaths. To facilitate the delivery of the master plan and deliver approximately 50% of housing to defence members and 50% to the private market, a rezoning is required.

The proposed LEP controls are intended to strike the right balance between development and conservation of the site's significant features. Sensitive ecological communities, heritage items and vulnerable coastal lands are proposed to be protected and enhanced, whilst the flatter, mostly featureless parts of the site are to be made available for housing and community amenities. Through new development, the historic site can be opened up to the public, new open space can be provided and degraded relics and vegetation communities can be restored.

The site offers an opportunity to deliver a sensitive, socially sustainable and diverse community in a high amenity ecological setting. The Planning Proposal is strongly supported and recommended to Council for endorsement.

Port Stephens Local Environmental Plan 2013

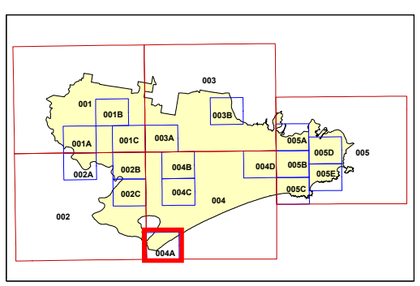
Land Zoning Map - Sheet LZN_004A

Zone

B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
B4	Mixed Use
B5	Business Development
B7	Business Park
E1	National Parks and Nature Reserves
E2	Environmental Conservation
E3	Environmental Management
E4	Environmental Living
IN1	General Industrial
IN2	Light Industrial
IN4	Working Waterfront
R1	General Residential
R2	Low Density Residential
R3	Medium Density Residential
R5	Large Lot Residential
RE1	Public Recreation
RE2	Private Recreation
RU1	Primary Production
RU2	Rural Landscape
RU3	Forestry
RU5	Village
SP1	Special Activities
SP2	Infrastructure
W1	Natural Waterways
W2	Recreational Waterways

Cadastre

Cadastre 08/05/2015 © Land and Property Information (LPI)



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Projection: GDA 1994 Zone 56

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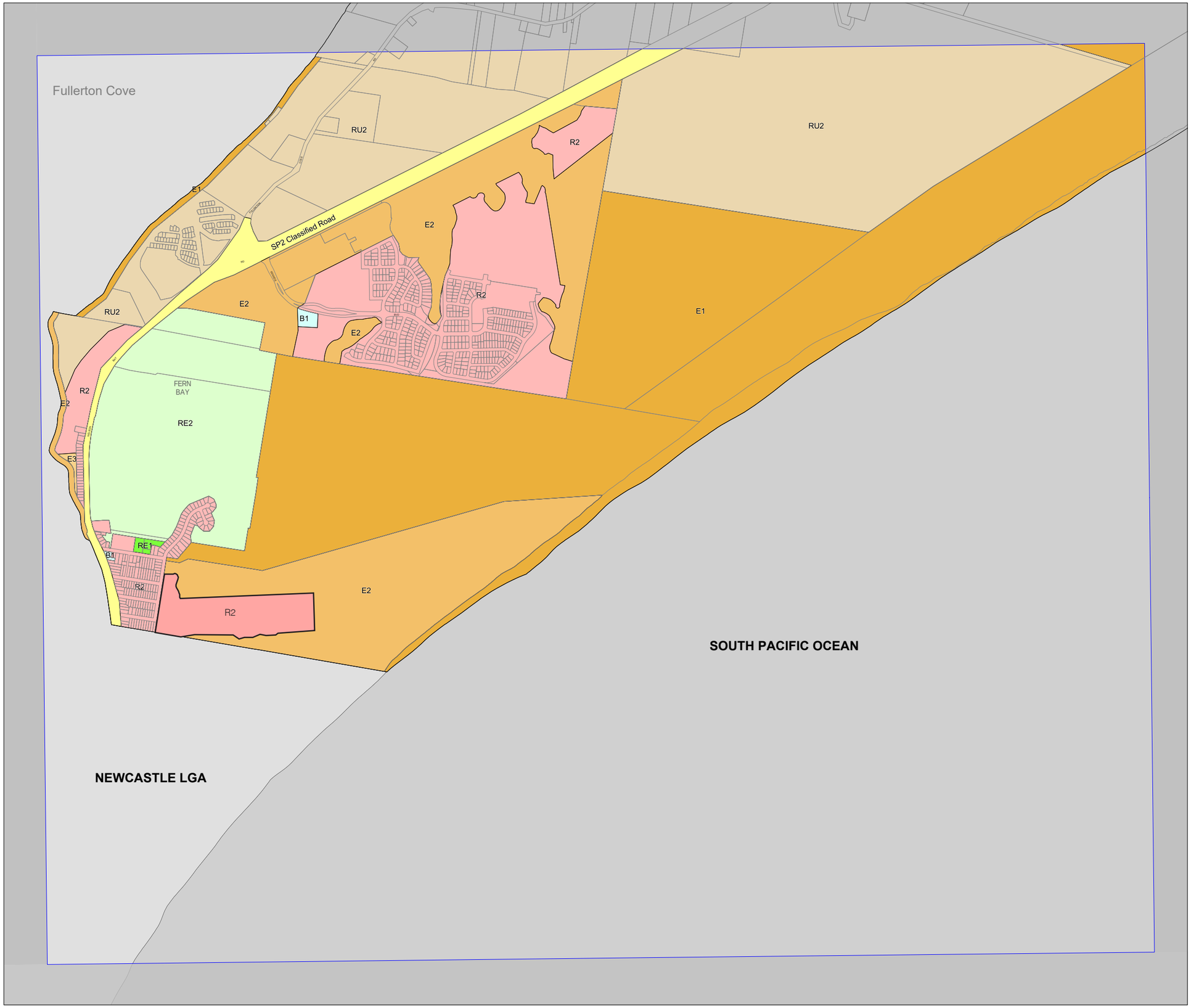


Port Stephens Local Environmental Plan 2013

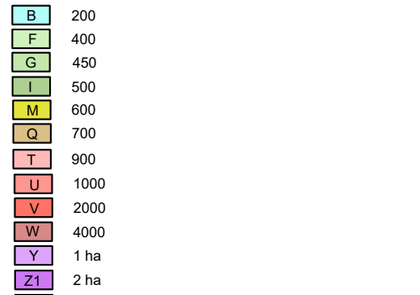
Lot Size Map - Sheet LSZ_004A

Minimum Lot Size (sq m)

B	200
F	400
G	450
I	500
M	600
Q	700
T	900
U	1000
V	2000
W	4000
Y	1 ha
Z1	2 ha
Z2	4 ha
AB1	10 ha
AB2	20 ha
AB3	40 ha

Cadastre

Cadastre 8/05/2015 © Land and Property Information (LPI)



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GDA 1994
MGA Zone 56

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Port Stephens Local Environmental Plan 2013

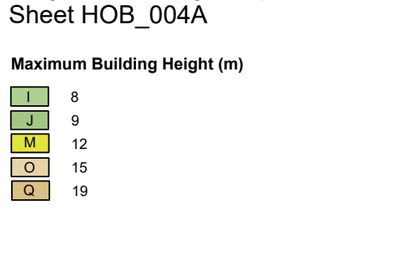
Height of Buildings Map - Sheet HOB_004A

Maximum Building Height (m)

I	8
J	9
M	12
O	15
Q	19

Cadastre

Cadastre 18/02/2013 © Land and Property Information (LPI)



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GDA 1994
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Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

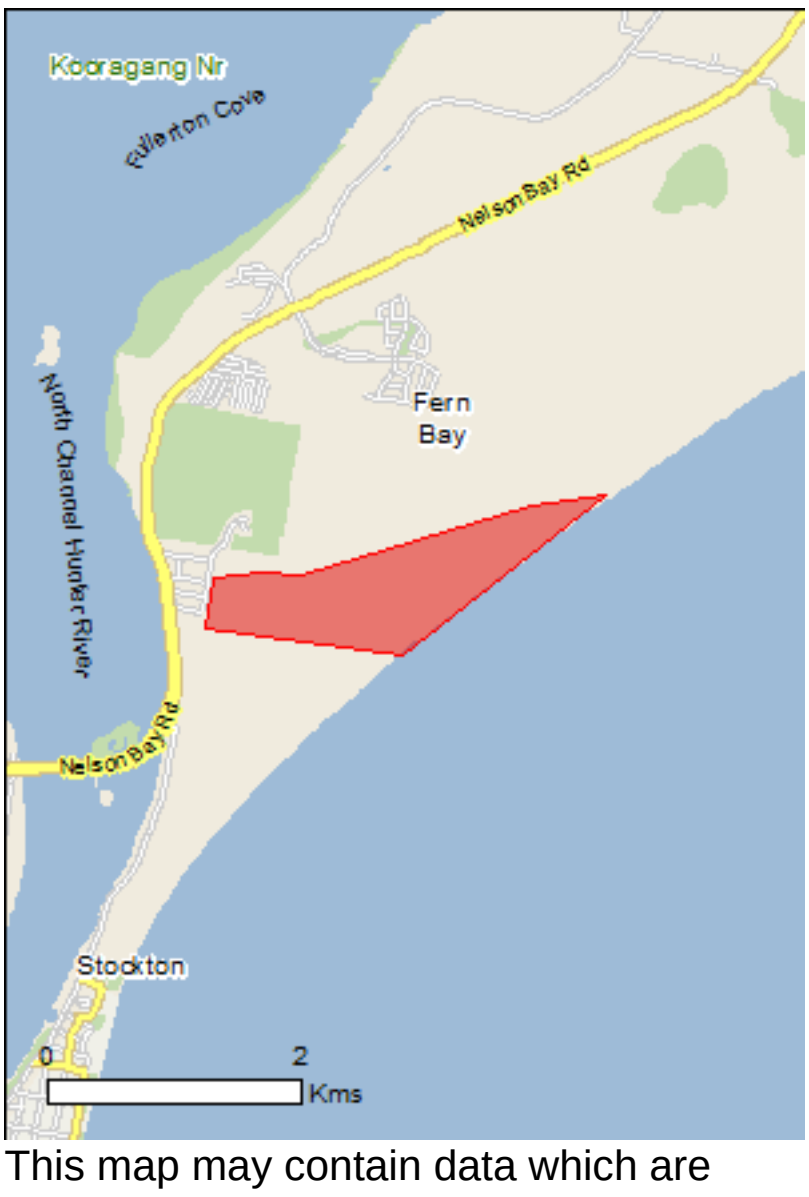
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 02/02/17 12:03:56

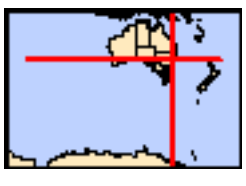
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	68
Listed Migratory Species:	77

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	16
Commonwealth Heritage Places:	3
Listed Marine Species:	101
Whales and Other Cetaceans:	14
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	6
Regional Forest Agreements:	1
Invasive Species:	46
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Hunter estuary wetlands	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
Temperate East

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area

Name	Status	Type of Presence
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Commersonia prostrata		
Dwarf Kerrawang [87152]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Diuris praecox		
Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus camfieldii		
Camfield's Stringybark [15460]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens		
Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat known to occur within area
Grevillea parviflora subsp. parviflora		
Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa		
Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior		
Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis		
Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Rutidosis heterogama		
Heath Wrinklewort [13132]	Vulnerable	Species or species habitat may occur within area
Syzygium paniculatum		
Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea		
Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
Reptiles		

Name	Status	Type of Presence
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (east coast population)		
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora (sensu stricto)		
Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Sterna albifrons Little Tern [813]		Breeding may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat known to occur within area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Roosting known to occur within area
[Arenaria interpres](#) Ruddy Turnstone [872]		Roosting known to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Roosting known to occur within area
[Calidris canutus](#) Red Knot, Knot [855]	Endangered	Roosting known to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Roosting known to occur within area
[Calidris ruficollis](#) Red-necked Stint [860]		Roosting known to occur within area
[Calidris tenuirostris](#) Great Knot [862]	Critically Endangered	Roosting known to occur within area
[Charadrius bicinctus](#) Double-banded Plover [895]		Roosting known to occur within area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
[Charadrius mongolus](#) Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
[Gallinago megala](#) Swinhoe's Snipe [864]		Roosting likely to occur within area
[Gallinago stenura](#) Pin-tailed Snipe [841]		Roosting likely to occur within area
[Heteroscelus brevipes](#) Grey-tailed Tattler [59311]		Roosting known to occur within area
[Limicola falcinellus](#) Broad-billed Sandpiper [842]		Roosting known to occur within area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area
[Limosa limosa](#) Black-tailed Godwit [845]		Roosting known to occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian & Overseas Telecommunications Corporation
Commonwealth Land - Australian Broadcasting Corporation
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Commonwealth Bank of Australia
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Director of War Service Homes
Defence - ADF CAREERS REFERENCE CENTRE
Defence - OFFICES
Defence - RAAF BASE WILLIAMTOWN
Defence - STOCKTON RIFLE RANGE
Defence - TS TOBRUK

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Fort Wallace	NSW	Listed place
Nobbys Lighthouse	NSW	Listed place
Williamtown RAAF Base Group	NSW	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
[Phyllopteryx taeniolatus](#) Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
[Solegnathus spinosissimus](#) Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
[Solenostomus cyanopterus](#) Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
[Solenostomus paegnius](#) Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
[Solenostomus paradoxus](#) Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
[Stigmatopora argus](#) Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
[Stigmatopora nigra](#) Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
[Stigmatopora olivacea](#) a pipefish [74966]		Species or species habitat may occur within area
[Syngnathoides biaculeatus](#) Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
[Trachyrhamphus bicoarctatus](#) Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
[Urocampus carinirostris](#) Hairy Pipefish [66282]		Species or species habitat may occur within area
[Vanacampus margaritifer](#) Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
[Arctocephalus forsteri](#) Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
[Arctocephalus pusillus](#) Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
[Dugong dugon](#) Dugong [28]		Species or species habitat may occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Glenrock	NSW
Hunter Wetlands	NSW
Tilligerry	NSW
Worimi	NSW
Worimi	NSW
Worimi	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Nationally Important Wetlands

[Resource Information]

Name	State
Kooragang Nature Reserve	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.873504 151.797267,-32.873144 151.800614,-32.87336 151.803446,-32.869107 151.819668,-32.868602 151.82499,-32.877974 151.810742,-32.876388 151.796752,-32.873504 151.797267

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Attachment C - MNES Assessment

Threatened species, endangered populations and threatened ecological communities (TECs) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) having the potential to occur in the Referral Area have been identified based on the results of the searches of the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database and Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Database and are outlined in **Table 1**.

Additionally, migratory species listed under international agreements being the Bonn Convention (Bonn), China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) or Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) with potential to occur in the Study Area have also been identified based on the results of the searches and are outlined in **Table 2**.

Purely marine and pelagic species have been omitted from **Table 1** and **Table 2** due to a lack of suitable habitat.

The likelihood of a community/species to occur in the Study Area is noted using the following definitions:

Recorded	Species/community has been recorded within the Referral Area.
Likely	Suitable habitat is present for this species/community and/or records of the species are known to occur in the immediate locality
Potential	Suitable habitat is present for this species/community and/or however records of the species are not known to occur in the immediate locality
Unlikely	Species/community is considered unlikely to occur within the Referral Area due to lack of local records and/or lack of suitable habitat.
Not present	Species/community was not recorded in the Referral Area and is not expected to occur due to its distribution, habitat requirements or lack of local records.

Species/communities with a reasonable potential to be impacted by the proposed rezoning are subject to Assessments of Significance under the EPBC Act (refer to **Attachment D**).

Abbreviations used within **Table 1** and **Table 2** include the following:

V	Vulnerable
E	Endangered
EEC	Endangered Ecological Community
EP	Endangered Population
CE	Critically Endangered
CEEC	Critically Endangered Ecological Community
VEC	Vulnerable Ecological Community
C	CAMBA
J	JAMBA
K	ROKAMBA
B	Bonn

Table 1: MNES Recorded or with Potential to Occur within the Referral Area

Species Name		Status		Likelihood to Occur within the Study Area	Reasonable Potential to be Impacted by the Proposal
Common Name	***Scientific Name***	**TSC Act**	**EPBC Act**		
Threatened Ecological Communities					
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (TSC Act) *Subtropical and Temperate Coastal Saltmarsh* (EPBC Act)		EEC	VEC	Not present	No
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (TSC Act) *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia* (EPBC Act)		EEC	CEEC	Not present	No
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (TSC Act) *Lowland Rainforest of Subtropical Australia* (EPBC Act)		EEC	CEEC	Not present	No
Threatened Flora Species					
dwarf kerrawang	*Commersonia prostrata*	E	E	Unlikely	No
leafless tongue orchid	*Cryptostylis hunteriana*	V	V	Unlikely	No
rough doubletail	*Diuris praecox*	V	V	Likely	**Yes**
Camfield's Stringybark	*Eucalyptus camfieldii*	V	V	Unlikely	No
Earp's gum	*Eucalyptus parramattensis subsp. decadens*	V	V	**Recorded** (likely hybrid)	**Yes**
small-flower grevillea	*Grevillea parviflora subsp. parviflora*	V	V	Unlikely	No
biconvex paperbark	*Melaleuca biconvexa*	V	V	Unlikely	No
tall knotweed	*Persicaria elatior*	V	V	Unlikely	No
lesser swamp-orchid	*Phaius australis*	E	E	Unlikely	No
heath wrinklewort	*Rutidosis heterogama*	V	V	Unlikely	No
magenta lilly pilly	*Syzygium paniculatum*	E	V	Unlikely	No

Species Name		Status		Likelihood to Occur within the Study Area	Reasonable Potential to be Impacted by the Proposal
Common Name	*Scientific Name*	TSC Act	EPBC Act		
black-eyed Susan	*Tetratheca juncea*	V	V	Unlikely	No
Threatened Fauna Species					
Amphibians					
green and golden bell frog	*Litoria aurea*	E	V	Unlikely	No
little John's Tree Frog	*Litoria littlejohni*	E	V	Unlikely	No
Birds					
regent honeyeater	*Anthochaera phrygia*	CE	E	Potential	**Yes**
painted honeyeater	*Grantiella picta*	V	V	Unlikely	No
Australasian bittern	*Botaurus poiciloptilus*	E	E	Unlikely	No
curlew sandpiper	*Calidris ferruginea*	E	CE	Unlikely	No
great knot	*Calidris tenuirostris*	V	CE	Unlikely	No
greater sand-plover	*Charadrius leschenaultii*	V	V	Unlikely	No
lesser sand-plover	*Charadrius mongolus*	V	E	Unlikely	No
swift parrot	*Lathamus discolor*	E	CE	Potential	**Yes**
bar-tailed godwit	*Limosa lapponica baueri*	-	V	Unlikely	No
northern Siberian bar-tailed godwit	*Limosa lapponica baueri*	-	CE	Unlikely	No
eastern bristlebird	*Dasyornis brachypterus*	E	E	Unlikely	No
eastern curlew	*Numenius madagascariensis*	-	CE	Unlikely	No
Mammals					
large-eared pied bat	*Chalinolobus dwyeri*	V	V	Unlikely	No
spotted-tailed quoll	*Dasyurus maculatus*	V	E	Potential	**Yes**
greater glider	*Petauroides volans*	-	V	Unlikely	No
long-nosed potoroo	*Potorous tridactylus*	V	V	Potential	**Yes**

Species Name		Status		Likelihood to Occur within the Study Area	Reasonable Potential to be Impacted by the Proposal
Common Name	***Scientific Name***	**TSC Act**	**EPBC Act**		
New Holland mouse	*Pseudomys novaehollandiae*	-	V	Likely	**Yes**
grey-headed flying-fox	*Pteropus poliocephalus*	V	V	**Recorded**	**Yes**
Fishes					
black rockcod	*Epinephelus daemelii*	-	V	Not present	No

Table 2 - Migratory Species Recorded or with Potential to Occur within 10km of the Referral Area

Common Name	*Scientific Name*	International Convention	Likelihood to Occur within Study Area	Reasonable Potential to be Impacted by the Proposal
little tern	*Sternula albifrons*	B, C, J, K	Likely	**Yes**
crested tern	*Thalasseus bergii*	J	Likely	**Yes**
common sandpiper	*Actitis hypoleucos*	B, C, J, K	Unlikely	No
ruddy turnstone	*Arenaria interpres*	B, C, J, K	Unlikely	No
sharp-tailed sandpiper	*Calidris acuminata*	B, C, J, K	Unlikely	No
red knot	*Calidris canutus*	B, C, J, K	Unlikely	No
curlew sandpiper	*Calidris ferruginea*	B, C, J, K	Unlikely	No
pectoral sandpiper	*Calidris melanotos*	B, C, K	Unlikely	No
red-necked stint	*Calidris ruficollis*	B, C, J, K	Unlikely	No
great knot	*Calidris tenuirostris*	B, C, J, K	Unlikely	No
double-banded plover	*Charadrius bicinctus*	B	Unlikely	No
greater sand-plover	*Charadrius leschenaultia*	B, C, J, K	Unlikely	No
lesser sand-plover	*Charadrius mongolus*	B, C, J, K	Unlikely	No
oriental cuckoo	*Cuculus optatus*	C, J, K	Unlikely	No
Latham's snipe	*Gallinago hardwickii*	B, J, K	Unlikely	No

Common Name	*Scientific Name*	International Convention	Likelihood to Occur within Study Area	Reasonable Potential to be Impacted by the Proposal
Swinhoe's snipe	*Gallinago megala*	B, C, J, K	Unlikely	No
pin-tailed snipe	*Gallinago stenura*	B, C, J, K	Unlikely	No
white-throated needletail	*Hirundapus caudacutus*	C, J, K	Likely	**Yes**
fork-tailed swift	*Apus pacificus*	C, J, K	Likely	**Yes**
eastern osprey	*Pandion cristatus*	B	Potential	**Yes**
broad-billed sandpiper	*Limicola falcinellus*	B, C, J, K	Unlikely	No
bar-tailed godwit	*Limosa lapponica*	B, C, J, K	Unlikely	No
black-tailed godwit	*Limosa limosa*	B, C, J, K	Unlikely	No
black-faced monarch	*Monarcha melanopsis*	B	Unlikely	No
spectacled monarch	*Monarcha trivirgatus*	B	Unlikely	No
eastern yellow wagtail	*Motacilla tschutschensis*	C, K, J	Unlikely	No
satin flycatcher	*Myiagra cyanoleuca*	B	Unlikely	No
eastern curlew	*Numenius madagascariensis*	B, C, J, K	Unlikely	No
little curlew	*Numenius minutus*	B, C, J, K	Unlikely	No
whimbrel	*Numenius phaeopus*	B, C, J, K	Unlikely	No
ruff	*Philomachus pugnax*	B, C, J, K	Unlikely	No
Pacific golden plover	*Pluvialis fulva*	B, C, J, K	Unlikely	No
grey plover	*Pluvialis squatarola*	B, C, J, K	Unlikely	No
rufous fantail	*Rhipidura rufifrons*	B	Unlikely	No
grey-tailed tattler	*Tringa brevipes*	B, C, J, K	Unlikely	No
common greenshank	*Tringa nebularia*	B, C, J, K	Unlikely	No
terek sandpiper	*Xenus cinereus*	B, C, J, K	Unlikely	No

Attachment D - Assessment of Significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires an Assessment of Significance relating to the potential impacts of a Project on listed matters of national environmental significance (MNES). These assessments have been conducted in accordance with the Significant Impact Guidelines 1.1 (DoE 2013), based on the current Master Plan.

Under the EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on MNES. These matters are:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Great Barrier Reef Marine Park
- nuclear actions
- a water resource, in relation to coal seam gas development and large coal mining development.

A search of the Department of Environment and Energy Protected Matters Search Tool in February 2017 and collated information from literature reviews identified a range of threatened ecological communities, threatened species and terrestrial migratory species listed under the EPBC Act that are known to occur, or considered to have the potential to occur on the basis of habitat modeling within the Referral Area. Each of these has been included in Tables 1 and 2 of **Attachment D** (note that purely marine or pelagic species were excluded due to lack of habitat), together with an indication of those species that warrant further assessment by way of an Assessment of Significance.

As outlined in Tables 1 and 2 of **Attachment D**, the following EPBC Act listed species and communities are considered to have the potential to occur or be impacted by the Project, based on previously records or suitable habitat, and are subject to an Assessment of Significance below:

Critically Endangered and Endangered Species

- swift parrot (*Lathamus discolor*)
- regent honeyeater (*Anthochaera phrygia*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) SE mainland population

Vulnerable Species

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)
- Newcastle doubletail (*Diuris praecox*)
- long-nosed potoroo (*Potorous tridactylus tridactylus*)
- koala (*Phascolarctos cinereus*) combined populations of Qld, NSW and the ACT
- New Holland mouse (*Pseudomys novaehollandiae*)
- grey-headed flying-fox (*Pteropus poliocephalus*)

Migratory Species Listed under International Conventions

- little tern (*Sternula albifrons*)
- crested tern (*Thalasseus bergii*)
- white-throated needletail (*Hirundapus caudacutus*)
- fork-tailed swift (*Apus pacificus*)
- eastern osprey (*Pandion cristatus*)

Critically Endangered and Endangered Species

The following critically endangered and endangered species are considered in this assessment:

- swift parrot (*Lathamus discolor*)
- regent honeyeater (*Anthochaera phrygia*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) SE mainland population

Species descriptions, in the Assessments of Significance below, are referenced from the Office of Environment and Heritage (OEH 2017) and Department of the Environment and Energy (DoEE 2017) online species profiles, unless otherwise noted.

Swift Parrot

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**
- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

The swift parrot occurs as a single population that migrates annually from breeding grounds in Tasmania to the winter foraging grounds on the coastal plains and slope woodlands of mainland eastern Australia (Saunders 2011). Approximately 200 mature birds (10 per cent of the total estimated population) are known to over-winter in the Lower Hunter Region of New South Wales (Saunders 2002).

As the species occurs as a single population in Australia, any record of the species would constitute a *population* as described above. A *population* of the swift parrot has not been recorded within the Referral Area however it has been recorded approximately 8 km north of the Referral Area near Williamtown feeding on swamp mahogany (OEH 2016).

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population; or**

The *population* of the swift parrot has not been recorded within the Referral Area or the immediate locality. The proposed rezoning may result in the loss of 0.8 hectares containing key feed tree individuals (swamp mahogany (*Eucalyptus robusta*) and blackbutt (*Eucalyptus pilularis*)) for the swift parrot. The Referral Area is not known as a historical or important foraging site for this species.

It is considered unlikely that the proposed rezoning and residential development will lead to a decrease in the size of the *population* of swift parrot.

- **reduce the area of occupancy of the species; or**

The swift parrot has not been recorded within the Referral Area or the immediate locality. The proposed rezoning may result in the loss of 0.8 hectares of vegetation containing swamp mahogany and blackbutt. While the proposed rezoning and residential development will remove potential habitat for the swift parrot, it is not likely to lead to a significant reduction in foraging habitat in the region. Substantial areas of similar habitats for this species are protected in proximity to the Referral Area, including in the Worimi Conservation Lands.

The proposed rezoning may result in a reduction of the potential area of occupancy for the swift parrot in the Referral Area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region.

- **fragment an existing *population* into two or more populations; or**

The *population* of the swift parrot has not been recorded within the Referral Area or the immediate locality. The swift parrot is highly dispersive and it is unlikely that the proposed rezoning would create a significant change to the species' dispersal capacity or create a significant barrier the movement of the species.

It is unlikely that the proposed rezoning and residential development would result in the fragmentation of the existing *population* into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the swift parrot includes those areas of priority habitat for which the species has a level of site fidelity or possess phenological characteristics likely to be of importance to the swift parrot (Saunders 2011). The swift parrot has not been recorded within the Referral Area or the immediate locality and has not shown site fidelity to the habitats of the Referral Area. The Referral Area does include vegetation containing swamp mahogany and blackbutt which are key feed tree species for the swift parrot in the Hunter-Central Rivers (Saunders 2011). The proposed rezoning may result in the loss of 0.8 hectares of this habitat.

The proposed rezoning and residential development is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of a population; or**

The swift parrot breeds and nests exclusively in Tasmania and migrates to mainland Australia during the non-breeding season. There is no potential for breeding habitat to occur in the Referral Area.

The proposed rezoning and residential development is not expected to disrupt the breeding cycle of the *population* of swift parrot.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The proposed rezoning will involve the removal of 0.8 hectares of vegetation that contains some areas of key feed tree species for the swift parrot. The Lower Hunter and Port Stephens area supports other areas of habitat that contain suitable woodland and forest vegetation that would also provide potential habitat for this species (such as the adjacent Worimi Conservation Lands).

It is considered unlikely that the proposed rezoning and residential development would modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the swift parrot would decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The proposed rezoning and residential development is not expected to result in invasive species that are harmful to the swift parrot becoming established in this species habitat.

- **introduce disease that may cause the species to decline; or**

Psittacine beak and feather disease is a common and potentially deadly disease of parrots caused by a circovirus named beak and feather disease virus. The disease appears to have originated in Australia and is widespread and continuously present in wild populations of Australian parrots. Beak and feather disease affecting endangered psittacine species (parrots and related species) was listed in April 2001 as a key threatening process under the EPBC Act.

It is considered unlikely that the proposed rezoning and residential development will introduce beak and feather disease or any other disease that may cause the swift parrot to decline.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (Saunders 2011)

Any impacts to known habitat of the swift parrot will likely contravene the objectives of the recovery plan. The swift parrot has not been recorded within the Referral Area, however potential foraging habitat has been identified. It is considered unlikely that the proposed rezoning and residential development will interfere with the recovery of the swift parrot throughout Australia.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on the *population* of the swift parrot. Although the Referral Area provides potential foraging habitat for this species, the area proposed to be disturbed is minimal and the swift parrot has not been recorded utilising the potential habitat within the Referral Area or in the immediate surrounds.

Regent Honeyeater

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**

- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

The regent honeyeater comprises a single population, with some exchange of individuals between regularly used areas (DoE 2016). As at 2010, the total population size is estimated at 350–400 mature individuals (DoE 2016).

As the species occurs as a single population in Australia, any record of the species would constitute a *population* as described above. The *population* of regent honeyeater has not been recorded within the Referral Area however it has been recorded approximately 15 km north of the Referral Area near Medowie (OEH 2016).

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population; or**

The *population* of the regent honeyeater has been recorded within the Referral Area or the immediate locality. The proposed rezoning may result in the loss of 0.8 hectares of vegetation containing swamp

mahogany (*Eucalyptus robusta*) foraging trees for the regent honeyeater. The Referral Area is not known as a historical or important foraging site for this species.

It is considered unlikely that the proposed rezoning and residential development will lead to a decrease in the size of the *population* of regent honeyeater.

- **reduce the area of occupancy of the species; or**

The regent honeyeater has not been recorded within the Referral Area or the immediate locality. The proposed rezoning may result in the loss of 0.8 hectares of vegetation containing swamp mahogany. While the proposed rezoning will remove potential habitat for this species, it is not likely to lead to a significant reduction in known habitat in the region. Substantial areas of similar habitats for this species are protected in proximity to the Referral Area, including the Worimi Conservation Lands.

The proposed rezoning may result in a reduction of the potential area of occupancy for the regent honeyeater in the Referral Area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region.

- **fragment an existing *population* into two or more populations; or**

The *population* of regent honeyeater has not been recorded within the Referral Area or the immediate locality. The regent honeyeater is highly dispersive and it is unlikely that the proposed rezoning would create a significant change to the species' dispersal capacity or create a significant barrier the movement of the species.

It is unlikely that the proposed rezoning and residential development would result in the fragmentation of the existing *population* into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the regent honeyeater includes any breeding or foraging areas where the species is likely to occur and any newly discovered breeding or foraging locations (DoEE 2016). The species has not been recorded breeding in the Referral Area or in the coastal region of Newcastle and Port Stephens. The Referral Area does include vegetation containing swamp mahogany which is a key feed tree species for the regent honeyeater (DoE 2016). The proposed rezoning may result in the loss of 0.8 hectares of this habitat.

The proposed rezoning and residential development is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of a population; or**

The regent honeyeater mainly breeds in three key sites in NSW being the Bundarra-Barraba area, the Capertee Valley, and the Lower Hunter Valley (DoE 2016). Other breeding areas are known in the Pilliga woodlands and the Mudgee-Wollar areas of NSW. The regent honeyeater has not been recorded in the Referral Area and it is unlikely to contain breeding or nesting habitat for the species.

The proposed rezoning and residential development is not expected to disrupt the breeding cycle of the *population* of regent honeyeater.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The proposed rezoning will involve the removal of 0.8 hectares of vegetation that contains areas of key feed tree species for the regent honeyeater. The Lower Hunter and Port Stephens area supports other areas of habitat that contain suitable woodland and forest vegetation that would also provide potential habitat for this species (such as the adjacent Worimi Conservation Lands).

It is considered unlikely that the proposed rezoning and residential development would modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the regent honeyeater would decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The proposed rezoning and residential development is not expected to result in invasive species that are harmful to the regent honeyeater becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The proposed rezoning and residential development is not expected to introduce any disease that may cause the regent honeyeater to decline.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (DoE 2016)

Any impacts to known habitat for the regent honeyeater will likely contravene the objectives of the recovery plan. The regent honeyeater has not been recorded within the Referral Area, however potential foraging habitat has been identified. It is considered unlikely that the proposed rezoning and residential development will interfere with the recovery of the regent honeyeater throughout Australia.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on the *population* of the regent honeyeater. Although the Referral Area provides potential foraging habitat for this species, the area proposed to be disturbed is minimal and the regent honeyeater has not been recorded utilising the potential habitat within the Referral Area or in the immediate surrounds.

Spotted-tailed quoll

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**

- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

There is very little research-based literature that allows confident definition of population size or population boundaries of the spotted-tailed quoll. There are few recent records of this species occurring from the Port Stephens and Newcastle area and no important southeast mainland populations around Port Stephens are listed in the National Recovery Plan (DELWP 2016).

The spotted-tailed quoll has not been recorded within the Referral Area however it has been recorded approximately 10 km north of the Referral Area near Medowie and Salt Ash (OEH 2016). It is considered likely that any individuals of this species occurring around the Referral Area would be part of a broad *regional population* that included the Tomaree Peninsula and the Karuah – Raymond Terrace area.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population; or**

No *populations* of the spotted-tailed quoll have been recorded within the Referral Area or the immediate locality. The proposed rezoning may result in the loss of up to 15.3 hectares of forest and dune scrub habitat for the spotted-tailed quoll. The Referral Area is not known as a historical or important foraging or denning site for this species.

It is considered unlikely that the proposed rezoning and residential development will lead to a decrease in the size of a *population* of the spotted-tailed quoll.

- **reduce the area of occupancy of the species; or**

The spotted-tailed quoll has not been recorded within the Referral Area. The proposed rezoning may result in the loss of up to 15.3 hectares of forest and scrub habitat for the spotted-tailed quoll. While the proposed rezoning will remove potential habitat for this species, it is not likely to lead to a significant reduction in known habitat in the region. Substantial areas of similar habitats for this species are protected in proximity to the Referral Area, including the Worimi Conservation Lands.

The proposed rezoning and residential development may result in a reduction of the potential area of occupancy for the spotted-tailed quoll in the Referral Area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region.

- **fragment an existing *population* into two or more populations; or**

The spotted-tailed quoll has not been recorded within the Referral Area or the immediate locality. The spotted-tailed quoll occupies home ranges of several hundred to several thousand hectares in size (DELWP 2016). Connectivity from the Referral Area to Stockton is currently highly fragmented as a result of previous residential and urban development and the proposed rezoning is unlikely to fragment an existing population of spotted-tailed quoll.

It is unlikely that the proposed rezoning and residential development would result in the fragmentation of the existing *population* into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Habitat that is critical to the survival of the spotted-tailed quoll includes large patches of forest with adequate denning resources and relatively high densities of medium-sized mammalian prey (DELWP 2016). No denning sites have been recorded in the Referral Area. More suitable habitat is likely to occur in the adjacent Worimi Conservation Lands and the adjoining forested habitats in the north of the Referral Area, which will not be impacted.

The proposed rezoning and residential development is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of a population; or**

The spotted-tailed quoll generally dens in rock shelters, small caves, hollow logs or tree hollows and utilises numerous dens within its home range. Potential den sites were not recorded in the Referral Area. The spotted-tailed quoll has not been previously recorded in the Referral Area and it is unlikely to contain suitable breeding habitat for the species.

The proposed rezoning and residential development is not expected to disrupt the breeding cycle of the *population* of the spotted-tailed quoll.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The proposed rezoning will involve the removal of up to 15.3 hectares of potential forest and dune scrub habitat for spotted-tailed quoll. The Lower Hunter and Port Stephens area supports other areas of habitat that contain suitable woodland and forest vegetation that would also provide potential habitat for this species (such as the adjacent Worimi Conservation Lands).

It is considered unlikely that the proposed rezoning and residential development would modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the spotted-tailed quoll decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The proposed rezoning and residential development is not expected to result in invasive species that are harmful to the spotted-tailed quoll becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The proposed rezoning and residential development is not expected to introduce any disease that may cause the spotted-tailed quoll to decline.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Spotted-tailed Quoll (*Dasyurus maculatus*) (DELWP 2016).

Any impacts to known habitat for this species in the Referral Area are likely to contravene the objectives of the recovery plan. The spotted-tailed quoll has not been recorded within the Referral Area, however potential foraging habitat has been identified. It is considered unlikely that the proposed rezoning and residential development is not expected to introduce any disease that may cause the will interfere with the recovery of the spotted-tailed quoll throughout Australia.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on the population of the spotted-tailed quoll. Although the Referral Area provides potential habitat for this species, the area proposed to be disturbed is minimal and the spotted-tail quoll has not been recorded utilising the potential habitat within the Referral Area or in the immediate surrounds.

Vulnerable Species

The following vulnerable species are considered in this assessment:

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)
- Newcastle doubletail (*Diuris praecox*)
- long-nosed potoroo (*Potorous tridactylus*)
- koala (*Phascolarctos cinereus*) combined populations of Qld, NSW and the ACT
- New Holland mouse (*Pseudomys novaehollandiae*)
- grey-headed flying-fox (*Pteropus poliocephalus*)

Earp's Gum

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

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

An atypical eucalypt was recorded within the Referral Area that may be Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*). This species is known to hybridise with *Eucalyptus robusta* in the Worimi Regional Park just north of the Referral Area (Bell and Driscoll 2010). Most specimens appear closest to *Eucalyptus robusta*, and this parent seems to be the more dominant, resulting in a hybrid swarm of specimens very difficult to identify to species level (Bell and Driscoll 2010). Samples from the Referral Area sent to the Royal Botanic Gardens Sydney for formal identification showed genetic influences of *Eucalyptus robusta*, *Eucalyptus parramattensis* subsp. *decadens* and *Eucalyptus tereticornis*.

Neither the OEH profile (OEH 2016) or the approved Commonwealth conservation advice (TSSC 2014) for the species discusses the inclusion of hybrids in the listed species, however in accordance with the precautionary principle, these individuals are being assessed as the threatened species. The Recovery Plan for Earp's gum (OEH 2011) outlines the importance of the potentially distinct population (i.e. hybrid form) of Earp's gum around Fern Bay. The potential Earp's gum hybrids in the Referral Area may constitute an *important population*.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Habitat for potential Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens*) has been recorded in the Referral Area, however the Referral Area is unlikely to be important for an *important population* of this species. The potential Earp's gum hybrids occur in the Mahogany- Baloskion Swamp Forest, which will be avoided during the construction of the residential development. There is potential, however, for two potential Earp's gum hybrid individuals to be disturbed as a result of the proposed action. Where possible, these individuals will be selectively retained and/or replanted in the post-construction landscape.

The proposed rezoning and residential development may result in a short-term decrease in the local distinct *important population* of potential Earp's gum hybrids as the proposed rezoning may result in the disturbance of two Earp's gum hybrids.

- **reduce the area of occupancy of an important population, or;**

The potential Earp's gum hybrids occur in the Mahogany- Baloskion Swamp Forest in the Rifle Range portion of the Referral Area, which will be avoided during the construction of the residential development. However, the proposed rezoning may result in the disturbance of two potential Earp's gum hybrids.

The proposed rezoning may result in a reduction in the area of occupancy for the locally occurring potential Earp's gum hybrid *important population* in the Referral Area and the locality.

- **fragment an existing important population into two or more populations, or;**

It is unlikely that the proposed rezoning may result in the fragmentation of potential Earp's gum population into two or more populations. The occurrence of Earp's gum is unlikely to occur to the south of the Rifle Range and all other records of these individuals occur north into the habitats of the Worimi Regional Park and the Fern Bay golf course.

The disturbance of two potential Earp's gum hybrids in the Referral Area will not fragment an existing *important population* into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

The Draft National Recovery Plan for Earp's gum (OEH 2011) does not identify habitat critical to the survival of the species, noting that all habitat where the species occurs contributes to the long-term conservation of the species.

Given that the Referral Area contains a small area of potential hybrid Earp's gum separate to the known large populations of Earp's gum in the Tomago sandbeds, it is unlikely that this area would be habitat critical to the survival of this species.

- **disrupt the breeding cycle of an important population, or;**

Flowering typically occurs for Earp's gum from November to January (OEH 2011). Seed dispersal is likely to be undertaken via gravity and wind with seeds likely to cover generally low dispersal distances (OEH 2011).

The proposed rezoning and residential development may result in the disturbance of two potential Earp's gum hybrids in the Referral Area. There is potential that the population within the Referral Area is part of the Fern Bay *important population* of a distinct hybrid type of the species.

The reduction of size of this *important population* may result in the disruption of the breeding cycle of the hybrid type of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

Earp's gum is known to occur in large numbers along the Tomago Sandbeds and within the Tilligerry conservation areas in Coastal Dune Dry Sclerophyll Forests and further inland around Kurri Kurri in the Sydney Sand Flats Dry Sclerophyll Forests. Records of the potential hybrid with swamp mahogany occur north of the Referral Area into the habitats of the Worimi Regional Park and the Fern Bay golf course.

The proposed rezoning and residential development may result in the disturbance of two potential Earp's gum hybrids in the Referral Area. It is considered unlikely that the proposed rezoning will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the wider Earp's gum species would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

Weed invasion by common coastal exotic species such as bitou bush (*Chrysanthemoides monilifera*) and lantana (*Lantana camara*) would threaten the establishment of vulnerable flora species such as Earp's gum. It is expected that this threat would be managed within the construction and post-construction phases of the proposed rezoning.

The proposed rezoning and residential development is not expected to result in invasive species that are harmful to the Earp's gum becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

Key biological pathogens that have the most risk of impacting Earp's gum include the disease-causing rusts to plants of the Myrtaceae family (particularly myrtle rust (*Uredo rangelii*)) and the soil pathogen causing root-rot (*Phytophthora cinnamomi*). The presence of these pathogens has not been specifically identified within the Referral Area, however both are known to occur throughout NSW.

The proposed rezoning does not involve any processes that are likely to introduce a disease for the Earp's gum that may cause this species to decline.

- **interfere substantially with the recovery of the species.**

The following recovery plan has been prepared:

- Draft National Recovery Plan for Earp's Dirty Gum *Eucalyptus parramattensis* subsp. *decadens* (OEH 2011)

Any impacts to known habitat for Earp's gum in the Referral Area are likely to contravene the objectives of the recovery plan. It is considered unlikely that the proposed rezoning will interfere with the recovery of Earp's gum species throughout its range in the Hunter and NSW.

Conclusion

While the proposed rezoning is unlikely to result in a significant impact on the species of Earp's gum, further investigations into the likely hybrid occurring within the Referral Area will likely be required to determine the conservation status and importance of the potential distinct population occurring within the Referral Area.

Newcastle Doubletail

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

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

Newcastle doubletail (*Diuris praecox*) was subject to targeted surveys on 8 September 2016 during the known flowering period for the species. This species was not recorded within the Referral Area, despite other known populations flowering in the locality, however suitable habitat is known to occur within the Referral Area.

It is unlikely an *important population* of Newcastle doubletail occurs within the Referral Area.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

It is unlikely an *important population* of the Newcastle doubletail occurs within the Referral Area. The proposed rezoning may result in the loss of up to approximately 0.8 hectares of forested habitat for the species.

It is considered unlikely that the proposed rezoning and residential development will lead to a decrease in the size of an *important population* of the Newcastle doubletail.

- **reduce the area of occupancy of an important population, or;**

It is unlikely an *important population* of the Newcastle doubletail occurs within the Referral Area. The proposed rezoning may result in the loss of up to approximately 0.8 hectares of forested habitat for the species.

It is unlikely that the proposed rezoning and residential development would substantially reduce the area of known occupancy of an *important population* of the species in the wider locality or region.

- **fragment an existing important population into two or more populations, or;**

It is unlikely an *important population* of the Newcastle doubletail occurs within the Referral Area. The proposed rezoning may result in the loss of up to approximately 0.8 hectares of forested habitat for the species.

It is unlikely that the proposed rezoning and residential development would fragment an existing *important population* of the species into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

No habitat critical to the survival for Newcastle doubletail has been recorded within the Referral Area.

- **disrupt the breeding cycle of an important population, or;**

No *important populations* of the Newcastle doubletail have been recorded within the Referral Area.

The proposed rezoning and residential development is not expected to disrupt the breeding cycle of an *important population* of the Newcastle doubletail.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposed rezoning may result in the loss of up to approximately 0.8 hectares of forested habitat for the species. This species was not recorded within the Referral Area, despite other known populations flowering in the locality.

It is considered unlikely that the proposed rezoning will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the Newcastle doubletail.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

Weed invasion by common coastal exotic species such as bitou bush (*Chrysanthemoides monilifera*) and lantana (*Lantana camara*) would threaten the establishment of vulnerable flora species such as Newcastle doubletail.

The proposed rezoning and residential development is not expected to result in invasive species that are harmful to the Newcastle doubletail becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The proposed rezoning does not involve any processes that are likely to introduce a disease for the Newcastle doubletail that may cause this species to decline.

- **interfere substantially with the recovery of the species.**

No recovery plans have been prepared for this species. The proposed rezoning may result in the loss of up to approximately 0.8 hectares of forested habitat for the species. This species was not recorded within the Referral Area, despite other known populations flowering in the locality.

The proposed rezoning will not interfere with the recovery of the Newcastle doubletail throughout Australia.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on an important population of the Newcastle doubletail. Although the Referral Area provides potential habitat for this species, the area proposed to be disturbed is minimal and the species has not been recorded in the potential habitat within the Referral Area or in the immediate surrounds.

Long-nosed Potoroo

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

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

Records of the long-nosed potoroo are scarce within the Port Stephens and Newcastle coastal areas however one record occurs from Williamtown approximately 10km north of the Referral Area. The species is known to occur in greater densities in the Barrington Top National Park to the north and the Watagans National Park to the west of the Referral Area.

It is not considered that an *important population* of long-nosed potoroo occurs in the Referral Area as it has not been identified as containing a key source population either for breeding or dispersal, populations that are necessary for maintaining genetic diversity, and/or populations that are near the limit of the species range.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

No *important populations* of the long-nosed potoroo have been recorded within the Referral Area or the immediate locality. The proposed rezoning may result in the loss of up to 15.3 hectares of forest and dune scrub potential habitat for the species. The Referral Area is not known as a historical or important foraging site for this species.

It is considered unlikely that the proposed rezoning and residential development will lead to a decrease in the size of an *important population* of the long-nosed potoroo.

- **reduce the area of occupancy of an important population, or;**

No *important populations* of the long-nosed potoroo have been recorded within the Referral Area or the immediate locality. The proposed rezoning may result in the loss of up to 15.3 hectares of forest and dune scrub potential habitat for the species. Substantial areas of similar, higher quality habitats for this species are protected in proximity to the Referral Area, including the Worimi Conservation Lands.

The proposed rezoning and residential development is unlikely to reduce the area of occupancy of an *important population* of the long-nosed potoroo.

- **fragment an existing important population into two or more populations, or;**

No *important populations* of the long-nosed potoroo have been recorded within the Referral Area or the immediate locality. Long-nosed potoroos are expected to have small home ranges of up to a couple of hectares in size.

It is unlikely that the proposed rezoning and residential development would result in the fragmentation of an *important population* of long-nosed potoroo into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

No habitat critical to the survival for the long-nosed potoroo has been recorded within the Referral Area.

- **disrupt the breeding cycle of an important population, or;**

No *important populations* of the long-nosed potoroo have been recorded within the Referral Area. The long-nosed potoroo breeds all year round. A single young is born after a gestation of 37 days and pouch life is about 100–125 days and sexual maturity achieved at about 12 months.

The proposed rezoning and residential development is not expected to disrupt the breeding cycle of an *important population* of the long-nosed potoroo.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposed rezoning may result in the loss of up to 15.3 hectares of forest and dune scrub potential habitat for the species. Substantial areas of similar, higher quality habitats for this species are protected in proximity to the Referral Area, including the Worimi Conservation Lands.

It is considered unlikely that the proposed rezoning will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the long-nosed potoroo would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The long-nosed potoroo are impacted by predation by foxes, wild dogs and cats. Foxes and cats, in particular, are likely to already be established in the habitats around the Referral Area.

The proposed rezoning and residential development is not expected to exacerbate the existing invasive species that are harmful to the long-nosed potoroo in the species habitat.

- **introduce disease that may cause the species to decline; or**

The proposed rezoning does not involve any processes that are likely to introduce a disease for the long-nosed potoroo that may cause this species to decline.

- **interfere substantially with the recovery of the species.**

No recovery plans have been prepared for this species. Any impacts to known habitat for the long-nosed potoroo in the Referral Area are likely to contravene the objectives of these recovery plans. The long-nosed potoroo has not been recorded within the Referral Area, however potential habitat has been identified.

It is considered unlikely that the proposed rezoning will interfere with the recovery of the long-nosed potoroo throughout Australia.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on the populations of the long-nosed potoroo. Although the Referral Area provides potential habitat for this species, the long-nosed potoroo has not been recorded utilising the potential habitat within the Referral Area or in the immediate surrounds.

Koala

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

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

The koala is known to occur in eucalypt woodlands and forests from the north-eastern Queensland, along the eastern coast of NSW, to the south-east corner of South Australia. The species has not been recorded within the Referral Area, however it has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park.

Koalas occurring within the Port Stephens locality are likely to comprise an *important population*, in accordance with the criteria listed above. While the Referral Area is unlikely to be core habitat for the Port Stephens koala *important population*, individuals may occur infrequently as they move through the landscape around Fern Bay.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

No *important populations* of the koala have been recorded within the Referral Area or the immediate locality, however potential habitat occurs in the Frontal Dune Blackbutt-Apple Forest which will be impacted by the proposed action. The proposed rezoning may result in the loss of up to 0.8 hectares of vegetation containing swamp mahogany (*Eucalyptus robusta*) and Earp's gum (*Eucalyptus parramattensis* subsp *decadens* x *robusta*) koala feed trees. However, the Referral Area is not known as a historical or important foraging site for this species.

It is considered unlikely that the proposed rezoning and residential development will lead to a decrease in the size of the Port Stephens *important population* of koala.

- **reduce the area of occupancy of an important population, or;**

The proposed rezoning may result in the loss of 0.8 hectares of vegetation containing key feed trees for the koala. While the proposed rezoning will remove potential habitat for this species, it is not likely to lead to a significant reduction in known habitat in the region. Substantial areas of similar habitats for this species are protected in proximity to the Referral Area, including the Worimi Conservation Lands.

The proposed rezoning may result in a reduction of the potential area of occupancy for the koala in the Referral Area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region.

- **fragment an existing important population into two or more populations, or;**

Home range size for koala varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size (DECC 2008). Connectivity from the south of the site to Stockton is currently highly fragmented as a result of previous residential and urban development and the proposed rezoning is unlikely to fragment an existing population of koala in the Port Stephens locality.

It is unlikely that the proposed rezoning may result in the fragmentation of the existing Port Stephens *important population* into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

The Referral Area contains preferred and supplementary koala habitat as per Lunney *et al.* (1998) with up to 2.3 hectares of preferred habitat, 3.6 hectares of buffer habitat and 15.9 hectares of supplementary koala habitat. According to the EPBC Act Referral Guidelines for the Vulnerable Koala (DoE 2014), koala habitat is defined as forest or woodland containing species that are known koala food trees or shrubland with emerging food trees. As per the Koala Habitat Assessment Tool in the EPBC Act Referral Guidelines, the preferred habitats within the Referral Area score 7 out of 10 and are therefore considered to contain habitat critical to the survival of the species (refer to **Attachment E**).

The proposed rezoning may result in the loss of up to 0.8 hectares of koala foraging habitat containing preferred feed trees. This area represents a minor impact of habitat that has not been recorded as being known habitat utilised by the species. The proposed rezoning and residential development is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of an important population, or;**

The breeding season for koalas peak between September and February and animals are most active during this period (DECC 2008). The gestation period for the koala is 35 days. Following birth, the young remains in the pouch for approximately 6 months, and on leaving the pouch, remains dependent on its mother and is carried on her back. Young reach independence at about 12 months old, although they can remain in the mother's home range for a further two to three years (Mitchell and Martin 1990). After this time, young animals of both sexes disperse to establish their own home range areas (Ramsay 1999). Dispersal distances range from one to 11 km although movements in excess of 50 km have been recorded (DECC 2008).

While koala breeding has not been recorded in the Referral Area, suitable foraging habitat does occur. The proposed retention of the majority of preferred and supplementary habitat in the Referral Area will enable the species to utilise optimal habitats and breeding is not considered likely to be adversely impacted.

The proposed rezoning and residential development is not expected to disrupt the breeding cycle of the Port Stephens *important population* of the koala.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposed rezoning may result in the loss of up to 0.8 hectares of koala foraging habitat containing preferred feed trees. The Referral Area is unlikely to be frequently utilised by the Port Stephens koala population as koalas have not been recorded within the Referral Area. The Lower Hunter and Port Stephens area supports other areas of habitat that contain suitable woodland and forest vegetation that would also provide potential habitat for this species (such as the adjacent Worimi Conservation Lands).

It is considered unlikely that the proposed rezoning and residential development would modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the koala decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The proposed rezoning and residential development is not expected to result in invasive species that are harmful to the koala becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The koala is known to contract strains of *Chlamydia* and the koala retrovirus. Chlamydia infections are known to cause reduced female fertility and are expected to reduce the reproductive potential of koala populations. It has been predicted that up to half of the koalas in south-east Queensland have reproductive disease likely to result in infertility (TSSC 2012). The koala retrovirus can cause a range of conditions including leukaemia and immunodeficiency syndrome. It is estimated that up to 100 per cent of koala populations in Queensland and New South Wales have the koala retrovirus (TSSC 2012).

The proposed rezoning and residential development does not involve any processes that are likely to introduce a disease for the koala that may cause this species to decline.

- **interfere substantially with the recovery of the species.**

Following determination of the importance of the habitat for the koala in the Referral Area, an assessment was undertaken to determine the impacts which are likely to substantially interfere with the recovery of the koala. The Referral Guidelines (DoE 2014) identifies impacts likely to substantially interfere with the recovery of the koala (refer to Table 2 of **Attachment E**).

The proposed rezoning and residential development may:

- result in an increase to vehicle movements such that the koala could be subjected to increased mortality levels and

- the introduction or increase of dogs to the local area and therefore may increase the threat of dog attacks to any local koala population.

The proposed rezoning and residential development is not expected to:

- result in the creation of substantial additional barriers to koala movement in the local area

- facilitate the introduction or spread of pathogens as *Phytophthora cinnamomi* or Chlamydia

- result in hydrological changes to the surrounding environment such that the function and integrity of the existing habitat for the koala is jeopardized.

Based on the above, it is considered unlikely that the proposed rezoning will interfere with the recovery of the koala throughout its range in Qld, NSW and the ACT.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on the Port Stephens *important population* of koala. While the proposed action will disturb koala feed trees, this area is minimal, fragmented and the species has not been recorded at this southern extremity of the potential extent of the Port Stephens koala population. Based on the current Master Plan, the proposed rezoning is unlikely to result in a significant impact on the koala.

New Holland Mouse

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

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

Genetic evidence indicates that the New Holland mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement (Breed and Ford, 2007). It is associated with heathlands and vegetation sand dunes and is found to peak in abundance 3 to 5 years following a fire. The last fire to impact the Rifle Range portion of the Referral Area occurred in late 2006 and would have likely resulted in suitable habitat for the species.

While the species has not been recorded in the Referral Area, coastal dune vegetation occurring in the Port Stephens locality is likely to comprise an *important population* of the species.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

No *important populations* of the New Holland mouse have been recorded within the Referral Area. The proposed rezoning may result in the loss of up to 15.3 hectares of forest and dune scrub habitat for the New Holland mouse. The Referral Area is not known as a historical or important foraging site for this species.

It is considered unlikely that the proposed rezoning will lead to a decrease in the size of an *important population* of the New Holland mouse.

- **reduce the area of occupancy of an important population, or;**

No *important populations* of the New Holland mouse have been recorded within the Referral Area. The proposed rezoning may result in the loss of up to 15.3 hectares of forest and scrub habitat for the species. While the proposed rezoning will remove potential habitat for this species, it is not likely to lead to a significant reduction in known habitat in the region. Substantial areas of similar habitats for this species are protected in proximity to the Referral Area, including the Worimi Conservation Lands.

The proposed rezoning and residential development may result in a reduction of the potential area of occupancy for the New Holland Mouse in the Referral Area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region.

- **fragment an existing important population into two or more populations, or;**

No *important populations* of the New Holland mouse have been recorded within the Referral Area. Connectivity from the Referral Area to Stockton is currently highly fragmented as a result of previous residential and urban development and the proposed rezoning is unlikely to fragment an existing *important population* of New Holland Mouse.

It is unlikely that the proposed rezoning may result in the fragmentation of an existing *important population* of New Holland Mouse into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

No habitat critical to the survival for the New Holland mouse has been recorded within the Referral Area.

- **disrupt the breeding cycle of an important population, or;**

No *important populations* of the New Holland mouse have been recorded within the Referral Area.

The New Holland Mouse breeds between late winter to early summer, sometimes extending into autumn. The timing of breeding is related to abundance and quality of food (Kemper 1980b), which in turn is related to rainfall patterns and fire succession.

The proposed rezoning and residential development is not expected to disrupt the breeding cycle of an *important population* of the New Holland Mouse in the locality.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposed rezoning may result in the loss of up to 15.3 hectares of forest and scrub habitat for the species. While the proposed rezoning will remove potential habitat for this species, it is not likely to lead to a significant reduction in known habitat in the region. Substantial areas of similar habitats for this species are protected in proximity to the Referral Area, including the Worimi Conservation Lands.

It is considered unlikely that the proposed rezoning will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the New Holland Mouse would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The New Holland Mouse is impacted by predation by foxes, wild dogs and cats. Foxes and cats, in particular, are likely to already be established in the habitats around the Referral Area.

The proposed rezoning and residential development is not expected to exacerbate the existing invasive species that are harmful to New Holland Mouse in the species habitat.

- **introduce disease that may cause the species to decline; or**

The proposed rezoning does not involve any processes that are likely to introduce a disease for the New Holland Mouse that may cause this species to decline.

- **interfere substantially with the recovery of the species.**

No recovery plans have been prepared for this species. Any impacts to known habitat for the New Holland Mouse in the Referral Area are likely to contravene the objectives of these recovery plans. The New Holland Mouse has not been recorded within the Referral Area, however potential habitat has been identified.

It is considered unlikely that the proposed rezoning will interfere with the recovery of the New Holland Mouse throughout Australia.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on the populations of the New Holland mouse. Although the Referral Area provides potential foraging habitat for this species, the New Holland mouse has not been recorded utilising the potential habitat within the Referral Area or in the immediate surrounds.

Grey-headed Flying Fox

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

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

The grey-headed flying-fox (*Pteropus poliocephalus*) has been recorded within the Referral Area. Up to five individuals were observed foraging in the forested habitats of the Referral Area in April 2007 and the Referral Area is likely to provide suitable foraging habitat for a local population.

No flying-fox camps have been recorded in the Referral Area. The closest active camp is located approximately 5 km to the southwest of the Referral Area near Carrington (DoEE 2017). From these camps, the species can travel up to 50 km in one night in search of food where they feed on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia*, and fruits of rainforest trees and vines. It is likely that the species utilises the Referral Area as foraging habitat.

It is unlikely the Referral Area contains an *important population* of the grey-headed flying-fox.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Known foraging habitat for the grey-headed flying-fox has been recorded in the Referral Area, however no flying-fox camps have been recorded in the Referral Area. The Referral Area is unlikely to be important for an *important population* of this species.

The proposed rezoning may result in the loss of up to 0.8 hectares of forest foraging habitat for the species.

It is considered unlikely that the proposed rezoning will lead to a decrease in the size of an *important population* of the grey-headed flying-fox.

- **reduce the area of occupancy of an important population, or;**

The proposed rezoning may result in the loss of approximately 0.8 hectares of foraging habitat for grey-headed flying-fox. Substantial areas of similar, higher quality habitats for this species are protected in proximity to the Referral Area, including the Worimi Conservation Lands.

The proposed rezoning and residential development is unlikely to reduce the area of occupancy of an *important population* of the grey-headed-flying-fox.

- **fragment an existing important population into two or more populations, or;**

The grey-headed flying fox is highly dispersive and it is unlikely that the proposed rezoning would create a significant change to the species' dispersal capacity or create a significant barrier the movement of the species.

It is unlikely that the proposed rezoning may result in the fragmentation of an existing *important population* into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

According to the draft National Recovery Plan for the grey-headed flying-fox (DECC 2009), foraging habitat is considered critical to the survival of the species if it is productive during winter and spring and productive during the final weeks of gestation, and during the weeks of birth, lactation and conception. Swamp mahogany (*Eucalyptus robusta*) dominated forest communities in the Referral Area are productive during winter, during which food bottlenecks have been identified.

The Referral Area is considered to comprise an area of foraging habitat for this species but is unlikely to contain significant breeding and roosting habitat. The proposed rezoning and residential development is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of an important population, or;**

No grey-headed flying-fox breeding populations or camps have been identified in the Referral Area. The closest active camp is located approximately 5 km to the southwest of the Referral Area near Carrington (DoEE 2017).

The proposed rezoning is not expected to disrupt the breeding cycle of an *important population* of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposed rezoning may result in the loss of approximately 0.8 hectares of foraging habitat for grey-headed flying-fox. The Lower Hunter and Port Stephens area supports other areas of habitat that contain suitable woodland and forest vegetation that would also provide potential habitat for this species (such as the adjacent Worimi Conservation Lands). The Referral Area is unlikely to be depended on by local grey-headed flying-fox colonies.

It is considered unlikely that the proposed rezoning will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the grey-headed flying-fox would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The proposed rezoning and residential development is not expected to result in invasive species that are harmful to the grey-headed flying-fox becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause the grey-headed flying-fox to decline are likely to be introduced as a result of the proposed rezoning.

- **interfere substantially with the recovery of the species.**

The following recovery plan has been prepared:

- Draft Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*) (DECCW 2009)

Any impacts to known habitat for this species in the Referral Area are likely to contravene the objectives of this recovery plan.

The proposed rezoning may interfere with the recovery of the grey-headed flying-fox, however this is unlikely to be substantial.

Conclusion

Although the grey-headed flying-fox has been recorded within the Referral Area, the proposed rezoning is unlikely to result in a significant impact on the populations of this species. Due to the small area of impact, the Referral Area is unlikely to be depended on by local grey-headed flying-fox colonies.

Migratory Species under International Conventions

The following migratory species are considered in this assessment:

- little tern (*Sternula albifrons*)
- crested tern (*Thalasseus bergii*)
- white-throated needletail (*Hirundapus caudacutus*)
- fork-tailed swift (*Apus pacificus*)
- eastern osprey (*Pandion cristatus*)

None of the migratory species above have been recorded within the Referral Area, however the little tern has been previously recorded nesting in mined dunes along the south-western edge of the Worimi Conservation Lands. Likely habitat for the species occurs in the sandy dune habitats of the Study for little tern and crested tern. Potential habitat has been identified for white-throated needletail, fork-tailed swift and eastern osprey.

An area of important habitat is:

- **habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or**
- **habitat utilised by a migratory species which is at the limit of the species range; or**
- **habitat within an area where the species is declining.**

The habitats within the Referral Area for migratory species listed under international conventions is not considered to meet the criteria listed above, and important habitat is not likely to occur.

The Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015) defines important habitat for the white-throated needletail, fork-tailed swift and eastern osprey. Important habitat

for white-throated needletail includes tree hollows in tall trees on ridge tops (DoE 2015). Otherwise the species is almost entirely aerial (DoE 2015). Important habitat for fork-tailed swift includes open plains to woodland areas, however the species is almost entirely aerial (DoE 2015). Important habitat for the eastern osprey includes Bays, estuaries, along tidal stretches of large coastal rivers, mangrove swamps, coral and rock reefs, terrestrial wetlands and coastal lands of tropical and temperate Australia and off shore islands (DoE 2015).

No guidelines are available for little tern or crested tern. Little terns and crested terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches (DoE 2016). The Referral Area contains suitable sand dune habitat to the east of the site. Little tern has been previously recorded nesting in mined dunes along the south-western edge of the Worimi Conservation Lands, however this has not been recorded within the Referral Area.While this is not expected to be impacted by the proposed rezoning, the proposed rezoning may result in increased human access to the sand dunes.

The habitats within the Referral Area for migratory species listed under international conventions is not considered to meet the criteria listed above, and *important habitat is* not likely to occur.

The proposed rezoning is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

- ***substantially modify and/or destroy an area of important habitat for a migratory species;***
- ***seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species; and/or***
- ***result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species****.*

The Referral Area is not considered to comprise *important habitat* for any of the identified migratory species listed above, and therefore the proposed rezoning is not likely to substantially modify or destroy important migratory species habitat. Similarly, the proposed rezoning will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species; or result in an invasive species that is harmful to migratory species becoming established within the Referral Area.

Conclusion

The proposed rezoning is not likely to result in a significant impact on any migratory species listed under the EPBC Act or international conventions.

Attachment E - Assessment of Koala Habitat in the Referral Area

The koala has not been recorded within the Referral Area, however it has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park. Koalas occurring within the Port Stephens LGA are likely to comprise an important population in the region. The Referral Area is unlikely to be core habitat for the Port Stephens koala population, however individuals may occur infrequently as they move through the landscape around Fern Bay.

Preferred habitat on the coastal strip of Port Stephens generally occurs in the intact Swamp Sclerophyll Forest community and supplementary habitat includes areas where the Swamp Sclerophyll Forest intergrades with the Smooth-barked Apple Blackbutt Forest vegetation community. Based on the habitat categories by Lunney *et al.* (1998), it is likely that the Mahogany-Baloskion Swamp Forest would meet the definition of Category B vegetation detailed by Lunney *et al.* (1998) and therefore would be considered preferred koala habitat. The Frontal Dune Blackbutt-Apple Forest is likely to confirm to Category C vegetation and would be considered supplementary koala habitat. The remaining vegetation in the Referral Area is classified as 'other vegetation'. This is shown in Figure 3.2 of the Ecological Assessment for the Rifle Range site.

Koalas feed on the foliage of eucalypt tree species and in some areas exhibit extremely strong preferences for particular eucalypt species. The Approved Recovery Plan for the Koala (DECC 2008) outlines preferred feed tree species in the North Coast Koala Management Area. These species are outlined in **Table 1** below.

Table 1 Preferred/Primary Koala Feed Trees

Preferred/Primary Koala Feed Tree Species	SEPP 44	Port Stephens Comprehensive Koala Plan of Management	Approved Recovery Plan for the Koala^	Recorded in the Referral Area
swamp mahogany *Eucalyptus robusta*	✓	✓	✓	✓
Parramatta red gum *Eucalyptus parramattensis*	-	✓	✓	✓ (likely hybrid with *E. robusta*)
forest red gum *Eucalyptus tereticornis*	✓	✓	✓	-
tallowwood *Eucalyptus microcorys*	✓	-	✓	-
grey gum *Eucalyptus punctata*	✓	-	-	-
ribbon or manna gum *Eucalyptus viminalis*	✓	-	-	-
river red gum *Eucalyptus camaldulensis*	✓	-	-	-

Preferred/Primary Koala Feed Tree Species	SEPP 44	Port Stephens Comprehensive Koala Plan of Management	Approved Recovery Plan for the Koala^	Recorded in the Referral Area
broad-leaved scribbly gum *Eucalyptus haemastoma*	✓	-	-	-
scribbly gum *Eucalyptus signata*	✓	-	-	-
white box *Eucalyptus albens*	✓	-	-	-
bimble box or poplar box *Eucalyptus populnea*	✓	-	-	-
cabbage gum *Eucalyptus amplifolia*	-	-	✓	-

^Appendix 2 – North Coast Koala Management Area

The EPBC Act Referral Guidelines for the Vulnerable Koala (DoE 2014) (the guidelines) aim to address this complexity and provide guidance that can be applied consistently across the entire listed distribution of the koala. The guidelines break down the significant impact decision and guide proponents on important requirements, particularly on information expectations, survey planning, standards for mitigating impacts and guidance on significant impact.

In accordance with the Referral Guidelines, the habitat assessment tool was applied to the Referral Area which determined that the extent of vegetation that contains at least one known koala food tree corresponds to a small area of forest community occurring in the Referral Area. This includes:

- Mahogany-Baloskion Swamp Forest (swamp mahogany and potential Earp's gum)
- Frontal Dune Blackbutt-Apple Forest (minor occurrences of swamp mahogany only)

As the assessment of koala habitats resulted in a score greater than five using the Referral Guidelines habitat assessment tool (refer to **Table 2**), the Referral Area is considered to contain habitat critical to the survival of the species (DoE 2014).

Table 2 Assessment under the Koala Habitat Assessment Tool (DoE 2014)

Koala Habitat Assessment Tool (Table 4 from DoE 2014)			Referral Area Assessment	
Attribute	**Score**	**Coastal**	**Allocated Score**	**Score Justification**
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 2 years.	**1**	**Desktop:** • EPBC PMST report identified the koala or koala habitat as 'known to occur' in the Referral Area. • Atlas of NSW Wildlife point
	+1 (medium)	Evidence of one or more koalas within 5 km of the edge of the impact area		

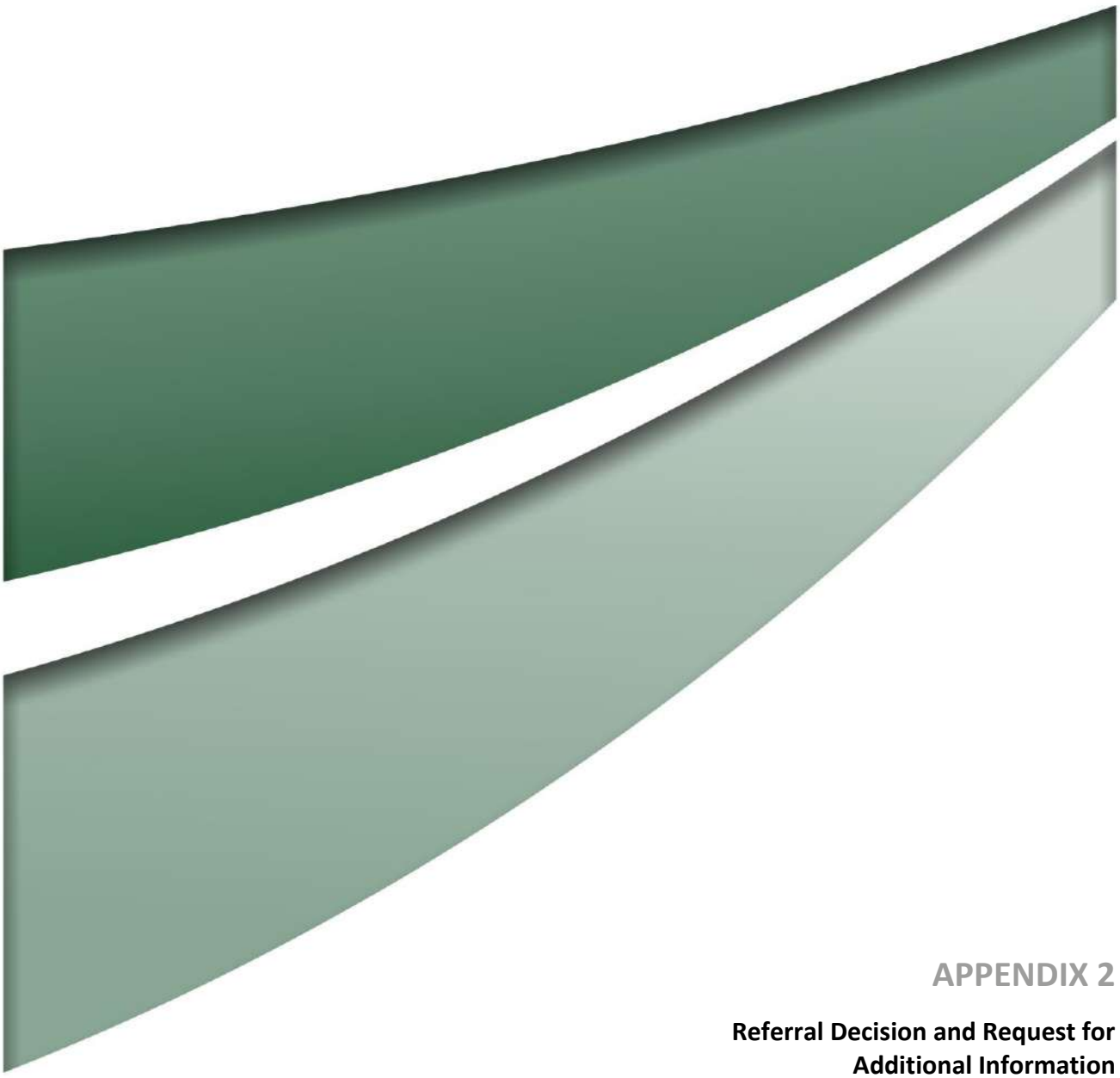
Koala Habitat Assessment Tool (Table 4 from DoE 2014)			Referral Area Assessment	
Attribute	**Score**	**Coastal**	**Allocated Score**	**Score Justification**
		within the last 5 years.		buffer search identified 0 koala records within the Referral Area and 145 records within a 10 km radius of the Referral Area. **On-ground:** • The koala has not been recorded on the site. • This species has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park.
	0 (low)	None of the above.		
Vegetation composition	+2 (high)	Has forest or woodland with 2 or more known koala food tree species in the canopy. **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	**2**	**Desktop:** The Port Stephens Council CKPoM maps the site as mainly cleared. **On-ground:** This Referral Area contains two known koala feed trees being swamp mahogany (*Eucalyptus robusta*) and potential Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*) listed as important for koalas in the Port Stephens LGA (PSC 2002) and SEPP 44 feed species.
	+1 (medium)	Has forest or woodland with only 1 species of known koala food tree present in the canopy.		
	0 (low)	None of the above.		
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 500 ha.	**2**	The Referral Area borders the Worimi Regional Park and Worimi Conservation Lands that extend along the Stockton Bight to the north in Nelson Bay. Land to the south and east is fragmented.
	+1 (medium)	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.		
	0 (low)	None of the above.		
Key existing threats	+2 (low)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.	**1**	**Desktop:** A desktop search has failed to locate any reports on koala mortality from vehicle strike or dog attack within the local area. **On-ground:** It is expected that the local koala population is adversely affected by vehicle strike associated with Nelson Bay and by dogs occurring in the local rural residential area.
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.		
	0 (high)	Evidence of frequent or regular koala mortality from vehicle strike or dog		

Koala Habitat Assessment Tool (Table 4 from DoE 2014)			Referral Area Assessment	
Attribute	**Score**	**Coastal**	**Allocated Score**	**Score Justification**
		attack in the Referral Area at present, or Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.		
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	**1**	**Desktop:** Table 1 of the Referral Guidelines (DoE 2014) prescribes, that for coastal areas, the interim recovery objective(s) are to: "Protect and conserve large, connected areas of koala habitat, particularly large, connected areas that support koalas that are: of sufficient size to be genetically robust/operate as a viable sub-population OR free of disease or have a low incidence of disease OR breeding and to maintain corridors and connective habitat that allow movement of koalas between large areas of habitat." and "Maintain corridors and connective habitat that allow movement of koalas between large areas of habitat." Despite the small size of the koala habitat within the Referral Area, surrounding connected habitats are likely to be important for the local koala population. The habitat present for the koala in the Referral Area is consistent with this description. **On-ground:** No clearing of preferred koala habitat is proposed. Disturbance of buffer and supplementary habitat will not result in fragmentation of retained habitats and is not likely to influence the recovery objectives.
	+1 (medium)	Uncertainty exists as to whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		
TOTAL SCORE			**7**	**≥ 5 indicates habitat critical for the survival of the koala.**

Following determination of the importance of the habitat for the koala in the Referral Area an assessment was undertaken to determine the impacts which are likely to substantially interfere with the recovery of the koala. The Referral Guidelines identifies the following impacts listed in **Table 3** as likely to substantially interfere with the recovery of the koala.

Table 3 – Assessment of Impacts that are Likely to Substantially Interfere with the Recovery of the Koala in Accordance with the Referral Guidelines for the Koala (DoE 2014)

Potential Impact to the Koala As Identified in the Koala Referral Guidelines	Level of Impact Operating in the Project Area
Increasing koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.	The Project is likely to result in an increase to vehicle movements such that the koala could be subjected to increased mortality levels. Car movements within the Referral Area and out onto Nelson Bay Road and Fullerton Street are will increase due to the vehicles required to access the development.
Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.	The Proposed Action may result in the introduction or increase of dogs to the local area and therefore may increase the threat of dog attacks to any local koala population. It is recommended that dog management be enforced to minimise dog/koala encounters.
Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.	The Proposed Action will result in the removal of 0.8 ha of suitable koala habitat, however most areas of koala habitat have been avoided by the project. The Proposed Action is considered unlikely to result in the creation of substantial additional barriers to koala movement in the local area. The Referral Area occurs on the southern edge of extensive areas of forested habitat within the Worimi Conservation Lands and adjacent vegetated areas along the Port Stephens coast that provide connectivity and movement corridors for a wide range of flora and fauna species from Fern Bay to Nelson Bay. The rezoning may result in the loss of up to 0.8 hectares of koala habitat south of Worimi Conservation Lands which will result in the loss of a small area of the southern extent of continuous habitat between Fern Bay and Nelson Bay. It is considered unlikely that the residential development as a result of the rezoning will restrict ecological vectors from moving from one habitat to another throughout the wider area or have substantial adverse impacts on the movement corridors and connectivity for species.
Facilitating the introduction or spread of disease or pathogens for example Chlamydia or *Phytophthora cinnamomi*, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.	The Proposed Action is not expected to facilitate the introduction or spread of pathogens as *Phytophthora cinnamomi* and Chlamydia have not been recorded in the environments or within the local population of koala within the Referral Area surrounds.
Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.	The project will remove approximately 0.8 ha of habitat considered critical to the survival of the koala. The Proposed Action is not expected to result in hydrological changes to the surrounding environment such that the function and integrity of the existing habitat for the koala is jeopardised.



APPENDIX 2

Referral Decision and Request for Additional Information

GUIDELINES FOR PRELIMINARY DOCUMENTATION FOR:

Rifle Range Residential Development Proposal (EPBC 2017/7993)

1. General content

The Preliminary Documentation Package (PD) should be provided to the Department as a consolidated package or stand-alone indexed document. The PD should include your initial referral as an appendix as well as the additional information requested below.

The information provided should be objective, clear, succinct, and where appropriate, supported by maps, plans, diagrams or other descriptive detail. All sources must be appropriately referenced using the Harvard standard. The reference list should include the address of any web pages used as data sources.

The PD should be written to enable interested stakeholders and the Minister to understand the environmental consequences of the proposed development. The information presented should also allow any conclusions reached to be independently assessed. Detailed technical information, studies or investigations supporting the text of the main document should be included as appendices where feasible, or at least directly linked to avoid readers having to search for the documents. Any such documents that are not already available to the public should be made available at appropriate locations at least during the period for public display of the PD. If it is necessary to make use of material that is considered to be confidential in nature, the proponent should consult the Department on the preferred presentation of that material, before submitting the documents to the Department.

Any variables or assumptions made in the assessment should be clearly stated and discussed. The extent to which limitations, if any, of available information may influence the conclusions of the environmental assessment should be discussed.

The assessment should clearly address any standards or criteria published by the Department that are relevant to matters being assessed, and appropriate reference should be made to any relevant policy documents.

2. FORMAT AND STYLE

The Proponent should consider the format and style of the document appropriate for publication on the Internet. The capacity of the website to store data and display the material may have some bearing on how the document is constructed.

The PD should comprise three elements, namely:

- The executive summary
- the main text of the document,
- appendices containing detailed technical information and other information that can be made publicly available.

This format need not be followed where the required information can be more effectively presented in an alternative way. However, each of the elements must be addressed to meet the requirements of the EPBC Act and Regulations.

The main text of the PD should include a list of abbreviations, a glossary of terms and appendices containing:

- A copy of these guidelines

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- a list of persons and agencies consulted during the PD
- contact details for the Proponent,
- the names of the persons involved in preparing the PD and work done by each of these persons.

Maps, diagrams and other illustrative material should be included in the PD. The PD should be electronically produced on A4 size paper capable of being photocopied, with maps and diagrams on A4 or A3 size and in colour where possible.

SPECIFIC CONTENT

1. GENERAL INFORMATION

This should provide the background and context of the action including:

A. The title of the action

B. the full name and postal address of the designated Proponent

C. a clear outline of the objective of the action

D. the location of the action

E. the background to the development of the action

F. how the action relates to any other actions (of which the Proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action

G. the current status of the action,

H. the consequences of not proceeding with the action.

2. DESCRIPTION OF THE ACTION

The PD must provide background to the action and describe in detail all components of the action, including (but not limited to) the land and vegetation clearance, road, housing and infrastructure development and rehabilitation components of the action. This must include:

A. Precise location of all the works to be undertaken, including boundaries and size (in hectares) of the disturbance footprint, any offsite infrastructure and any adjoining areas which may be indirectly impacted by the proposed action

B. details of the full scope of the works including permanent and temporary infrastructure, built structures, land or vegetation disturbance, landscaping, fencing, stockpiles of materials (including waste or spoil) and any proposed storm water diversion channels, erosion control measures or rehabilitation works

C. a final layout plan (or as near as possible) for the proposed action area, including the location and type of land use, key infrastructure, open space and conservation areas

D. details of construction methods, techniques and materials

E. description of the operational requirements of the action including vehicle and pedestrian traffic management on site and in the surrounding area and any anticipated maintenance works

F. the anticipated timing and duration (including start and completion dates) for both construction and operational components, and

G. details on the cumulative impacts from other developments in the immediate vicinity of the proposed development site that impact on the Mahogany-Baloskion Swamp Forest, Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree-Banksia Scrub.

3. DESCRIPTION OF THE EXISTING ENVIRONMENT

The Department notes that potential habitat is present on the proposed development site and in the surrounding area for the Koala and Grey-headed Flying-fox (GHFF). To better understand impacts to those, please provide the following details:

A. A general description of the environment of the proposed action site, as well as the surrounding areas that could be impacted by the action both in the short and long term. Please provide:

1. A description of the matters protected by the EPBC Act, which may be affected by the proposed action and their regional context. This section must address (but need not be limited to) threatened species and ecological communities and the environment, which include the Koala and the GHFF, and the native vegetation such as Mahogany-Baloskion Swamp Forest, Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree-Banksia Scrub.

2. The quality of native vegetation, which is habitat for the Koala and GHFF including Mahogany-Baloskion Swamp Forest, Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree-Banksia Scrub, that contains tree species, including but not limited to, Swamp Mahogany *E. robusta*, Earp's Gum hybrids *E. parramattensis* subsp. *decadens* x *robusta* (two individuals), Blackbutt (*Eucalyptus pilularis*), Smooth-barked Apple (*Angophora costata*), mid-storey Coastal Tea-tree (*Leptospermum laevigatum*) and Coastal Banksia (*Banksia intergrifolia*) within the proposed action site, adjacent, and in the broader local area of the proposed action site. If additional surveys are considered necessary, please provide the details of the scope, timing (survey season), location, effort and methodology, including a discussion on whether surveys were undertaken in accordance with published best practice guidelines.

3. The ecological value of native vegetation habitat for the Koala and GHF that includes Mahogany-Baloskion Swamp Forest, Frontal Dune Blackbutt-Apple Forest and Coastal Tea-tree-Banksia Scrub, to be removed by the proposed action and to be retained in surrounding areas, and on the proposed action site.

4. Maps displaying the above information (points A2 and A3) overlaid with the proposed development footprint and any potential areas to be avoided and/or reserved.

5. Further information about the occurrence of the Koala and GHFF and discussion on the likelihood of the site's vegetation as suitable habitat for these species on and within the vicinity of the proposed action site. This must include:

    i. Reporting on surveys for the Koala consistent with the survey methodology as identified in the Department's *Survey Guidelines for Australia's Threatened mammals* at: http://www.environment.gov.au/resource/survey-guidelines-australias-threatened-mammals-guidelines-detecting-mammals-listed. The general survey design principles detailed in the guidelines are highly relevant to surveying for koalas, although these species are not specifically referred to in the guidelines.

    ii. Further analysis of the suitability of the habitat on proposed action site and in adjacent land against the *EPBC Act Referral Guidelines for the Vulnerable Koala* (*combined populations of Queensland, New South Wales and the Australian Capital Territory*) (2014) at: http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala.

iii. Reporting on targeted surveys for the GHFF consistent with the survey methodology as identified in the Department's *Survey Guidelines for Australia's Threatened bats* at: http://www.environment.gov.au/resource/survey-guidelines-australias-threatened-bats-guidelines-detecting-bats-listed-threatened.

iv. An account of the survey effort and methodology used in the surveys undertaken for the point A6 above, including evidence that the surveys were undertaken for a suitable period of time by a qualified person and used accepted methodology for targeting the species and its habitat.

v. A description of the distribution and abundance of these species, including, but not limited to, the estimated size, density and location of occurrences on site and in the region.

vi. Further quantification and description of the extent of suitable habitat on-site and in the region (including whether the habitat is critical to the survival of the species)[1,2].

vii. Maps displaying the above information (points A8v and A8vi) overlaid with the proposed development footprint.

Please note that, unless it can be demonstrated that surveys have been undertaken in accordance with best practice survey techniques, additional targeted field surveys may be required to be undertaken if the information presented in the PD is not sufficient to support robust decision making.

4. RELEVANT IMPACTS

The PD should provide a detailed assessment of any likely impact that this proposed action may have on the following (at the local, regional, state, national and international scale):

i. Listed threatened species and communities (section 18 & section18A):

   a. Koala (*Phascolarctos cinereus*)(combined populations of Qld, NSW and the ACT) – vulnerable, and

   b. Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable.

ii. The environment because the proposal is a Commonwealth action (section 28):

   a. Impacts on landscapes and soils

   b. Impacts on water resources

   c. Impacts on plants

   d. Impacts on animals

[1] Significant Impact Guidelines 1.1 – Matters of National Environmental Significance https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

[2] EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (2014) at: http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala

e. Impacts on Heritage

For each protected matter listed below, please provide a description of the direct and indirect impacts that the action will have, or is likely to have.

4.1 Detailed assessment - Listed threatened species and communities

Please include:

A. The total area (in hectares) and quality of habitat that is suitable for the GHFF that will be impacted.

B. The total area (in hectares) and quality of habitat that is suitable for the Koala that will be impacted, against the criteria for habitat critical to the survival of the Koala contained in the *EPBC Act Referral Guidelines for the Vulnerable Koala* (*combined populations of Queensland, New South Wales and the Australian Capital Territory*) (2014) at: http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-vulnerable-koala.

    a. Please analyse in detail the quality of the potential koala habitat to be cleared and its relative importance to the species in the context of the local Port Stephens koala population.

C. The impact assessment should include habitat within all areas to be protected or cleared (quantified in area) and all areas that will be disturbed including, but not limited to, any buffer zones.

D. A detailed assessment and quantification of the vegetation on site as suitable habitat for the Koala and GHFF. Please provide:

    a. Analysis of the relative quality of habitat, specifically its value as connective habitat, particularly to the north and south of the site.

    b. Discussion of the relative conservation benefit of retaining connective habitat, on the rifle range (particularly for the Koala), with regard to the site's context in the broader region. For example, whether there is good quality habitat to the north, and south and the specific likelihood that habitat to the south (beyond the project boundary) will likely be used by the Koala and GHFF.

        i. Analysis of habitat to the south of the site's boundary should specifically focus on any possible benefits and/or threats to the Koala and GHFF

    c. For the Koala and GHFF, analysis and discussion should be focused towards the quantity and quality of habitat for these species which will be impacted by clearing onsite.

        i. Analysis should be undertaken of the possible benefits and/or impacts to these species from retaining habitat, such as key tree species, onsite.

    d. Consideration should be given to indirect impacts to the Koala and GHFF during the construction and ongoing occupancy of the development site, including those resulting from:

        i. edge effects

ii. fragmentation

iii. disturbance from increased noise, light, dust and sediment generation, introduced predators

iv. dog attacks to the Koala to the level that is likely to result in multiple, ongoing mortalities and/or dislodgement from habitat

v. vehicle-strikes to the Koala to a level that is likely to result in multiple, ongoing mortalities, and

vi. introduction or spread of disease or pathogens, specifically, *Phytophthora cinnamomi* and Myrtle Rust that may further degrade the GHFF foraging and resting habitat on site and the surrounding areas.

E. Should any additional species listed under the EPBC Act be identified as likely impacted from the action (e.g., during additional surveys (if they are undertaken)), or assumed present, they must be described and considered with the already identified listed matters.

When addressing relevant impacts, consideration should be given to Recovery Plans, Conservation Advices and Threat Abatement Plans relevant to each species that is 'likely to' or 'may be' impacted by the proposed action. At this stage, these are the Koala and GHFF.

4.2 Detailed Assessment – the environment because the proposal is a Commonwealth action

4.2.1 Impacts on landscapes and soils

The proposed master plan indicates a maximum disturbance area of approximately 18.3 ha (approximately 16% of the total site area) and requires clearance of vegetation, construction of housing, roads and associated infrastructure, and services. According to the Significant Impact Guidelines 1.2, the proposed action involves medium to large scale excavation of soil. The referral states that earthworks will be minimised through construction of raised buildings instead of using slab designs. Please provide information regarding the potential impacts of the proposed construction and development regarding the following:

A. What soils or other substrates are present?

a. What is the soil type/structure?

b. Are any other substrates present? e.g., sand, gravel and rock.

B. Is it likely that the soil/substrate will be directly or indirectly impacted by the action, and if so, to what extent?

C. Is the soil/substrate valuable, or does it contain objects that are rare or otherwise valuable, e.g., archaeological items with heritage value?

D. Is the soil susceptible to impacts or will disturbance of the soil cause further impacts?

a. Are there steep slopes?

b. Is there evidence of previous erosion?

c. Is the soil/substrate friable (easily eroded)?

d. Are acid sulphate soils present?

4.2.2 Impacts on water resources

Due to the uncertainty of post construction impacts on water resources, please provide the final Stormwater Management Plan for post construction that includes the outcome of the final MUSIC model. Please provide a summary of the final Stormwater Management Plan with key outcomes from the Model, which reveals the estimated quality of effluent (stormwater) that will be discharged to the Hunter River.

4.2.3 Impacts on plants

The referral documentation states that 15.3 ha of native vegetation is proposed to be cleared for the proposed development. Five native vegetation community types have been recorded within the proposed action area including Frontal Dune Blackbutt-Apple Forest, Coastal Tea-tree-Banksia Scrub, Mahogany-Baloskion Swamp Forest, Foredune Spinifex and Beach wetlands. The native vegetation contains Blackbutt (*E. pilularis*), Earp's gum (*E. parramattensis* subsp. *decadens*), Swamp Mahogany (*E. robusta*), Coastal Banksia (*B. intergrifolia*) and Coastal Tea-tree (*Leptospermum laevigatum)* that provide habitat for a range of listed threatened species, which are known or likely to occur within the proposed action area. Please refer to and cross reference with *Section 4.1. Listed threatened species and communities* as appropriate, in addressing this section:

A. Please analyse and discuss the potential for the vegetation to regenerate into higher quality habitat, timeframes and proposed management measures to enhance the regeneration.

4.2.4 Impacts on animals

The environment of the proposed action area comprises 44.9 ha of intact native vegetation that provides habitat for native animals. According to the *Significant Impact Guidelines 1.2*, it is likely that the proposed action will substantially reduce or fragment available habitat for native species. Please provide the information as described below:

A. Please describe the native animal species present (this should include all native species i.e. not be limited to the Matters of National Environmental Significance described in Section 4.1) and what are their characteristics?

B. Please assess and describe whether the action likely to directly or indirectly impact upon these animal species?

    a. Will the action result directly or indirectly in animal deaths or injury?

    b. Can animals be translocated?

    c. Will the action impact upon habitat, water or other resources utilised by animals?

C. Please cross reference with Section 4.1 as appropriate for the Koala and GHFF.

4.2.5 Impacts on Heritage

4.2.5.1 Impact on Historical Value

According to the referral documentation, historical values and indigenous values are identified on the proposed action site. It is stated in the Heritage Impact Statement (HIS) that no heritage items at the Rifle Range site meet the threshold for the Commonwealth Heritage list. However, the proposed action is likely to have an indirect impact on the Links Battery. Please provide:

A. Information in detail about how the Links Battery on the proposed action site will be stabilised, repaired where necessary, and appropriately conserved to promote the

heritage values of the site and better allow the Battery to demonstrate the story of WWII on the range.

B. There were nine heritage items, which were identified on the proposed action site in 2008 (Heritage Impact Statement, 2016), but only two (the rifle range and Battery) were identified during the 2017 study. Please discuss the other heritage items.

C. If additional heritage items of significance are identified, please analyse impacts of the action on these heritage items.

4.2.5.2 Impact on Indigenous Values

To protect Indigenous Values, please provide:

A. Details about how the burial sites, located at the south western corner of the proposed action site, will be protected.

B. The involvement of Registered Aboriginal Parties (RAP) in the field work survey identified culturally sensitive areas related to the protection of the broader Fern Bay Complex and includes newly identified archaeological sites. As these are on the proposed action site, appropriate consultation should continue to be undertaken with the RAP. The Department has guidance which may be relevant in this regard:

   a. Engage early - guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act, available at http://www.environment.gov.au/epbc/publications/engage-early).

   b. The guidelines should be read in conjunction with Ask First: A guide to respecting Indigenous heritage places and values, published by the Australian Heritage Commission (now the Australian Heritage Council) in 2002. The Ask First guidelines are a practical guide for proponents on Indigenous heritage issues, and include steps for consultation and negotiation http://www.environment.gov.au/heritage/ahc/publications/ask-first-guide-respecting-indigenous-heritage-places-and-values

The Department considers the Indigenous consultation process is incomplete until the Department is provided with the final Aboriginal Cultural Heritage and Archaeological Assessment (ACHAA) report, with reference to the impacts on Indigenous heritage in the Heritage Impact Statement. To confirm impacts on indigenous heritage matters are appropriately considered (whether there is the potential for either a direct, indirect, short term, long term, temporary or permanent impact on Indigenous heritage values), please ensure the final ACHAA includes any relevant responses and recommendations from RAP. If there are comments, please summarise how/whether the RAPs' comments have been addressed in the PD.

5. PROPOSED AVOIDANCE, MITIGATION AND MANAGEMENT MEASURES

The PD should provide proposed avoidance, mitigation and management measures for any likely impact that this proposed action may have on the following:

- Listed threatened species and communities (section 18 & section18A):

   a. Koala (*Phascolarctos cinereus*)(combined populations of Qld, NSW and the ACT) – vulnerable, and

   b. Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable.

- The environment because the proposal is a Commonwealth action (section 28):
    a. Impacts on landscapes and soils
    b. Impacts on water resources
    c. Impacts on plants
    d. Impacts on animals, and
    e. Impacts on Heritage.
- Any other matters likely to be impacted, which are protected by the EPBC Act, identified as a result of further investigations under this PD.

Please provide a consolidated list of avoidance and mitigation measures for each protected matter that is 'likely to' or 'may be' impacted by the proposed action. The avoidance and mitigation measures should include actions that will be undertaken to prevent or minimise potential direct and indirect impacts to the protected matters.

A. The provide the following management plans, which detail avoidance and mitigation measures for EPBC Act protected matters:
    a. a Construction Environmental Management Plan (CEMP)
    b. a site specific Development Conservation Plan (DCP)
    c. a Koala Plan of Management, which:
        i. includes options for protective covenants on un-impacted areas, in particular, areas which are better quality habitat for koalas
        ii. analysis of the quality of habitat, which will be avoided and discussion of its effectiveness in achieving conservation outcomes for these species.
        iii. includes mitigation measures to prevent the Koala to travel to the proposed action site
        iv. includes mitigation measures to prevent the impacts of proposed action (including but not limited to direct mortality, indirect mortality and injury from dog attack and vehicle strike, habitat loss from edge effect and fragmentation) on the Koala
        v. includes plans for re-establishment of native vegetation communities and koala habitat, and
        vi. is aligned with the broader Port Stephens Council Koala Plan of Management.
    d. a Stormwater Management Plan for post-construction that includes but is not limited to:
        i. Erosion and sediment control measures, and
        ii. Erosion and sediment control Plan in a diagram.

5.1 Proposed Summary Table

A. For each EPBC matter likely impacted, please provide the proposed avoidance and mitigation measures in a table, which outlines:

a. stage of development (e.g., construction phase or ongoing occupancy phase)

b. objectives (e.g., to protect water quality of nearby receiving water, to mitigate soil excavation)

c. avoidance (e.g., avoidance of clearance of habitat)

d. mitigation measures (e.g., implementation of construction management plan)

e. performance criteria (e.g., erosion and sediment control measures are consistent with those specified by a relevant Council)

f. monitoring and reporting (e.g., monitoring is to be undertaken weekly during construction)

g. corrective action (e.g., immediately reinstate appropriate erosion and sediment control devices after the identification of a failure)

h. responsible party (e.g., project environmental officer, who will ensure the measures are undertaken)

i. timing (the construction management plan to be approved by a relevant body prior to the commencement of construction), and

j. the cost of the mitigation measures, including how measures will be funded to ensure enduring protection (and by whom).

B. A description of the proposed mitigation measures, where possible, should incorporate objectives that are specified in relevant Conservation Advices, Recovery Plans and Threat Abatement Plans, for the construction and ongoing occupancy phases, that provide greater certainty that the direct and indirect impacts of the project will be reduced (and to what degree they are reduced), which includes (but not limited to):

a. revegetation and dune rehabilitation

b. erosion, sediment, weed, pest and runoff controls

c. treatment of stormwater and treatment efficiency

d. biodiversity buffers

e. dog and cat ownership policies

f. environmental objectives, and how these will be achieved, and

g. include maps of buffer, exclusion or protection zones and details of how these zones will be managed.

6. OFFSETS

In the event that there are residual significant impacts that cannot be avoided or mitigated, a description of any offsets to compensate for residual impacts on EPBC Act protected matters must be provided for each matter. Please consider whether an offset package is required and if so, provide an offset package for the identified protected matters.

There are two offset pathways available. Please follow one pathway appropriate to the action:

1. The *Commonwealth EPBC Act Environmental Offsets Policy 2012*	2. **Use one of the following endorsed NSW State policies:**
If offsets are provided in accordance with the *Commonwealth EPBC Act Environmental Offsets Policy 2012* please proceed to Attachment 1 for further information on how to meet the EPBC Act offset requirements. The Policy is available at: http://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy_2.pdf	I. *The NSW Biodiversity Offsets Policy for Major Projects* which includes the Framework for Biodiversity Assessment (FBA). II. *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update),* published by the Department of Trade and Investment, Regional Infrastructure and Services for the NSW Government in June 2013. III. Rules established under section 127B of the *Threatened Species Conservation Act 1995* (BioBanking assessment methodology). If offsets are provided in accordance with these endorsed NSW State policies please note and refer to the guidance below.

Endorsed NSW State policies - guidance

The *EPBC Act Condition-setting Policy* (January 2016) endorses NSW policies for **biodiversity offsets**[2]. However, all proposals must be consistent with the offsets principles specified in the *EPBC Act Environmental Offsets Policy*[3] (October 2012) and other relevant Commonwealth policies. This means that the following points must be addressed in the offsets section of the PD:

- In providing information on the Endorsed NSW State policy, impacts on threatened species and communities listed under the EPBC Act must be identified and quantified with reference to all relevant Commonwealth policies, definitions and survey guidelines (for example, this affects how 'patch sizes' are determined for some listed threatened communities).
- if offsets are required, the PD must demonstrate how those offsets (e.g. BioBank Sites) are 'like for like' according to Commonwealth descriptions of the MNES (note that the usual BioBanking substitution rules will not generally apply i.e. Ecosystem credits can

[2] http://www.environment.gov.au/system/files/resources/bb7eaf1b-29d5-463b-8fa9-f08560534b7f/files/epbc-condition-setting-policy-2016.pdf

[3] Department of Sustainability, Environment, Water, Population and Communities (2012). *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. Commonwealth of Australia, Canberra. Available at https://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy

only be used to offset Biodiversity impacts in the same ecological community as defined under the EPBC Act, they cannot be used for a substitute community).

- the offset must be provided prior to the action commencing.

If offsets are provided using the NSW BioBanking methodology, please note that:

- An approved BioBanking Statement, issued by the New South Wales Office of Environment and Heritage (OEH), must be submitted to the Department and included in the PD prior to any decision under the EPBC Act whether to approve the action.
- If a BioBanking Statement is not to be issued by NEW OEH, the proponent must ensure that any credit calculations for the impact and offset sites are independently peer reviewed by an accredited BioBanking assessor, and that the review is included in the PD along with the original calculations and assessment.
- peer reviewed by an accredited BioBanking assessor, and that the review is included in the PD along with the original calculations and assessment.
- A Commonwealth-specific Credit Retirement Report, issued by the NSW OEH, must be submitted to the Department prior to commencement of the action.
- The BioBanking Agreement(s) associated with each BioBank Site must include specific reference to EPBC matters and relevant EPBC policies or guidelines.
- A copy of BioBanking Agreement(s) relevant to the BioBank Sites must be submitted to the Department following the establishment of a BioBank Site.
- All documents must account for offsets against the species and communities as listed under the EPBC Act.

7. ECONOMIC AND SOCIAL MATTERS (s136(1)(b))

The PD must provide information on the relevant economic and social impacts of the action. Consideration of economic and social matters should include a discussion of the action's benefits and impacts at a local, regional and national context. Consideration of economic and social matters should include:

A. An analysis of the economic and social impacts of the action, both positive and negative should be provided. Matters of interest may include:

   i. details of any public consultation activities undertaken, and their outcomes;

   ii. projected economic costs and benefits of the project, including the basis for their estimation through cost/benefit analysis or similar studies; and

   iii. employment opportunities expected to be generated by the project (including construction and operational phases).

B. Consideration of different scales where relevant (e.g. local versus regional versus national).

C. The capital investment and estimated ongoing value of the project in $.

Economic and social impacts should be considered at the local, regional and national levels.

8. ENVIRONMENTAL RECORD OF PERSON PROPOSING TO TAKE THE ACTION

The information provided must include details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:

A. The person proposing to take the action,

B. for an action for which a person has applied for a permit, the person making the application.

If the person proposing to take the action is a corporation, details of the corporation's environmental policy and planning framework must also be included.

9. PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Provide relevant information to enable the delegate's consideration of the principles of ecologically sustainable development, as defined in Part 1, section 3A of the EPBC Act. This should include but not be limited to:

A. Identification and integration of both long-term and short-term economic, environmental, social and equitable considerations

B. identification of threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation

C. how health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations

D. how the conservation of biological diversity and ecological integrity has been considered in the decision-making process,

E. how improved valuation, pricing and incentive mechanisms will be promoted.

10. OUTCOME BASED CONDITIONS ENVIRONMENTAL OUTCOMES

The PD must provide information on the outcomes that the proponent will achieve for matters of national environmental significance (MNES). Outcomes need to be specific, measurable and achievable, and must be based on robust baseline data. Outcomes must be developed in consideration of the Department's Outcomes-based Conditions Policy 2016 and Outcomes-based Conditions Guidance 2016 (www.environment.gov.au/epbc/consultation/policy-guidance-outcomes-based-conditions), with suitable justification for considerations identified in the policy and guidance.

Where the Department determines that your project is suitable for outcome based conditions you will be advised and asked to provide additional information including environmental outcomes to be achieved, and reasoning for these with reference to relevant Recovery Plans, Conservation Advices and Threat Abatement Plans.

For each proposed outcome provide:

A. The risks associated with achieving the outcome

B. The measurability of the outcome, including all suitable performance measures

C. Appropriate baseline data upon which the outcome has been defined and justified

D. The likely impacts that the proposed outcome will address

E. Demonstrated willingness and capability of achieving the outcome

F. The level of knowledge about the protected matter or its surrogate, upon which outcomes were based

G. Commitments to independent and periodic audits of performance towards achieving outcomes

H. Assessment of the likely level of control that the proponent will have over achieving the outcome

I. Discussion of the appropriateness of any surrogates for protected matter outcomes, and

J. Details of proposed management to achieve the outcome, including, but not limited to performance indicators, periodic milestones, proposed monitoring and adaptive management, and record keeping, publication and reporting processes.

11. MONITORING AND REPORTING

Provide details of the proposed maintenance, monitoring and adaptive management programs to help limit the impacts of the action on matters of national environmental significance. These must include, but not be limited to:

A. Management programs, including offsets, construction EMP's, erosion, sediment and runoff controls, water quality testing and other measures to maintain or enhance habitats in the vicinity of the action.

B. Details of ongoing research and monitoring programs to support an adaptive management approach and determine the effectiveness of the proposed mitigation measures.

12. CONCLUSION

The Proponent should ensure that the PD assesses compliance of the proposed action with the objects of the EPBC Act at Attachment 2.

An overall conclusion as to the environmental acceptability of the proposed action should be provided. Reasons justifying undertaking the proposed action in the manner proposed should also be outlined.

Measures proposed or required by way of offset for any residual impacts on NES matters, and the relative degree of compensation, should be restated here.

MEETING THE REQUIREMENTS OF THE EPBC ACT OFFSET GUIDE

Offset measures should be consistent with the Department's the *EPBC Act environmental offsets policy 2012* available at: www.environment.gov.au/epbc/publications/environmental-offsets-policy.html.

Providing answers to the following items will assist the Department to determine whether your offset measures are consistent with this policy.

1. Details in relation to a proposed offsets package, must include for direct offsets:
    a. the location and size, in hectares, of any offset site(s)
    b. maps clearly showing for each offset site:
        i. the area to be protected
        ii. the relevant ecological features
        iii. the landscape context,
        iv. the cadastre boundary.
    c. the current and future tenure arrangements (including zoning and ownership) of any proposed offset sites
    d. confirmed records of presence (or otherwise) of relevant protected matter(s) on the offset site(s), and
    e. detailed information regarding the presence and quality of habitat for relevant protected matter(s) on the offset site. The quality of habitat should be assessed in a manner consistent with the approach outlined in the document titled *How to use the offset assessment guide* available at: http://www.environment.gov.au/epbc/publications/environmental-offsets-policy.html.
2. Details and justification on how the offsets package will deliver a conservation outcome that will maintain or improve the viability of the protected matter(s) consistent with the EPBC Act environmental offsets policy (October 2012); including:
    a. Management actions that will be undertaken that improve or maintain the quality of the proposed offset site(s) for the relevant protected matter(s). Management actions must be clearly described, planned and resourced as to justify any proposed improvements in quality for the protected matter(s) over time. Evidence of the likely effectiveness/success of any proposed management actions (i.e. rehabilitation / restoration / re-creation of habitat) must be provided.
    b. The time over which management actions will deliver any proposed improvement or maintenance of habitat quality for the relevant protected matter(s). This should include the timing for delivery of the offset (e.g. timing of proposed rehabilitation/restoration of habitat in relation to the timeframe for the proposed action).
    c. The risk of damage, degradation or destruction to any proposed offset site(s) in the absence of any formal protection and/or management over a foreseeable time period (20 years). This information is important in determining the comparative benefit of a proposed offset. Such risk assessments may be based on:
        i. presence of pending development applications, mining leases or other activities on or near the proposed offset site(s) that indicate development intent
        ii. average risk of loss for similar sites, and
        iii. presence and strength of formal protection mechanisms currently in place.

d. The legal mechanism(s) that are proposed to protect offset site(s) into the future and avert any risk of damage, degradation or destruction.

3. Information regarding how the proposed offsets package is additional to what is already required, as determined by law or planning regulations, agreed to under other schemes or programs or required under an existing duty-of-care.

4. The overall cost of the proposed offsets package; including costs associated with, but not limited to:
    i. acquisition and transfer of lands/property
    ii. implementation of all related management actions,
    iii. monitoring, reporting and auditing of offset performance.

THE OBJECTS OF THE

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

SECTION 3

Section 3 Objects of the Act

(a) to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance

(b) to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources

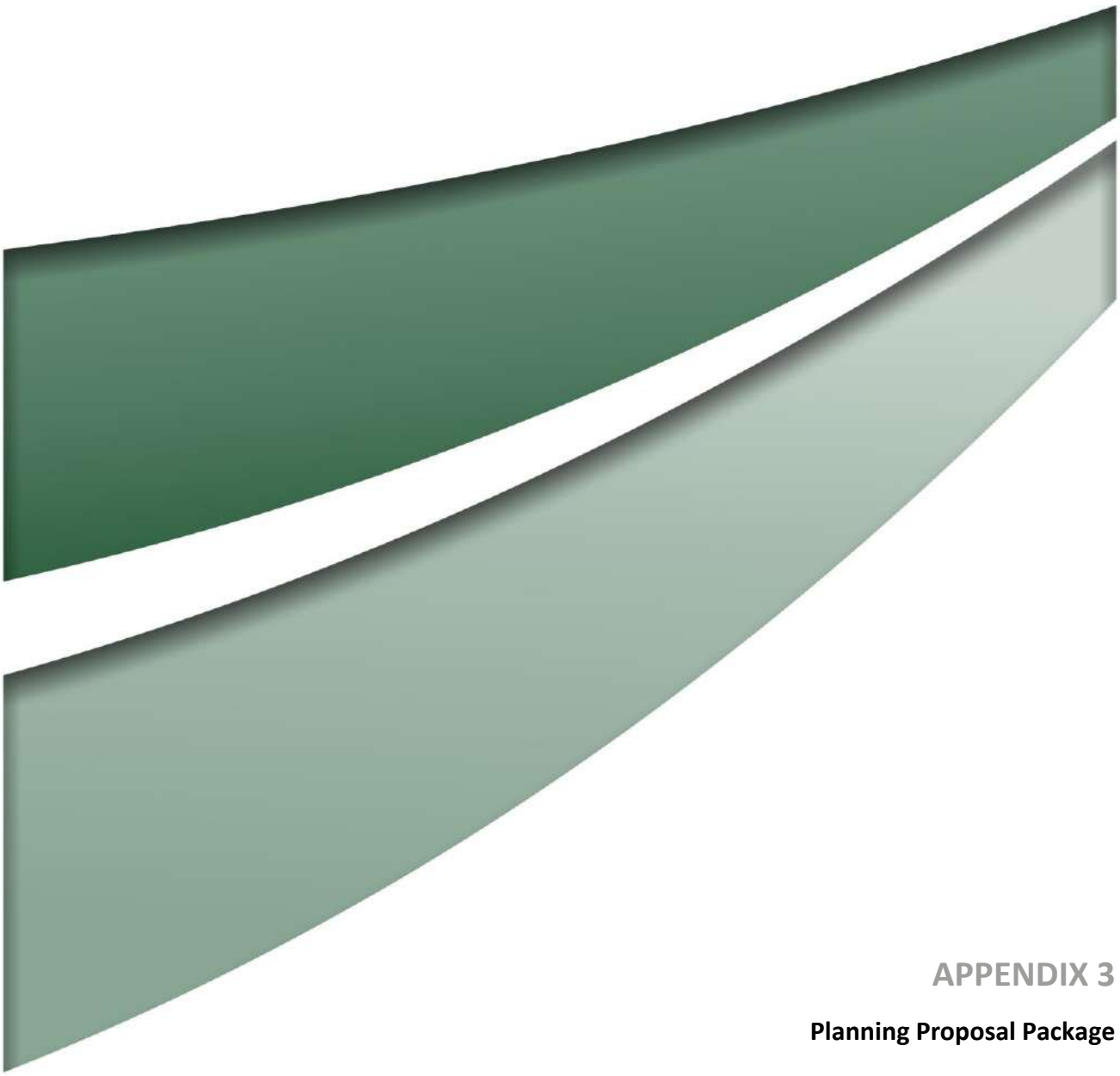
(c) to promote the conservation of biodiversity

(d) to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples

(e) to assist in the co-operative implementation of Australia's international environmental responsibilities

(f) to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity,

(g) to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.



APPENDIX 3

Planning Proposal Package

Prepared for
Defence Housing Australia

Updated
March 2019

Planning Proposal

Former Rifle Range
Popplewell Road, Fern Bay

architectus™

Architectus Group Pty Ltd
ABN 90 131 245 684

Adelaide
Lower Ground Floor
57 Wyatt Street
Adelaide SA 5000
Australia
T +61 8 8427 7300
adelaide@architectus.com.au

Melbourne
Level 25, 385 Bourke Street
Melbourne VIC 3000
Australia
T +61 3 9429 5733
F + 61 3 9429 8480
melbourne@architectus.com.au

Sydney
Level 18, MLC Centre
19 Martin Place
Sydney NSW 2000
Australia
T +61 2 8252 8400
F +61 2 8252 8600
sydney@architectus.com.au

architectus.com.au

Report Contact:
Jane Freeman
Principal, Urban Planning

This report is considered a draft unless signed by a Director or Quality Assurance Manager

Jane Freeman, Principal, Urban Design and Planning
March 2019

Revision history

Issue Reference	Issue Date	Issue Status
A	17 January 2017	75% Draft for internal use only
B	16 June 2017	Draft for internal review
C	22 June 2017	Draft for client review
D	28 June 2017	Final
E	12 December 2018	Amended Masterplan
F	8 March 2019	Updated in response to Council queries
File reference	190228_Updated Rifle Range Planning Proposal_Tv	

Report contact:
Jonathan Archibald
Senior Planner
Jonathan.Archibald@architectus.com.au

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A Proposed Mapping Amendments
Architectus

B Urban Design and Landscape Report
Prepared by Architectus and Spackman Mossop Michaels

C Transport Study Report
Prepared by Better Transport Futures

D Rifle Range Bushfire Assessment
Prepared by Kleinfelder

E Stormwater Management Plan
ADW Johnson

F Coastal Engineering Assessment
Prepared by BMT WBM

G Site Audit Statement
Prepared by Department of Environment and Climate Change

H Ecological Assessment Report
Prepared by Umwelt

I Heritage Impact Statement
Prepared by Urbis

J Aboriginal Cultural Heritage and Archaeological Assessment Report
Prepared by Umwelt

K Servicing Report
Prepared by ADW Johnson

L Consultation Report
Prepared by Elton

M Site Environmental Management Plan
Prepared by SMEC

Executive Summary

This Planning Proposal is prepared by Architectus on behalf of Defence Housing Australia for the former rifle range site at Popplewell Road, Fern Bay. The site is legally known as Lot 5, DP233358. The Rifle Range Site is located to the north of the Stockton Centre and south of Worimi Lands, approximately 4km north of Stockton and 6km from Newcastle.

To achieve the intended outcomes, the rezoning request seeks to amend the following provisions in the Port Stephens LEP 2013:

- Land zoning map – Sheet LZN_004A, to show part of the subject site appropriate for residential development as R3 Medium Density Residential while retaining the existing E2 Environmental Conservation on the remainder of the site;
- Height of Buildings map – Sheet HOB_004A, to show part of the subject site as 9m and part 15m; and
- Lot size map – Sheet LSZ_004A, to show part of the subject site with a minimum lot size of 500sqm and part of the site with a minimum lot size of 200sqm, being limited to areas zoned for residential development only. while retaining the existing AB3 40ha minimum lot size zoning on the remainder of the site.

It is intended that these legislative amendments would be supported by a site specific DCP, to be developed with Council concurrent to the Planning Proposal process. The key principles of this DCP are set out in this report.

The site is a disused rifle range, with a central road dividing the relatively disturbed area of vegetation to the south and the intact vegetation area adjoining Worimi lands to the north. A significant portion of the site to the east comprises coastal dune system, approximately 600m from the proposed area of residential zoning.

The former Rifle Range site is a unique and sensitive coastal setting that has the opportunity to offer high amenity of the bushland, access to Stockton Beach and walking opportunities both north and south to Stockton, whilst accommodating new homes and open space that will contribute to the vitality of the area.

The site is currently zoned E2 Environmental Conservation under the Port Stephens LEP 2013, allowing a range of land uses including dwelling houses, dual occupancies, and bed and breakfast accommodation. The site has no maximum height of buildings control, however is subject to a minimum lot size of 40ha.

DHA have a responsibility to provide housing for members of the defence force and their families in proximity to army bases and amenity. In 2015, the site was transferred from Defence to DHA as it was no longer needed for defence purposes. The proximity of the site to the Williamtown base and the amenity of Stockton and Newcastle CBD make it an excellent site for development of housing.

Strategic and technical assessments of the site were undertaken to consider the potential of the site to deliver housing, including urban design and planning; landscape; ecological; indigenous heritage; bushfire; European heritage; coastal engineering; civil engineering; and traffic and transport. This consultant team has consulted with local Council, State Government, the community, RMS, and local aboriginal groups in the preparation of these assessments.

A concept master plan was developed to demonstrate how a sensitive residential development could be achieved in the context of the rezoning, facilitating approximately 300 lots and associated infrastructure such as green space, roads and footpaths. To facilitate the delivery of the master plan and deliver approximately 50% of housing to defence members and 50% to the private market, a rezoning is required.

For the reasons discussed within this report, the Planning Proposal offers site specific and strategic merit, providing a unique opportunity to deliver a sensitive, socially sustainable and diverse community in a high amenity ecological setting. The Planning Proposal is strongly supported and recommended to Council for endorsement.

Figure 1 Artists Illustration of the Concept Master Plan
Source: David Wardman

Figure 2 Indicative Master Plan and Landscape Context
Source: Architectus

1. Introduction

1.1 Preliminary

This Planning Proposal explains the extent of, and justification for, proposed amendments to Port Stephens Local Environmental Plan 2013 (Port Stephens LEP 2013). The report has been prepared in accordance with Section 55 of the Environmental Planning and Assessment Act 1979 (the Act) and guidelines published by the Department of Planning and Environment including 'A guide to preparing planning proposals' and 'A guide to preparing local environmental plans'.

This Planning Proposal has been prepared by Architectus on behalf of Defence Housing Australia (DHA) to demonstrate the strategic merit of amending the Port Stephens LEP 2013 to facilitate the use of land on Popplewell Drive, Fern Bay, also known as the former Rifle Range site, for a mixed defence and private housing development.

Specifically, this rezoning request seeks to amend the land use zoning, maximum height of building control, and minimum lot size control for the subject site.

This Planning Proposal should be read in conjunction with the Urban Design and Landscape Report provided at Attachment B, prepared by Architectus and Spackman Mossop Michaels.

1.2 Defence Housing Australia

DHA was established as a Statutory Agency in 1988 and became a Government Business Enterprise in 1992 whose principal role is housing Defence members. DHA manages around 18,500 residences nationally, representing approximately $10 billion worth of housing stock.

DHA currently manages 1,200 dwellings in Newcastle providing housing for Defence Members posted to the Williamstown RAAF base. DHA has an ongoing requirement for additional housing in the Newcastle and Port Stephens area to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards.

DHA is currently seeking to provide more accommodation on sites that are:

- Within close proximity to the Williamtown RAAF base;
- Not affected by the airport ANEF contours or other unworkable site or environmental constraints; and
- Within close proximity to services and community infrastructure.

1.3 The Site

The site is legally known as Lot 5, DP233358. The Rifle Range Site is located to the north of the Stockton Centre and south of Worimi Lands, approximately 4km north of Stockton and 6km from Newcastle. The site is approximately 111 hectares in area.

Figure 3 The Subject Site
Source: Architectus

The site is part of the Stockton Peninsula, with the town centre of Stockton sitting on the headland located approximately 4km to the south. Stockton town centre is a small community of low and medium density residential, with a mix of uses that serves the day to day needs of residents such as newsagencies, hairdressers and grocers, as well as services such as hardware and real estate agents. The community enjoys amenity from green spaces around the water and the beach, which stretch north to the subject site and on to Port Stephens. Access to the Newcastle City Centre is available via ferry from Stockton, a trip of approximately ten minutes.

The site is located in the suburb of Fern Bay, which accommodates a number of small communities in distinct pockets of residential development separated by Nelson Bay Road, the Newcastle Golf Club, and Worimi lands. The site lies immediately to the east of the existing community of Fern Bay, comprising six streets of low-density residential development, some small scale retail including the Fern Bay Store, and social infrastructure including the Fern Bay Public School and Fern Bay Reserve. The Newcastle Golf Club and Worimi lands lie to the north, with the developments 'Bayway Village' (an over 50s community), 'The Cove Village' and 'Seaside' beyond.

The site forms part of a special uses area that sits between the two residential communities of Stockton and Fern Bay. These uses include the Stockton Cemetery and the Stockton Centre immediately adjoining the site to the south. Fort Wallace, a former defence site also currently owned by DHA, lies to the south of the Stockton Centre. A redundant Hunter Water wastewater treatment works and an oval separates Fort Wallace from the Stockton Town Centre. Some small pockets of private residential uses are interspersed.

Figure 4 Local Site Context (site outlined in red)
Source: Architectus

Figure 5 Local Site Context (site outlined in red)
Source: Architectus

Figure 6 View of Stockton Beach from the Site
Source: Architectus

1.4 History and Current Use of the Site

Consultation with Aboriginal stakeholders has concluded that the Stockton Peninsula, including the subject site, is considered to have very high Aboriginal cultural value to the Worimi people. A number of artefact scatterings in the form of shell middens and open campsites are located on the site that demonstrate the historical use of the site by the Aboriginal people.

From the early 1900s until 1940, rifle shooting in the area was undertaken at the Adamstown Rifle Range. In 1939-1940, construction of the Rifle Range at Fern Bay began in order to meet extra local demand from the Adamstown facility. The range was officially opened for use on 28 January 1941, although the government did not formally acquire the site until 1942.

An anti-aircraft battery, known as the Links Battery, was established on the site to the north of the classification range.

From 1953 the site was a training facility for all shooting in the region and was utilised by the police force, military, school cadets and civilian rifle clubs.

The site was no longer required by the military and was closed in December 1997. In 2015, DHA purchased the Rifle Range land holding from the Department of Defence ('Defence'). The site is currently vacant, non-operational and secured.

1.5 Land Use Zoning History

The subject site was zoned 7(a) Environmental Protection under the Port Stephens LEP 2000. The objective of the zone was to encourage the conservation and proper management of environmentally sensitive land. Development for the purposes of dwelling houses, dual occupancy housing, tourist facilities, recreation facilities, and clearing native vegetation were permissible with consent.

The Port Stephens LEP was revised in 2012 in accordance with the Standard Instrument LEP. The draft Port Stephens LEP 2012 showed the subject site as an E2 Environmental Conservation zone.

During exhibition of the draft LEP (on the 12th of December 2012), Defence, owners of the subject site at the time, made a submission that requested all Defence owned lands be zoned SP2 Infrastructure in accordance with the directions of the Standard Instrument. This reflects Defence land not being subject to planning instruments under NSW legislation and clearly distinguish the planning and management of the land. Relevant sites were mapped and listed in an attachment to the submission. The subject site was identified as one such piece of land (Lot 5 DP233358).

Council's response to the Department of Defence submission recommends *'amend[ing] Draft LEP to reflect all DoD lands as SP2 Infrastructure'* and notes that *'the request to rezone all DoD land has been complied with'*. A Planning Proposal recently implemented by Council has rezoned a number of Defence sites to the north of the subject site that were mistakenly zoned and has referenced Defence's submission and the intention of Council in its response.

However, when the Port Stephens LEP 2013 was gazetted, land zone mapping identified the subject site as E2 Environmental Conservation. The site is currently zoned E2 Environmental Conservation pursuant to the LEP 2013.

1.6 The Vision

The vision for the former Rifle Range site is for a sensitively designed residential community providing housing diversity, best practice design and the creation of new open space and connections, together with the preservation of European and Indigenous heritage and environmental assets for the wider community. The DHA team hopes to use this master planning process to explore opportunities to plan for new types of housing for DHA and exemplar open space and conservation projects.

Figure 7 Artist Illustration of the concept master plan
Source: David Wardman

1.7 Authorship

This report has been prepared by Rachael Nesbitt, Associate, Architectus, and has been reviewed by Jane Freeman, Principal, Urban Planner, Architectus.

2. Objectives and Intended Outcomes

2.1 Objectives of the Proposed Controls

This planning proposal seeks to amend the Port Stephens LEP 2013 to enable the redevelopment of the former Rifle Range site at Popplewell Road, Fern Bay, for a diversity of residential uses while maintaining the environmental values of the site.

2.2 The Master Plan

The indicative master plan for Rifle Range demonstrates a best practice outcome within the proposed LEP controls. The master plan responds to the site's natural and historic constraints, proposes a diverse mix of housing to accommodate a real community and includes high quality public open space and streets.

Figure 8 Indicative master plan and landscape context
Source: Architectus

The master plan respects the site's unique history and environmental character by reducing the development footprint to areas of the site with relatively few constraints.

Rather than covering the site with low density development, the master plan proposes more energy efficient, environmentally-sensitive and higher density development with a smaller development footprint. Significant vegetation communities and historic elements will be retained and opened to the public for their use and enjoyment.

The development will feel distinctly public, with access for all to streets, open space and the beach, as opposed to a gated or themed community.

2.3 Intended Outcomes

The intended outcomes of this proposal are to:

1. Maintain the areas of high ecological value to by retaining the northern part of the existing E2 Environmental Conservation zone;
2. Facilitate the sensitive renewal and ongoing management of a currently underutilised site in disturbed areas;
3. Deliver a diversity of housing through a mixture of densities and housing typologies on the site, including townhouses, single dwellings, and multi-dwelling housing; and
4. Open the site to the community through the delivery of public open space and landscaping;
5. Ensure orderly development and the clear delineation in the ownership and ongoing management of the site.

3. Explanation of Provisions

3.1 Amendments to Planning Provisions

This Planning Proposal seeks the following amendments to the Port Stephens LEP 2013:

- *Land Zoning Map – Sheet LZN_004A*, to show part of the subject site as R3 Medium Density Residential while retaining an E2 Environmental Conservation zoning on the remainder of the site;
- *Height of Buildings Map – Sheet HOB_004A*, to show part of the subject site as 9m and part 15m, being limited to areas zoned for residential development only; and
- *Lot Size Map – Sheet LSZ_004A*, to show the part of the subject site with a minimum lot size of 500sqm and part of the site with a minimum lot size of 200sqm, being limited to areas zoned for residential development only while retaining the existing AB3 40ha minimum lot size zoning on the remainder of the site.

It is intended that these legislative amendments would be supported by a site specific DCP, to be developed with the Planning Proposal with Port Stephens Council, the Fern Bay community, DHA and the NSW Department of Planning and Environment. The principles of this DCP have been set out in the following sections of this report.

3.2 Land Zoning

The site is currently zoned E2 Environmental Conservation under the Port Stephens LEP 2013. The objectives of the E2 Environmental Conservation zone are:

- *To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.*
- *To prevent development that could destroy, damage or otherwise have an adverse effect on those values.*

The following land uses are permitted without consent:

> *Bee keeping; Environmental protection works; Home occupations.*

The following land uses are permitted with consent:

> *Bed and breakfast accommodation; Building identification signs; Business identification signs; Dual occupancies; Dwelling houses; Eco-tourist facilities; Environmental facilities; Flood mitigation works; Home-based child care; Home businesses; Information and education facilities; Recreation areas; Research stations; Roads; Water recreation structures; Water supply systems.*

The following land uses are prohibited:

> *Business premises; Hotel or motel accommodation; Industries; Multi dwelling housing; Recreation facilities (major); Residential flat buildings; Restricted premises; Retail premises; Seniors housing; Service stations; Warehouse or distribution centres; Water treatment facilities; Any other development not specified in item 2 or 3.*

It is proposed that the land zoning for part of the site be amended to R3 Medium Density Residential. The objectives of the R3 Medium Density Residential zone are (Item 1):

- *To provide for the housing needs of the community within a medium density residential environment.*
- *To provide a variety of housing types within a medium density residential environment.*
- *To enable other land uses that provide facilities or services to meet the day to day needs of residents.*

The following land uses are permitted without consent (Item 2):

Home occupations.

The following land uses are permitted with consent (Item 3):

Attached dwellings; Bed and breakfast accommodation; Boarding houses; Building identification signs; Business identification signs; Centre-based child care facilities; Community facilities; Dual occupancies; Dwelling houses; Emergency services facilities; Environmental protection works; Exhibition homes; Exhibition villages; Flood mitigation works; Group homes; Home-based child care; Home businesses; Home industries; Hostels; Hotel or motel accommodation; Multi dwelling housing; Neighbourhood shops; Places of public worship; Recreation areas; Residential flat buildings; Respite day care centres; Roads; Secondary dwellings; Semi-detached dwellings; Serviced apartments; Seniors housing; Water reticulation systems

The following land uses are prohibited (Item 4):

Any development not specified in item 2 or 3.

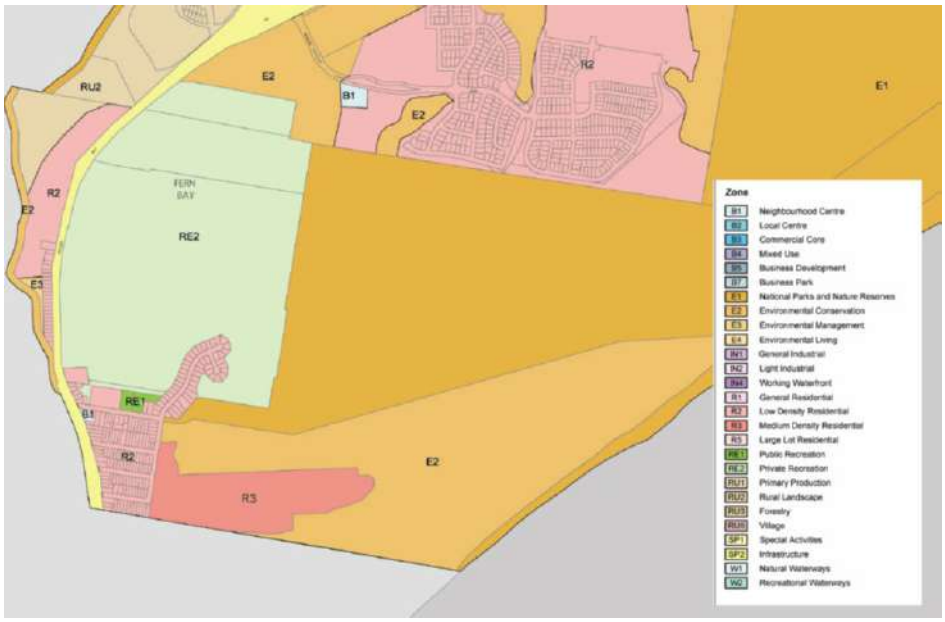


Figure 9 Proposed Land Use Zoning Map
Source: Architectus

Attachment B, the Urban Design and Landscape Report prepared by Architectus and Spackman Mossop Michaels, sets out an indicative master plan for the site that could be achieved through the rezoning. Architectural concepts for dwelling types that respond to the unique coastal environment have been developed. The relationship between these dwelling types and the Port Stephens Local Environmental Plan 2013 are summarised in the following table.

Table 1 Dwelling types and classifications

Dwelling type (Indicative Master Plan)	Port Stephens Local Environmental Plan 2013
Single eco-homes	Dwelling houses
Cluster homes	Multi-dwelling housing
Courtyard homes	Semi-detached dwellings
Townhouses	Attached dwellings
Dune Apartments	Residential flat building

The proposed land zoning change will facilitate the development of the land for a range of residential uses beyond those currently permitted under the E2 Environmental Conservation zoning, specifically multi-dwelling housing, semi-detached dwellings, attached dwellings and residential flat buildings. This is intended to facilitate capacity for dwelling diversity in accordance with Council's objectives and the needs of DHA for housing defence staff.

Direction 2.1 Environmental Protection Zones of the Section 117 Directions requires that a planning proposal must include provisions that facilitate the protection and conservation of environmentally sensitive areas, and that a planning proposal must not reduce the environmental protection standards that apply to land. A planning proposal may only be inconsistent with the Direction if:

> *'the relevant planning authority can satisfy the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) that the provisions of the planning proposal that are inconsistent are:*
>
> *[a]. justified by a strategy which:*
>
> *i. gives consideration to the objectives of this direction,*
>
> *ii. identifies the land which is the subject of the planning proposal (if the planning proposal relates to a particular site or sites), and*
>
> *iii. is approved by the Director-General of the Department of Planning, or*
>
> *(b) justified by a study prepared in support of the planning proposal which gives consideration to the objectives of this direction, or*
>
> *(c) in accordance with the relevant Regional Strategy or Sub-Regional Strategy prepared by the Department of Planning which gives consideration to the objective of this direction, or*
>
> *(d) is of minor significance.'*

The Ecological Assessment Report, prepared by Umwelt to inform the Planning Proposal, has given consideration to the objectives of the Direction and the objectives and requirements of the *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act), and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Consideration was given to the primary objectives for the land and the appropriate zoning to respond to the environmental sensitives of the coast and its ecology. In NSW, there are four environmental protection zoned use specifically for land where the primary focus is the conservation and / or management of environmental values. These zones are as follows:

- E1 National Parks and Nature Reserves. This zone is used for existing national parks, nature reserves and conservation areas, or new areas proposed for reservation that have been agreed with the NSW government.
- E2 Environmental Conversation. This zone is used for areas with high ecological, scientific, cultural or aesthetic values outside national parks and nature reserves.

- E3 Environmental Management. This zone is for land where there are special ecological, scientific, cultural or aesthetic attributes or environmental hazards / processes that require careful consideration and management.
- E4 Environmental Living. This zone is for land with special environmental or scenic values, and accommodates low impact residential development. Under the Port Stephens LEP 2013, this zone permits dual occupancies, dwelling houses, and roads with consent.

A detailed ecological assessment of the site's flora and fauna has been undertaken by Umwelt to determine the ecological significance and value of the site (full report provided in Attachment H). The assessment has concluded that, while parts of the site are ecologically significant, a significant proportion is of low value and is suitable for residential development.

The site is structured by the former rifle range use, specifically the main shooting straight and the 100 yard markers. The use of the site for shooting practice has degraded the vegetation. Areas outside of the main structure were rarely used and are significantly more intact than the main range.

Importantly, the former rifle range and proposed development area is to the south-west of the site, adjoining sites that are already developed including the Fern Bay community, Stockton Centre and the cemetery site. The highest value ecological parts of the site adjoin the Worimi lands to the north. The proposed zoning ensures that high value ecological communities are not isolated within the site. The objectives of this proposed zoning are:

1. To preserve the high-quality parts of the site adjoining the Wormi lands, avoiding the isolation of vegetation communities;
2. To maximise the development potential of a site significantly located in proximity to social and physical services and the Williamtown base; and
3. To facilitate better outcomes for the site as a whole by enabling sensitive development that will ensure the ongoing management of the site.

3.3 Height of Buildings

The site is not affected by a maximum height of buildings control under the current LEP 2013. In order to control the development capacity on this sensitive site, and manage potential for visual impact from surrounding areas, a maximum height of buildings of 9m is proposed to be applied to the majority of the site. A maximum height of buildings of 15m is also proposed to central elements of the site to facilitate a variety of dwelling types, including residential flat buildings.

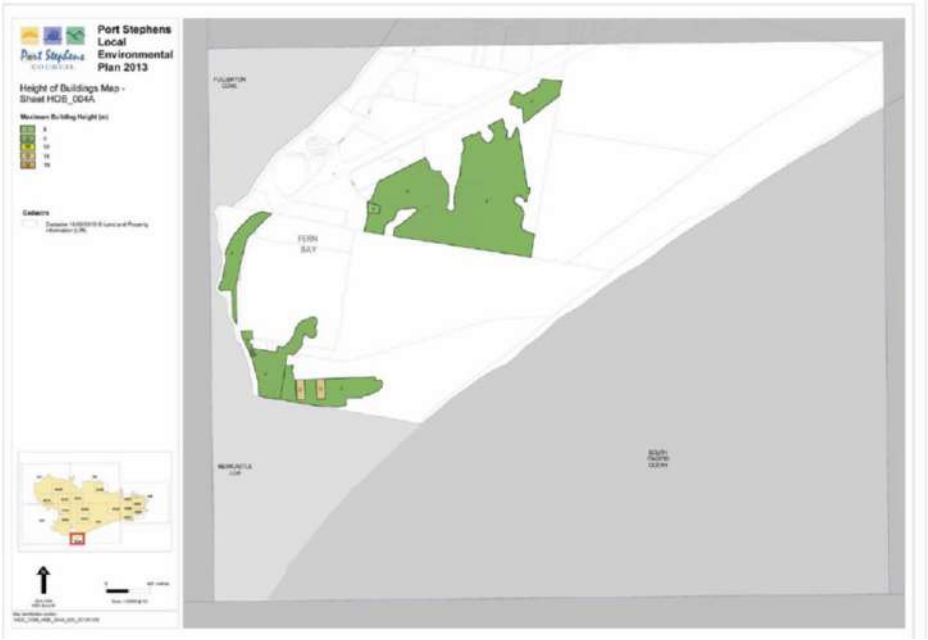


Figure 10 Proposed Height of Buildings Map
Source: Architectus

Clause 4.3 Height of buildings of the Port Stephens LEP 2013 controls the maximum height of buildings on land to which it applies. The objectives of this clause are as follows:

> *'(a) to ensure the height of buildings is appropriate for the context and character of the area,*
>
> *(b) to ensure building heights reflect the hierarchy of centres and land use structure.'*

The proposed maximum height of buildings control is consistent with the maximum height of buildings control applied to the adjoining residential area to the west of the site and will maintain a consistent approach to height in the area.

3.4 Lot Size

The site is currently affected by a minimum lot size of AB3, which restricts any lot to a minimum of 40 hectares in area.

Where the site is proposed to be zoned R3 Medium Density Residential, it is proposed that the minimum lot size requirement be reduced to facilitate lots of 500sqm, with a small portion of lots of 200sqm.

It is noted that Clause 4.1C of the Port Stephens LEP 2013 currently allows for development consent to be granted to the subdivision and development of attached dwellings, dwelling houses or semi-detached dwellings on land in the R3 Medium Density Residential zone to a minimum of 200sqm for the erection of an attached dwelling. Due to the testing undertaken and site specific DCP, it is proposed that the base minimum lot size facilitate 200sqm lots, rather than relying on Clause 4.1C.

Figure 11 Proposed Lot Size Map
Source: Architectus

The current 40-hectare minimum lot size is consistent with the E2 Environmental Conservation zoning for the site and the past vision for the sites use. Currently, the lot is approximately 111 hectares in size. Under the current minimum lot subdivision controls, the site would only be able to be subdivided into two lots (including strata subdivision and community title), providing two dwellings.

The proposed minimum lot size applicable to the part of the site that is proposed to retain an E2 Environmental Conservation zoning is 2 hectares. This would facilitate large lot single dwelling houses, ensuring the ongoing maintenance of the land in private ownership.

4. Justification and Process

4.1 Planning Process

Methodology

This Planning Proposal is supported by a suite of specialist assessments of the site that have informed consideration of the site's potential for redevelopment, including coastal engineering, ecology, heritage, landscape, transport, stormwater, bushfire and servicing assessments.

These assessments have been used as the basis of master plan options and the development of a recommended master plan, which has subsequently informed proposed revised planning controls for the site with respect to land use and height of buildings.

The concept master plan has been used as a demonstration of how the site could appropriately accommodate residential uses in response to best practice urban design and planning principles.

A rezoning process is considered to be the most appropriate process to achieve the objectives for the site and orderly planning. The intended planning framework would be as follows:

- An amended LEP, controlling the permissible land uses and height of buildings on the site;
- A site specific DCP, providing guidance on the development of the site to ensure that it is sensitively managed; and
- A voluntary planning agreement.

As set out in this report, the Port Stephens LEP 2013 would be amended to include changed land use and height of buildings controls for the site.

It is intended that the Planning Proposal be accompanied by a site-specific Development Control Plan (DCP) that sets out the key objectives for the development of the site and urban design and planning guidelines to achieve these objectives in order to provide more certainty around built form outcomes, ensure sensitive parts of the site are adequately managed, and complement zoning controls. The DCP is expected to be set out as follows:

a) Objectives;

b) Site history;

c) A vision for the Rifle Range;

d) Urban structure; and

e) Site planning and built form.

The aims of the DCP are to:

a) Provide appropriate development control principles for the development of the site;

b) Guide the delivery of a diversity of housing on the site to serve the needs of the community;

Ensure that development of the site is sensitive to the heritage and ecological significance of the site.

4.2 Need for the Planning Proposal

The need for the Planning Proposal is discussed in detail below.

4.3 Is the planning proposal a result of an endorsed local strategic planning statement, strategic study or report?

The proposed rezoning achieves the goals of the Hunter Regional Plan 2036, released in November 2016, including supporting the leading regional economy in Australia, a biodiversity-rich natural environment, thriving communities and greater housing choice and jobs. The Hunter Regional Plan seeks to deliver more housing and better housing choice in well serviced areas with high amenity, supporting the renewal of the strategically placed site. The directions of the Hunter Regional Plan are discussed in further detail in the next section.

The Port Stephens Planning Strategy 2011 applies to the site. Areas identified as Fern Bay - Fullerton Cove, to the north and west of the Rifle Range, have been identified as future growth areas within the Strategy. This area, including the subject sites, comprise the Eastern Growth Corridor identified within strategic planning for Port Stephens. The area has been recommended to increase in density over the next 15-20 years since the Strategy's release, with potential for:

- 42 infill residential dwellings; and
- 1,396 dwellings within green field residential zoned land.

The Strategy also recommends the opportunity to maximise access to existing infrastructure through density increases. As the suburb (of Stockton or Fern Bay) is among the LGA's small centres with no available commercial floorspace, the need for commercial rezoning has also been identified. The Strategy predicts a need for an indicative 14,441 additional dwellings throughout the LGA, including infill and within rural areas.

This Planning Proposal has been prepared to provide greater certainty and clarity on future development on the Rifle Range site, and to continue to implement the aims of the Port Stephens LEP 2013. The need for the planning proposal has resulted from consideration of specialist assessments prepared to assess the site's potential to deliver housing for defence members, including the following reports:

- Urban Design and Landscape Report, Architectus and Spackman Mossop Michaels, November 2018, Attachment B;
- Transport Study Report, Better Transport Futures, October 2018, Attachment C;
- Rifle Range Bushfire Assessment, Klienfielder, May 2018, Attachment D;
- Stormwater Management Plan, ADW Johnson, June 2018, Attachment E;
- DHA Stockton Rifle Range Stockton Beach Coastal Engineering Assessment, BMT WBM, December 2016, Attachment F;
- Rifle Range Defence Housing Project, Ecological Assessment Report, Umwelt, May 2018, Attachment H;
- Heritage Impact Statement, Stockton Rifle Range, Urbis, December 2018, Attachment I;
- Aboriginal Cultural Heritage and Archaeological Assessment Report, Umwelt, Attachment J;
- Rifle Range Servicing Report, ADW Johnson, June 2018, Attachment K;
- Consultation Report, Elton, December 2016, Attachment L; and
- Site Environmental Management Plan, SMEC, Attachment M.

The site comprises a significant land area of approximately 111ha. While the E2 Environmental Conservation zoning recognises the ecological significance of parts of the site, detailed investigation of the site has demonstrated that some areas are appropriate for more significant residential development. Such development would respond to the sites sensitivities while maximising its potential to deliver housing in close proximity to existing services, amenities and infrastructure such as the Williamtown RAAF base.

The Planning Proposal responds to the site opportunities and constraints identified in the technical specialist reports, and seeks to enable the recommended development scenario. Each report is discussed in detail in relevant sections of this report.

4.4 Is the Planning Proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

There is potential under the site's current land use zoning to develop the site for a range of uses with consent including residential, limited to bed and breakfast accommodation, dual occupancies, dwelling houses, and eco-tourist facilities. Under the E2 Environmental Conservation zoning, the site is considered appropriate for some residential uses so long as they meet the objectives of protecting areas of high ecological, scientific, cultural or aesthetic values. Semi-detached dwellings and multi-dwelling housing are among the uses not permitted under the current zoning, which this planning proposal seeks to allow.

The current minimum lot size of 40ha would allow for a maximum of 2 lots on the approximately 111ha site. Under Clauses 4.1AA Minimum subdivision lot size for community title schemes and 4.1A Minimum subdivision lot size for strata plan schemes in certain rural, residential and environment protection zones of the Port Stephens LEP 2013, the 40ha minimum lot size would be applicable to community title schemes and strata plan schemes while the site was zoned E2 Environmental Conservation.

Accordingly, the maximum residential development of the site under the current zoning would be two dwellings. It is considered that this does not achieve the best use of the site considering the low ecological value of the disturbed range area, the strategic location of the site, and the financial realities of maintaining the parts of the site with high ecological value.

There is no maximum height of buildings control applicable to the site. It is considered that a maximum height of buildings control would be appropriately applied to the site in conjunction with an amended land use and lot size zoning to control potential visual impacts and scale of development.

A Planning Proposal to amend the land use zoning, ensuring that it responds appropriately to the different parts of the large site, the minimum lot size and maximum height of buildings is considered to be the best way to achieve the objectives for the site.

4.5 Relationship to Strategic Planning Framework

The relationship of the Planning Proposal to the Strategic Planning Framework is discussed in detail below.

4.6 Will the planning proposal give effect to the objectives and actions of the applicable regional, or district plan or strategy (including any exhibited draft plans or strategies)?

This section provides a summary of the strategic planning framework within which the Planning Proposal outcomes for the site have been considered. It should be noted that only those relevant to the subject site have been identified below.

Hunter Regional Plan 2036

Overall, the growth strategy in the Hunter Regional Plan supports the renewal of the site to deliver a diversity of housing, serving the housing needs of the local population and supporting the defence base while making the most efficient use of existing social and physical infrastructure.

The Planning Proposal would achieve the goals of the Hunter Regional Plan 2036 by:

1. Supporting strategically important local employment through a relationship with DHA and the Williamtown RAAF base, and contributing to the Hunter region being the leading regional economy in Australia;
2. Protecting a biodiversity-rich natural environment by increasing the sustainability of funding sources for site management and introducing a zoning which would protect the ecological value of the site;
3. Increasing the diversity and sustainability of the local community by increasing the population and accommodating a broad range of age groups, supporting local retail and services such as the local school at Fern Bay; and
4. Allowing the renewal of the site with controls that facilitate a diverse range of housing typologies, supporting greater housing choice in the region.

However, there are several mapping inconsistencies in the Regional Plan with relation to the site, which create difficulties in interpreting the strategic direction particularly when considering the DPE's position on residential and employment uses on the site as part of a strategy for the region. Specifically, the Hunter Regional Plan includes seven maps showing conflicting/inconsistent information for the Stockton area, as follows:

1. Figure 3: Hunter 2036, showing the overall strategy for the Hunter region including growth areas, transport corridors, and biodiversity corridors. The Rifle Range site is shown as part of the Indicative Greater Newcastle Metropolitan Area. Part of the site appears to be considered residential and employment land.

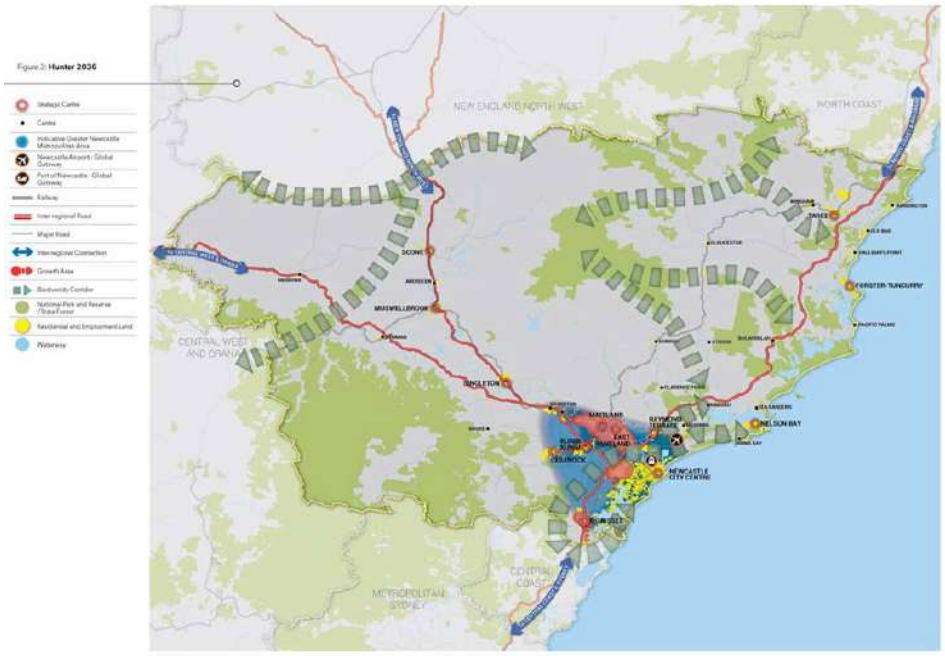


Figure 12 Extract of Figure 3 of the Hunter Regional Plan 2036
Source: Hunter Regional Plan 2036

2. Figure 4: Greater Newcastle 2036, showing the overall strategy for the Greater Newcastle region. The Rifle Range site is shown as part of the Indicative Greater Newcastle Metropolitan Area and is not identified as a national park and reserve or state forest.

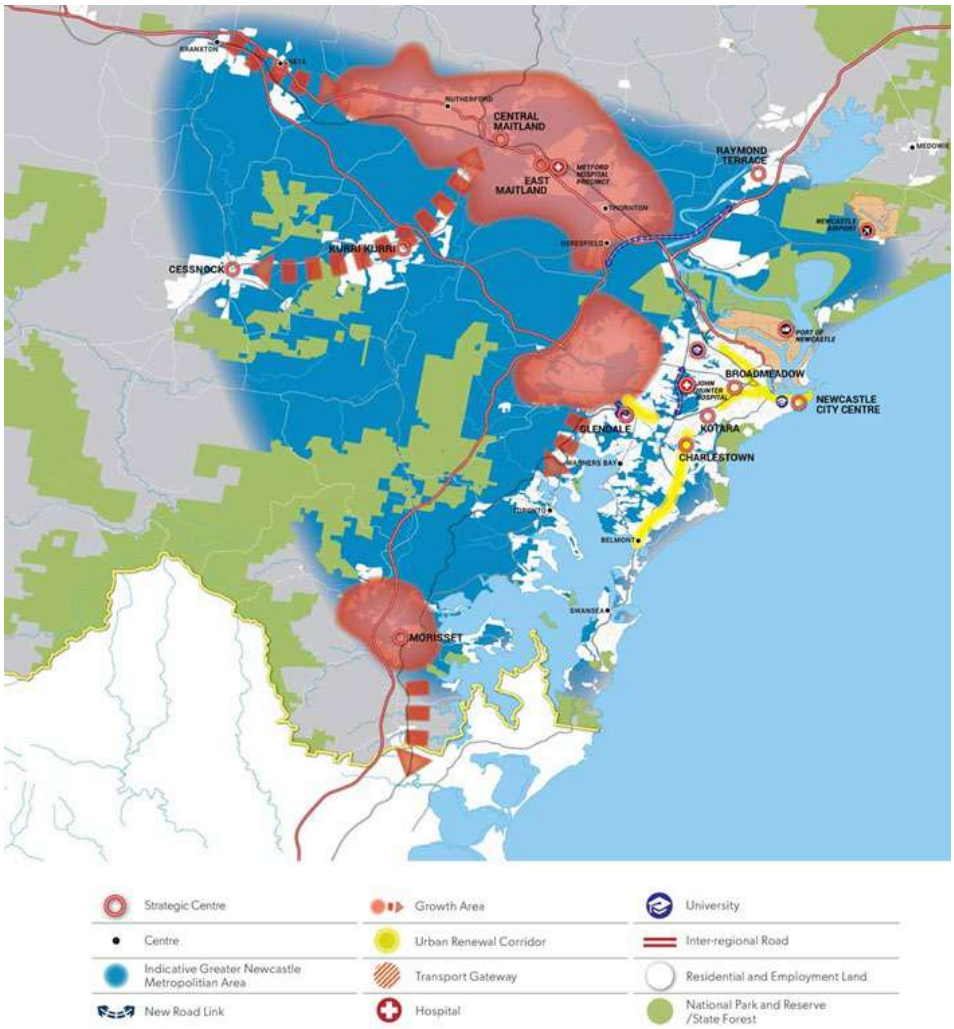


Figure 13 Extract of Figure 4 of the Hunter Regional Plan 2036
Source: Hunter Regional Plan 2036

3. Figure 5: Greater Newcastle Strategic Centre Connectivity, showing the intended transport connectivity improvements. It is shown that the Rifle Range site is in the path identified to be strengthened, which runs from Newcastle City Centre north to the airport.

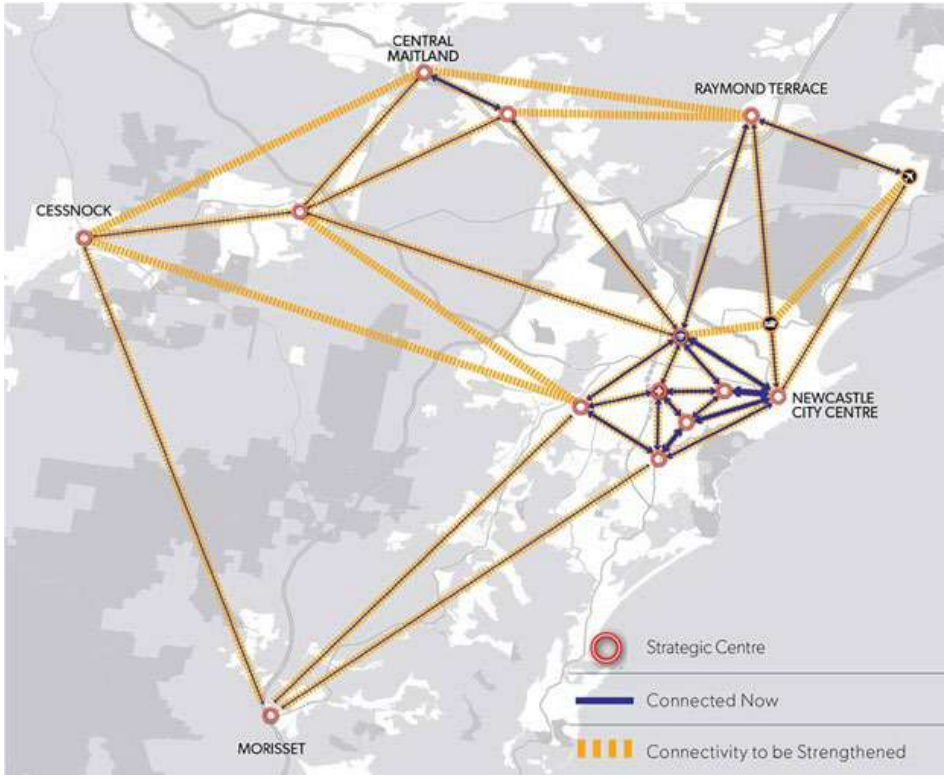


Figure 14 Extract of Figure 5 of the Hunter Regional Plan 2036
Source: Hunter Regional Plan 2036

4. Figure 9: Coal Mining and Renewable Energy, showing the locations of existing energy centres and potential areas to collect solar energy. The Rifle Range site is indistinguishable as the water is not shown.

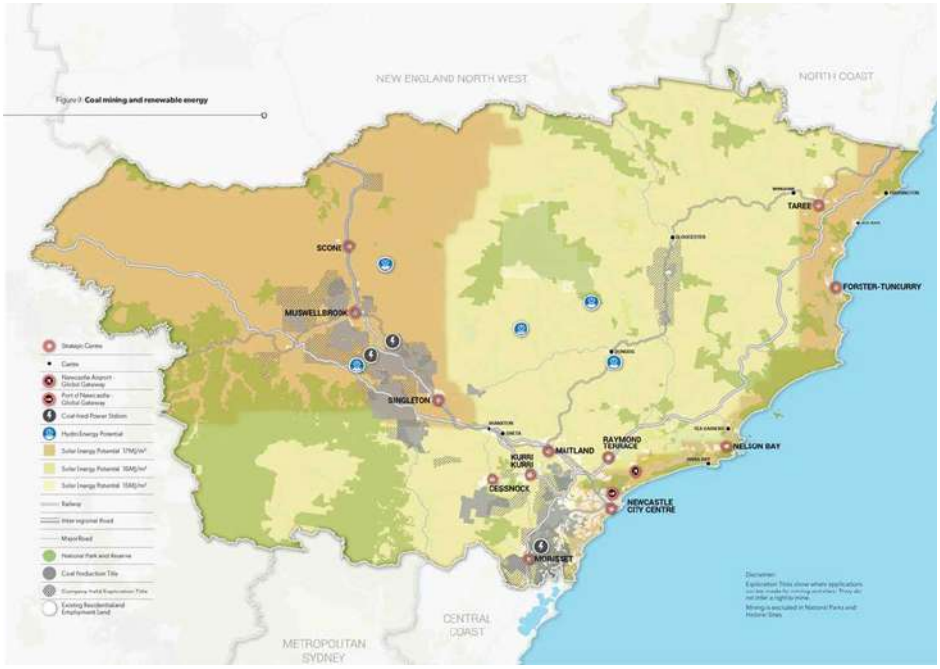


Figure 15 Extract of Figure 9 of the Hunter Regional Plan 2036
Source: Hunter Regional Plan 2036

5. Figure 10: Proposed Biodiversity Corridors, showing the proposed biodiversity corridors. The direction for the Rifle Range site is not clearly specified.

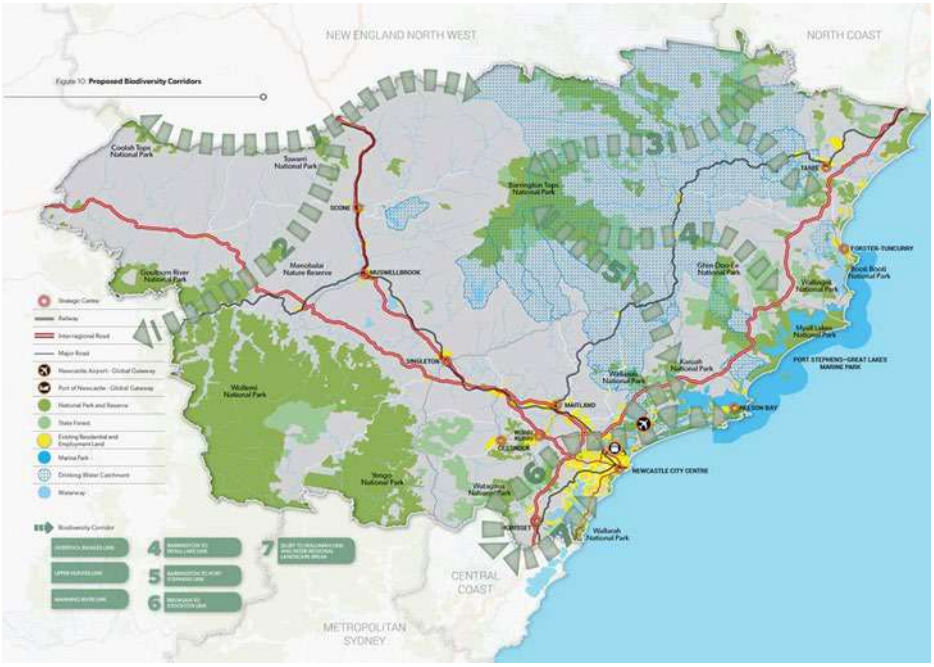


Figure 16 Extract of Figure 10 of the Hunter Regional Plan 2036
Source: Hunter Regional Plan 2036

6. Figure 11: Greater Newcastle Settlement Pattern, showing the intended urban release and settlement areas. The direction for the Rifle Range site is unspecified.

Figure 17 Extract of Figure 11 of the Hunter Regional Plan 2036
Source: Hunter Regional Plan 2036

7. Figure 14: Inner Newcastle, showing the settlement pattern in Newcastle. The Rifle Range site appears to be identified as open space.

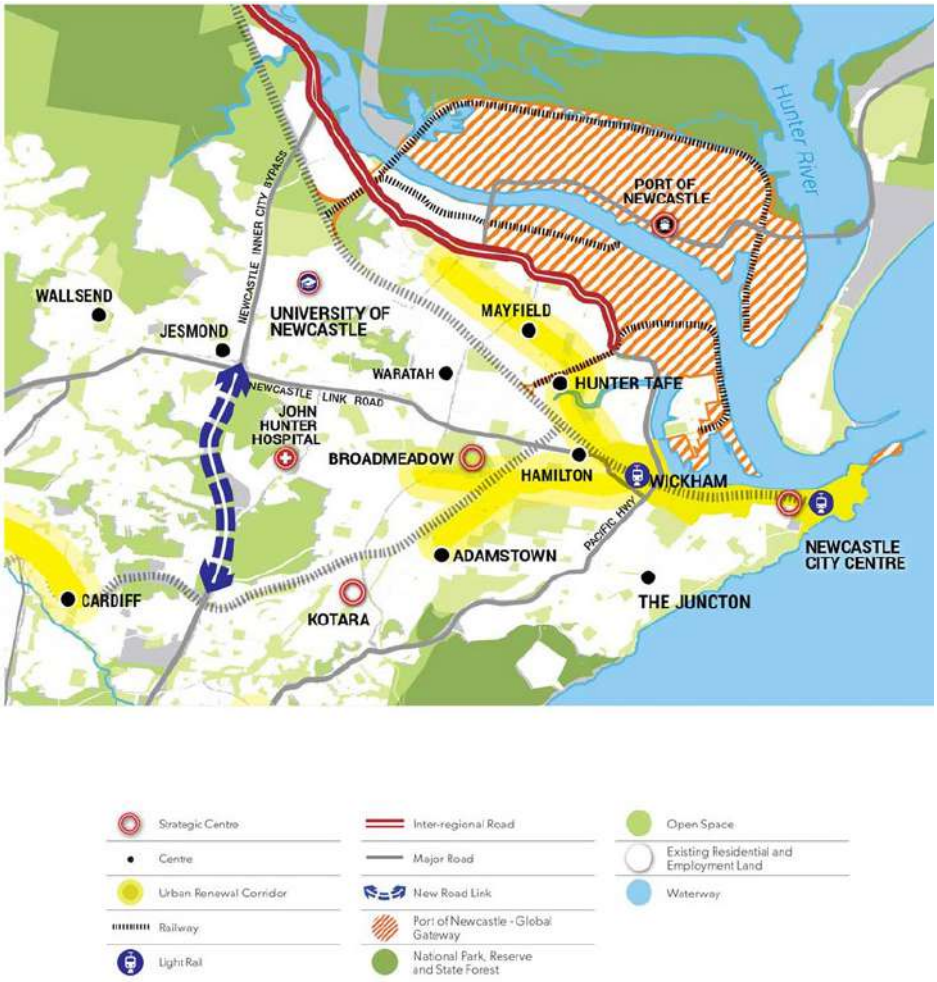


Figure 18 Extract of Figure 14 of the Hunter Regional Plan 2036
Source: Hunter Regional Plan 2036

Preliminary consultation with the DPE indicates that the mapping was based on existing zoning and is intended to provide a high-level strategic framework and does not provide direction in relation to particular sites. The DPE advised that the Regional Plan will be supported by local planning in order to provide direction on a site-specific basis. There is nothing in the plan, in the view of Architectus, which would preclude the merit assessment of a planning proposal to rezone the site for residential uses.

It is understood that the DPE, in briefing councils on the Regional Plan, has indicated that planning proposals should be assessed with particular consideration of Directions 20 – 24. The Planning Proposal would contribute to achieving the objectives of the plan as summarised below.

Table 2 Response to Hunter Regional Plan 2036 Directions

Direction	Consistent	Comment
Direction 20: Revitalise existing communities. This direction relates to the concentration of development in existing areas to revitalise communities and focus social and physical infrastructure.	Yes	The Rifle Range site lies adjacent the Fern Bay Town Centre and in close proximity to the Stockton Town Centre, both of which provide a range of social and physical infrastructure which would efficiently service the residential development of the Rifle Range site. Key infrastructure includes the Fern Bay public school and the ferry between Stockton and Newcastle CBD. Newcastle CBD, approximately 4km south of the site, also offers amenity and regional infrastructure and services. The proposal would accommodate growth in population to support local shops, schools, and services in Fern Bay and Stockton.
Direction 21: Create a compact settlement. This direction seeks to focus development in locations with established services and infrastructure. One identified action is for Councils to identify opportunities for urban redevelopment or renewal in urban locations with access to public transport and services in the Greater Newcastle metropolitan area and where there may no longer be a need for employment land.	Yes	The renewal of the Rifle Range site for residential uses would support an alignment of infrastructure delivery in the area by permitting residential uses on a well-located site in close proximity to both the Fern Bay and Stockton communities. It is important also for DHA to provide housing for defence members in close proximity to the Williamtown Base. When compared to other sites in the 30km radius of the Williamtown Base, the subject site is very well serviced and the most appropriate location for additional housing in the Port Stephens LGA. While the master plan achieves a range of dwelling types, it is not considered to be a high-density development. The number of dwellings delivered for the site area could be achieved with a traditional subdivision model, which would be unlikely to achieve dwelling diversity. A key principle of the master plan has been to appropriately balance the environmental values of the site with the delivery of housing. By reducing the footprint of development and increasing the height, the master plan has minimised impact on sensitive areas of the site and achieved a range of dwelling types.
Direction 22: Promote housing diversity. This direction relates to the need to provide diverse housing to accommodate the diverse needs of the community, including housing for older people, adaptable housing, and social and affordable housing. A key action is to respond to the demand for housing for resource industry personnel, and encourage housing diversity, including studios and one and two bedroom dwellings.	Yes	Housing diversity is a key objective of the master plan for the site, which has informed the planning proposal. The R3 Medium Density Residential zoning in the Port Stephens LEP permits a broad range of housing to be delivered on the site. It is intended that housing diversity in accordance with the master plan and residential typologies developed in the Urban Design and Landscape Report (**Attachment B**) would be promoted as an objective for the site in the site-specific DCP. In addition, the delivery of housing for defence personnel would support

		social diversity and affordability for these key workers in the region. The residential typologies that would be accommodated on site would allow for a diverse community, including defence members with families and single defence members. The indicative master plan accommodates a broad range of dwelling types such as freestanding houses, semi-detached terrace dwellings with private open spaces that could support single people and smaller families, as well as multi-dwelling cluster housing and small scale residential apartment buildings that encourage flexibility and households at all stages of life. This is a good social outcome compared to the typical options for housing around the base and in the local area. The DHA model also seeks to provide 50% defence housing on the site and 50% of housing available for private sale to members of the public. This again encourages a diverse community.
Direction 23: Grow centres and renewal corridors. Concentration of development in strategic centres, urban renewal corridors and locally significant centres.	Yes	Fern Bay is identified as a locally significant centre under the Hunter Regional Plan 2036. The proposal would contribute to the Fern Bay centre by opening the site to the community including access to the coast, a diverse and cohesive community to support local retail and services, and through the interpretation of the heritage elements of the site. The proposal would also accommodate growth in population to support local shops, schools, and services in Stockton.
Direction 24: Protect the economic functions of employment land. This direction encourages the promotion and protection of industry through land use and infrastructure planning.	Yes	The proposed rezoning would support the function of the nearby Williamtown RAAF base and the sustainability of the Defence force in the region by delivering housing stock for Defence personnel and contributing to financial outcomes for DHA. The site has not been required by Defence for defence purposes in some time and the use of the site in its current situation does not contribute to employment in the region. The site and proposed concept plan is sufficiently separated from nearby employment so as not to have an impact on the viability of existing industrial areas.

The Hunter Regional Plan 2036 also includes Local Government Narratives which are intended to guide councils in investigation and implementation of the plan in order to achieve outcomes on the ground. The alignment of the planning proposal with key priorities of relevance to the Rifle Range site are discussed below.

Table 3 Response to Hunter Regional Plan 2036 Local Priorities

Local Priority	Consistent	Comment
Provide a buffer to the Port of Newcastle operations through appropriate zoning to safeguard its future.	Yes	The Port of Newcastle is an increasingly important global gateway to the region. The Planning Proposal would not impact the sustainability of the Port of Newcastle in its continued operations. The site is located in an existing residential and special use area and is considered suitable for residential uses. Land buffers to the Port of Newcastle are appropriately zoned (IN1 and IN2). The subject site is not within the identified buffer zone.
Provide small-scale renewal and redevelopment of larger sites for infill housing.	Yes	The Planning Proposal would enable renewal of a currently underutilised site in a key location, with strong links to Newcastle and the airport, and provide increased, diverse housing to meet the needs of the community.

The Planning Proposal is considered to align with the Hunter Regional Plan 2036.

Greater Newcastle Metropolitan Plan 2036

The Hunter Regional Plan 2036 is supported by the Greater Newcastle Metropolitan Plan 2036. Released in September 2018, the plan is the first ever for Greater Newcastle. The Plan sets out strategies and actions that will drive sustainable growth, delivering on the vision established in the Regional Plan.

Overall, the Plan seeks to drive better planned and designed housing and infrastructure by primarily encouraging infill development to maximise the benefits of investment; support connections between homes and jobs; improve the mix of dwellings in the region; and improve amenity and environmental outcomes of development.

The Planning Proposal seeks to deliver well designed homes with a mix of densities through a concept design that carefully balances development and the surrounding environment. The Planning Proposal would enable Defence staff and their families to live close to their jobs, supporting the growth of the Williamtown base – a key area of jobs growth in the region. The Planning Proposal is located near existing residential areas, linking to existing public transport connections and infrastructure.

Specifically, the Planning Proposal supports the following strategies:

- *Strategy 2: Grow the airport and aerospace and defence precinct at Williamtown.*

  The base at Williamtown is a core strategy to achieve *Outcome 1: Create a workforce skilled and ready for the new economy*. Newcastle Airport is one of the largest combined defence and civilian aerodromes in Australia, with major upgrades planned to accommodate new Joint Strike Fighters posed to create a cluster of economic activity and new jobs. The Planning Proposal is directly related to the needs of Defence to deliver additional housing to accommodate growth and adequately support the needs of existing workers and their families at the Williamtown base. The

Planning Proposal will deliver high amenity housing for defence members and their families in close proximity to the base, without increasing housing in areas impacted by the ANEF contours.

- *Strategy 10: Create better buildings and great places.*

  The Planning Proposal will preserve the heritage value of the site, including the anti-aircraft battery. The concept plan that supports the Planning Proposal retains the layout of the firing range through the street network, and enshrines good urban design and placemaking principles through a sensitive approach to the site ecology, creation of new public spaces, and innovative built form concepts that would sit lightly on the land.

- Outcome 3: Deliver housing close to jobs and services

  The Planning proposal will deliver housing for Defence staff close to the Williamtown base, seeking to reduce travel time to the base and deliver high amenity housing for Defence members and their families.

  The Planning Proposal would locate additional housing in the Fern Bay centre, within walking distance of Fern Bay Public School, Community Hall, Fern Bay Reserve, Fern Bay store, and golf course. While not a major centre or transport node, the Planning Proposal does achieve housing in walking distance of key land uses and public transport. Nelson Bay Road is used as a bus route for regular and for school services. Buses serve Stockton and Fern Bay, and complete a loop via Vardon Road Popplewell Road and Rankin Rod to access Nelson Bay Road for the return journey to Newcastle.

  The Planning proposal seeks controls for the site that will enable a range of dwelling types, with a mix of densities, to be delivered.

- *Port Stephens Local Government Area Narrative*

  One aspect of the Port Stephens Local Government Area Narrative is for Port Stephens Council and Newcastle City Council to coordinate housing and infrastructure development between Stockton and Fern Bay, maximizing housing opportunities while protecting transport connections between the Newcastle Airport and Newcastle Port.

  The Planning Proposal directly supports this narrative by locating housing that supports the broader strategy for Greater Newcastle between Stockton and Fern Bay. Housing in this location for Defence staff would support transport connections between Newcastle Airport and Fern Bay.

4.7 Assessment Criteria

Does the proposal have strategic merit?

For the reasons provided below, this Planning Proposal, as supported by the Urban Design Report and Master Plan at **Attachment B**, holds strategic merit and should be supported by Council.

Will the proposal give effect to the relevant regional plan outside of the Greater Sydney Region, the relevant district plan within the Greater Sydney Region, or corridor/precinct plans applying to the site, including any draft regional, district or corridor/precinct plans released for public comment?

As detailed at Section 4.3 of this report, the Planning Proposal will give effect to the Hunter Regional Plan 2036 and the Greater Newcastle Metropolitan Plan 2036.

Will the proposal give effect to a relevant local strategic planning statement or strategy that has been endorsed by the Department or required as part of a regional or district plan or local strategic planning statement?

Yes. As detailed at Section 4.5 of this report, the Planning Proposal will give effect to the Port Stephens Planning Strategy 2011. The primary purpose of the PSPS is to guide land use planning and decision making for development and environmental outcomes.

Is the proposal responding to a change in circumstances, such as the investment in new infrastructure or changing demographic trends that have not been recognised by existing strategic plans?

The Planning Proposal is responding to a change in circumstances that have not been recognised by existing strategic plans. This Planning Proposal seeks to amend the zoning and density controls that apply to the site to provide for important housing for members of the Defence Force and their families.

There is an ongoing and increasing need to provide accommodation on sites that are:

- Within close proximity to the Williamtown RAAF base;
- Not affected by the airport ANEF contours or other unworkable site or environmental constraints; and
- Within close proximity to services and community infrastructure.

The subject site enables the provision of such development, maximising the delivery of a diversity of dwellings whilst protecting areas of high environmental significance and responding to the site's constraints. The delivery of housing for defence members and their families will also support the function of the Williamtown RAAF base, identified as a key economic driver in the region.

The Planning Proposal will provide essential housing for DHA through delivery of a range of dwelling types and will additionally allow for private housing to be developed, which will subsidise the delivery of housing for Defence staff and their families. The Planning Proposal will also provide for a range of key workers to be accommodated in the area close to their employment, with excellent amenity.

Does the proposal have site-specific merit, having regard to the following?

For the reasons provided below, this Planning Proposal, as supported by the Urban Design Report and Master Plan at **Attachment B**, holds site specific merit and should be supported by Council.

The natural environment (including known significant environmental values, resources or hazards)?

The site is subject to a number of environmental constraints, including coastal erosion, bushfire hazards and a threatened ecological community.

A range of technical assessments have been undertaken to ensure that potential impacts of the rezoning are acceptable, including a Bushfire Assessment (**Attachment D**), Coastal Engineering Assessment (**Attachment E**), Ecological Assessment Report (**Attachment H**) and the preparation of a Site Environmental Management Plan (**Attachment M**).

Overall, these technical assessments conclude that the Planning Proposal is not likely to result in development that will create any significant adverse environmental effects. Please refer to a detailed discussion of environmental matters at Section 4.8 of this report.

The existing uses, approved uses, and likely future uses of land in the vicinity of the proposal?

This Planning Proposal seeks the redevelopment of a long term vacant, previously under long term military control, and where no similar opportunities exist to surrounding sites or within the locality. As noted within this report, there is a strong and timely need for redevelopment of the site, which holds site-specific merit to accommodate the zoning and density amendments sought by this Planning Proposal.

Development to the north through east of the site consists of remnant bushland. Land to the south has also been identified for future development (Stockton Centre), however is both located within the adjoining Newcastle LGA and it is considered that development of this land is unlikely in the short to medium term.

On this basis, there is no likely future development that would affect the amendments sought by this Planning Proposal, nor would the proposal affect nor preclude the development capability of surrounding sites. Conversely, the proposed development is considered to result in a high-quality outcome for the site providing essential housing to meet the immediate needs of DHA and to serve the needs of people who live in, work in and visit the local area, without unreasonable environmental, economic or social impact. The Planning Proposal is therefore considered to have site specific merit.

The services and infrastructure that are or will be available to meet the demands arising from the proposal and any proposed financial arrangements for infrastructure provision?

As detailed within the Servicing Report prepared by ADW Johnson at Attachment K, there is adequate services infrastructure (water, sewer, gas, stormwater infrastructure and telecommunications infrastructure) to support the Planning Proposal.

As detailed within the Transport Study Report at Attachment C, the site is well located and seeks to utilise existing public transport infrastructure and road connections to the site. The external road network is more than capable of absorbing forecast traffic flows and trip generation, whilst remaining at a very good operational level of service.

The site is well located to areas of open space along the Stockton Peninsula as well as areas of open space and bushland associated with the Worimi Regional Park (controlled by NSW NPWS) to the north of the site. Importantly, the proposed master plan will deliver additional areas or open space and recreation within the site, to serve future residents and the surrounding community.

As detailed within the accompanying Social Impact Assessment (Attachment N), the site is also located within proximity to essential emergency services, including a fire station and police station, in Stockton Town Centre, and also benefits from local services such as the Fern Bay Store and Primary School. Refer to a further discussion of social and economic impacts of the Planning Proposal at Section 4.8 of this report.

4.8 Will the planning proposal give effect to a council's endorsed local strategic planning statement, or another endorsed local strategy or strategic plan?

Port Stephens Planning Strategy

The Port Stephens Planning Strategy (PSPS) was adopted by Council on 20 December 2011. The primary purpose of the PSPS is to guide land use planning and decision making for development and environmental outcomes.

The PSPS is a comprehensive document that identifies key trends and risks for future growth and development in the LGA. The strategy supports residential development primarily in existing centres to accommodate future demand for housing fuelled by broader population trends. Increased density in existing centres is intended to make the most effective use of infrastructure and promote the feasibility of increasing services, including retail and commercial uses.

Fern Bay is identified as one of the smaller village centres in the LGA, acting as urban support along with the centres of Kings Hill, Medowie, Anna Bay, Tanilba Bay and Karuah to the regional centre of Raymond Terrace. Fern Bay is also identified as part of the Eastern Growth Corridor that stretches from Medowie in the north to Fern Bay in the south.

The declining supply of land with urban potential in the LGA is a key challenge identified for future growth and development, responding to the risks of sea level rise and coastal erosion, flooding, bushfire and aircraft noise that affect large portions of the LGA. The loss of sites with urban potential to rural residential development, and subsequently underutilised well-serviced and located sites, is acknowledged. The PSPS seeks to ensure that land with urban potential is identified and maximised while responding appropriately to its context.

This planning proposal achieves the objectives of the PSPS by considering the subject site in detail to identify areas of development potential and maximising the delivery of a diversity of dwellings while protecting areas of high environmental significance and responding to the site's constraints. The delivery of housing for defence members and their families will also support the function of the Williamtown RAAF base, identified as a key economic driver in the region.

Part 6.4.3 of the PSPS sets out principles to guide the location of medium density housing areas in the LGA. These have been addressed below to demonstrate how the planning proposal achieves the key objectives for residential development.

1. *Residential densities should be highest near the centre and lowest at the outer edge of the urban area.*

The planning proposal seeks to impose a height and minimum lot size control that generally corresponds with the adjoining Fern Bay residential area.

A small part of the subject site is proposed to have a minimum lot size of 200sqm. The proposed minimum lot size of 200sqm is a result of detailed site testing to accommodate semi-detached dwellings along the main street, delivering a range of dwelling typologies and minimising the footprint of the development area while maximising the urban potential of the site. The 200sqm lot size is necessary to accommodate this dwelling form within the existing structure of the range (between the 100 yard markers), which is being retained as part of the site's heritage interpretation.

While the master plan achieves a range of dwelling types, it is not considered to be a high-density development. The number of dwellings delivered for the site area could be achieved with a traditional subdivision model, which would be unlikely to achieve dwelling diversity. A key principle of the master plan has been to appropriately balance the environmental values of the site with the delivery of housing. By reducing the footprint of development and increasing the height, the master plan has minimised impact on sensitive areas of the site and achieved a range of dwelling types.

Under the Port Stephens LEP 2013, semi-detached dwellings may be approved on lots of a minimum of 250sqm if the subdivision is considered with a development application. The PSPS envisages infill development utilising this clause in the Fern Bay residential area. It is considered that the proposed combined approach of 200sqm and 500sqm minimum lot sizes on the subject site appropriately responds to the character of permissible and expected densities in the area.

2. *Medium density housing should be generally within:*

a. *a five minute walk (400m) of a centre, or;*

b. *five minute (400m) walk of bus stops with frequent services to major centres, or;*

c. *ten minute walk (800m) of the regional centre and other town centres, or;*

d. *selected areas of high amenity or suitable topography for such development, with adequate social and physical infrastructure and an acceptable level of visual or amenity impact.*

The planning proposal focuses urban growth around centres. The subject site adjoins the existing Fern Bay community and is within 400m of the Fern Bay Store, public school, and bus services. The increased residential population is likely to support growth of retail services in the centre to the benefit of the existing community. This is consistent with the principles set out for medium density housing in Part 6.4.3 of the PSPS.

The concept master plan developed for the site also demonstrates how the site topography would appropriately accommodate residential development and minimise the visual impact, particularly when viewing the site from Popplewell road.

3. *Not identified on a Flood Planning Area map.*

The PSPS notes that substantial portions of the LGA are limited in their potential to contribute to housing targets by flooding hazards. The subject site is not identified as flood prone land under the Port Stephens LEP 2013, as shown in the following figure.

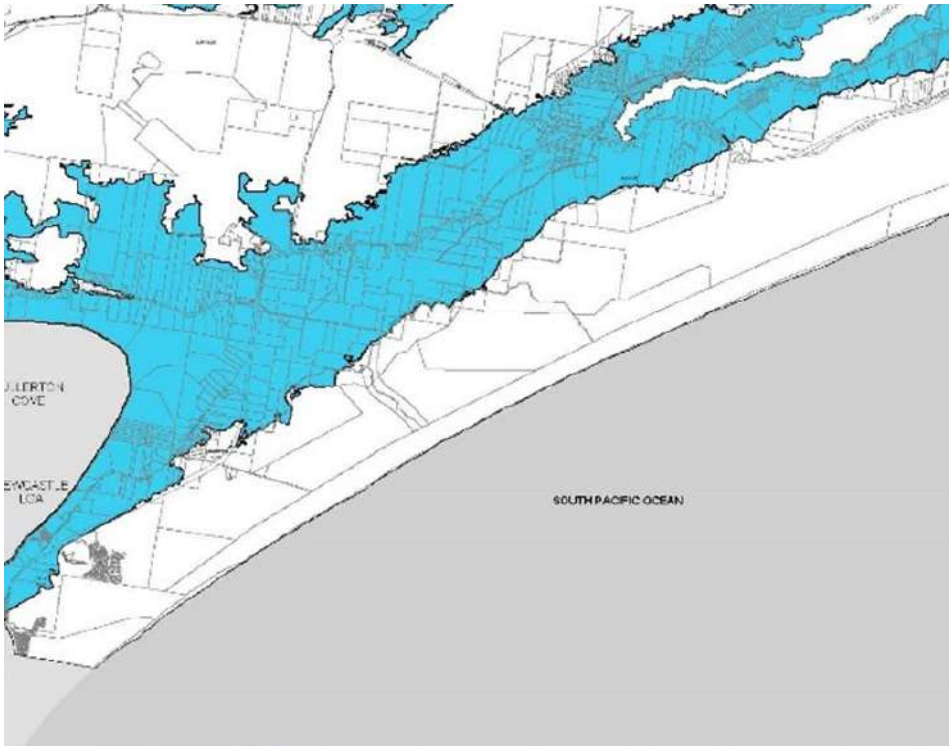


Figure 19 Flood Planning Map
Source: Port Stephens Council

4. *Not adversely affected by aircraft noise.*

The site is not adversely impacted by aircraft noise, as demonstrated in the following figure, showing the ANEF contour forecasts prepared by the Department of Defence for the Williamtown base.

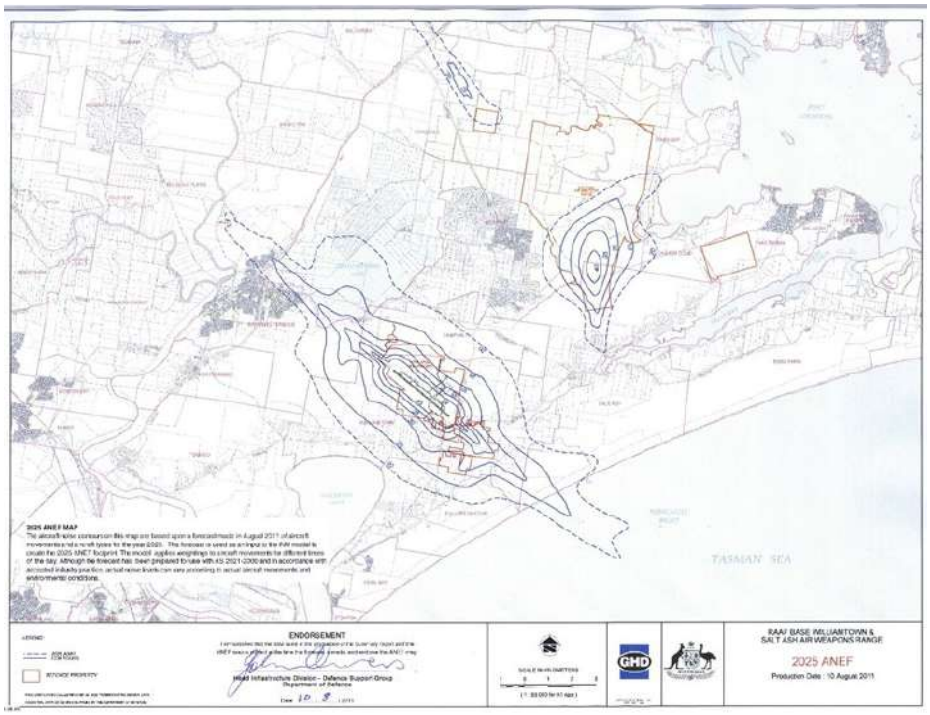


Figure 20 2025 ANEF Mapping
Source: Department of Defence, 2011

5. *Not adversely impacted by sea level rise.*

A coastal engineering assessment was prepared by BMT WBM to inform the development of the concept master plan and this planning proposal, provided in full at Attachment F. The assessment concludes that, even considering the worst-case scenario of coastal erosion and sea level rise to 2100, the site could accommodate residential development in line with coastal hazard and management policies.

Fern Bay and North Stockton Strategy

In preparation of this report it is understood that Port Stephens Council and Newcastle City Council are in the process of developing a land use strategy for Fern Bay and North Stockton which incorporates the subject site. However, this strategy has not been developed at the time of writing.

The Port Stephens Council website however identifies that the strategy will focus on identifying a site for commercial development and improving the supply of open space for residents. Whilst not yet determined, it is considered there may be potential for future development on the Stockton Centre site and surrounding land owned by NSW Family and Community Services (FACS).

The Planning Proposal and concept master plan seeks to provide a broad range of dwelling types that encourage flexibility and households at all stages of life. This is a good social outcome compared to the typical options for housing in the local area and will assist in delivering a resilient coastal community.

Further, the Planning Proposal and concept master plan include provision for a central community park which will improve access to useable open spaces and well-designed community facilities to support daily activity and healthy lifestyles. As the concept master

plan has been developed around a predominately north-south road network, in response to the existing rifle range layout, this will enable the potential future connection to the Stockton Centre.

4.9 Is the Planning Proposal consistent with applicable State Environmental Planning Policies?

The consistency of this Planning Proposal with current State Environmental Planning Policies (SEPPs) considered applicable to the Planning Proposal are outlined in the table below. SEPPs which have been repealed or were not finalised are not included in this table.

Table 4 Response to State Environmental Planning Policies

State Environmental Planning Policy	Consistency	Comment
SEPP 1 – Development Standards	Yes	Clause 1.9 of the Port Stephens LEP 2013 excludes the application of SEPP 1. Clause 4.6 of the LEP 2012 is the alternative mechanism, for varying development standards. Clause 4.6 provides a comprehensive merit test to ensure design excellence is achieved. The Planning Proposal will not contradict or hinder the application of this SEPP.
SEPP 44 – Koala Habitat Protection	Yes	The SEPP applies to land in the Port Stephens LGA. The Port Stephens Comprehensive Koala Plan of Management also applies to the site. The consistency of the Planning Proposal with SEPP 44 and the Port Stephens Comprehensive Koala Plan of Management has been considered in detail in the Ecological Assessment prepared by Umwelt, provided in Attachment H. The assessment concludes that preferred koala habitat, including suitable koala feed trees, are present on the site. A preliminary Koala Plan of Management has been submitted with the Planning Proposal to demonstrate how the concept master plan facilitates appropriate management of koala habitat. The current indicative Master Plan indicates potential disturbance to 2 koala feed trees. Where possible, koala feed trees will be selectively retained within the development footprint. This will be assessed in detail at DA stage. The planning proposal is therefore considered to be consistent with SEPP 44.
SEPP 55 – Remediation of Land	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP. A Site Audit Statement has been prepared and provided at Attachment G that demonstrates that the site is considered to be suitable for the uses set out in the Planning Proposal. Application of the SEPP at DA stage and further work will ensure that the land is developed in accordance with the SEPP.

State Environmental Planning Policy	Consistency	Comment
SEPP 64 – Advertising and Signage	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP if and when signage is proposed under future development.
SEPP 65 – Design Quality of Residential Flat Development	Yes	The Urban Design and Landscape Study for the site, provided in **Attachment B**, has been informed by SEPP 65 Principles. The Planning Proposal is not considered to hinder the application of this SEPP or the accompanying Apartment Design Guide.
SEPP (Building Sustainability Index: BASIX) 2004	Yes	The Planning Proposal will be consistent with the application of this SEPP. Future residential use on the site will be required to achieve minimum BASIX requirements (lighting, heating, cooling, and ventilation) to qualify for a BASIX Certificate and compliance with SEPP BASIX.
SEPP (Exempt and Complying Development Codes) 2008	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP.
SEPP (Infrastructure) 2007	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP.
SEPP (Rural Lands) 2008	Yes	The Planning Proposal will not contradict or hinder the application of this SEPP.
SEPP (Coastal Management) 2018	Yes	The State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) commenced on 3 April 2018 and consolidates and replaces SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5 of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed. The site falls within the Land Application Map of the Coastal Management SEPP, which gives effect to the objectives of the NSW Coastal Management Act 2016 by specifying how development proposals are to be assessed if they fall within the coastal zone. The Planning Proposal will not contradict or hinder the application of this SEPP.

4.10 Is the Planning Proposal consistent with applicable Ministerial Directions?

The consistency of this Planning Proposal with the applicable Ministerial Directions (S.117 Directions) is discussed below.

Table 5 Response to Section 117 Directions

No.	Direction	Application / Controls	Consistency	Comment
1	Employment and Resources			
1.1	Business and Industrial Zones	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed business or industrial zone (including the alteration of any existing business or industrial zone boundary).	N/A	The planning proposal does not seek to affect land within an existing or proposed business or industrial zone.
1.2	Rural Zones	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed rural zone (including the alteration of any existing rural zone boundary).	N/A	The Planning Proposal does not affect land within an existing or proposed rural zone.
1.3	Mining, Petroleum Production and Extractive Industries	*Application* This direction applies when a relevant planning authority prepares a planning proposal that would have the effect of: (a) prohibiting the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials, or (b) restricting the potential development of resources of coal, other minerals, petroleum or extractive materials which are of State or regional significance by permitting a land use that is likely to be incompatible with such development.	N/A	The Planning Proposal does not relate to the mining of coal or other materials, production of petroleum or extractive materials.

No.	Direction	Application / Controls	Consistency	Comment
1.4	Oyster Aquaculture	*Application* This direction applies to Priority Oyster Aquaculture Areas and oyster aquaculture outside such an area as identified in the NSW Oyster Industry Sustainable Aquaculture Strategy (2006) ("the Strategy"). The planning authority must consider the potential impacts of the planning proposal on the oyster aquaculture areas consult with the Director General of the Department of Primary Industries (DPI).	N/A	The Planning Proposal does not affect land in proximity to a Priority Oyster Aquaculture Area.
1.5	Rural Lands	*Application* This direction applies when: (a) a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed rural or environment protection zone (including the alteration of any existing rural or environment protection zone boundary) or (b) a relevant planning authority prepares a planning proposal that changes the existing minimum lot size on land within a rural or environment protection zone.	Yes	The objectives of the direction are to protect the agricultural production value of rural land and facilitate the orderly and economic development of rural lands for rural and related purposes. The planning proposal must address the Rural Planning Principles under SEPP (Rural Lands) 2008. The planning proposal applies to land that is currently subject to an environment protection zone, although it is noted that the zoning history indicates that the SP2 Defence zone should have been applied (refer Section 1.5 of this report). As the site does not currently accommodate any rural activities, the planning proposal would not result in a loss or displacement of an existing use. Further, the Planning Proposal would not result in adverse impacts to any nearby rural lands. The objectives of the current E2 Environmental Conservation zone are to protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. The biodiversity value of parts of the site would likely make it unsuitable for agriculture, meaning that the potential for rural production on the site is low. The Planning

No.	Direction	Application / Controls	Consistency	Comment
				Proposal maintains areas of high biodiversity. Refer to Umwelt Ecological Assessment, provided at **Attachment H**, for further detailed assessment. The Planning Proposal achieves a balance between the social, economic and environmental interests of the community and the land by carefully locating housing on the site while protecting biodiversity, in accordance with Rural Planning Principles D, E and F.
2	**Environment and Heritage**			
2.1	Environmental Protection Zones	*Controls* 4) A planning proposal must include provisions that facilitate the protection and conservation of environmentally sensitive areas. 5) A planning proposal that applies to land within an environment protection zone or land otherwise identified for environment protection purposes in a LEP must not reduce the environmental protection standards that apply to the land (including by modifying development standards that apply to the land). This requirement does not apply to a change to a development standard for minimum lot size for a dwelling in accordance with clause (5) of Direction 1.5 "Rural Lands".	Yes	The planning proposal relates to land that is currently zoned E2 Environmental Conservation, with a portion of this land considered suitable for residential development proposed to be rezoned to R3 Medium Density Residential. A planning proposal may be inconsistent with the terms of the Direction if the planning proposal is justified by a strategy prepared in support of the planning proposal which gives consideration to the objectives of the Direction. The Umwelt Ecological Assessment, provided at **Attachment H**, gives consideration to this Direction and has concluded that the planning proposal seeks to appropriately protect and conserve environmentally sensitive areas. The Rifle Range site contains five native vegetation communities including Frontal Dune Blackbutt-Apple Forest, Mahogany-Baloskion Swamp Forest, Coastal Tea-tree-Banksia Scrub, Foredune Spinifex and Beach Wetlands. A wide range of flora and fauna species have been recorded within and surrounding the Study Area as part of previous ecological surveys. The proposed rezoning has focused on the retention of as much intact vegetation as possible, and the impacts to local biodiversity and threatened

No.	Direction	Application / Controls	Consistency	Comment
				species are minimal. As such, a key mitigation strategy is for the proposal to minimise direct impact. This is enshrined in the proposed controls and extent of area to be rezoned. Mitigation measures including pre-clearance surveys, clearance supervision, weed control, and dune rehabilitation will be employed at DA and construction to further address Direction 2.1. In addition, it is noted that the site was identified by both Defence and Council for a SP2 Infrastructure (Defence) zoning. This is discussed in Section 1.5 of this report.
2.2	Coastal Protection	*Application* This direction applies when a relevant planning authority prepares a planning proposal that applies to land in the coastal zone.	Yes	The consistency of the Planning Proposal with key coastal planning policies has been assessed in detail in the Coastal Engineering Report, provided at **Attachment F**. The Planning Proposal gives effect to the relevant legislation and guidelines.
2.3	Heritage Conservation	*Controls* A planning proposal must contain provisions that facilitate the conservation of: (a) items, places, buildings, works, relics, moveable objects or precincts of environmental heritage significance to an area, in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item, area, object or place, identified in a study of the environmental heritage of the area, (b) Aboriginal objects or Aboriginal places that are protected under the National Parks and Wildlife Act 1974, and (c) Aboriginal areas, Aboriginal objects, Aboriginal places or	Yes	The site has no associated heritage listings. However, it does include two items with some heritage significance, being the Links Anti-Aircraft Battery (hereafter Links Battery) which is located near the northern boundary of the site and the remnants of the 1000yd Firing Range which constitutes semi cleared tracks extending south from the central track at 100yd intervals, now largely overgrown. The subject site is also located in the general vicinity of the Stockton Beach Dune System (item 34) as identified in the Port Stephens Local Environmental Plan 2013. In addition, the proposed development area includes a portion of the Fern Bay site complex (38-4-0895) and six sites (burials and artefacts) of significance of the aboriginal community. The assessment of European heritage conservation has been undertaken in detail in the attached Heritage Impact Assessment, provided at

No.	Direction	Application / Controls	Consistency	Comment
		landscapes identified by an Aboriginal heritage survey prepared by or on behalf of an Aboriginal Land Council, Aboriginal body or public authority and provided to the relevant planning authority, which identifies the area, object, place or landscape as being of heritage significance to Aboriginal culture and people.		**Attachment I**. The assessment concludes that the Planning Proposal appropriately manages the heritage value of the site. An Aboriginal Cultural Heritage and Archaeological Assessment Report has also been prepared to inform this Planning Proposal, provided at **Attachment J**. The assessment concludes that the planning proposal appropriately manages the aboriginal cultural heritage value of the site. The recommendations of both reports relevant to the planning proposal include the extent of the proposed rezoning, including no development to the north side of the current access road and avoiding key sites of significance. Further measures, including further survey prior to construction, an interpretation strategy, excavation of test pits, full salvage excavation, and management of any artefacts found have been recommended for subsequent development stages should the rezoning proceed.
2.4	Recreation Vehicle Areas	*Controls* A planning proposal must not enable land to be developed for the purpose of a recreation vehicle area (within the meaning of the Recreation Vehicles Act 1983): (a) where the land is within an environmental protection zone, (b) where the land comprises a beach or a dune adjacent to or adjoining a beach, (c) where the land is not within an area or zone referred to in paragraphs (4)(a) or (4)(b) unless the relevant planning authority has taken into consideration: (i) the provisions of the guidelines entitled	Yes	The Planning Proposal does not seek to enable land to be developed for the purposes of a recreation vehicle area. In its current situation, the site is often illegally accessed by recreational vehicles, primarily by quad bikes. The proposed rezoning and concept master plan would facilitate increased passive surveillance through appropriate development, landscaping and management.

No.	Direction	Application / Controls	Consistency	Comment
		Guidelines for Selection, Establishment and Maintenance of Recreation Vehicle Areas, Soil Conservation Service of New South Wales, September, 1985, and (ii) the provisions of the guidelines entitled Recreation Vehicles Act, 1983, Guidelines for Selection, Design, and Operation of Recreation Vehicle Areas, State Pollution Control Commission, September 1985.		
3	**Housing, Infrastructure and Urban Development**			
3.1	Residential Zones	*Controls* A planning proposal must include provisions that encourage the provision of housing that will: (a) broaden the choice of building types and locations available in the housing market, and (b) make more efficient use of existing infrastructure and services, and (c) reduce the consumption of land for housing and associated urban development on the urban fringe, and (d) be of good design. (5) A planning proposal must, in relation to land to which this direction applies: (a) contain a requirement that residential development is not permitted until land is adequately serviced (or arrangements satisfactory to the council, or other appropriate authority,	Yes	The Planning Proposal is consistent with this Direction. Housing diversity is a key objective of the master plan for the site, which has informed the planning proposal. The R3 Medium Density Residential zoning in the Port Stephens LEP 2013 permits a broad range of housing to be delivered on the site. In addition, the delivery of housing for defence personnel would support social diversity and affordability for these key workers in the region. The location of the site, in close proximity to the Stockton Centre and Newcastle CBD, will ensure that residential development is well serviced and contributes to the efficient use of existing infrastructure. This Planning Proposal does not contain provisions which would reduce the permissible residential density of land.

No.	Direction	Application / Controls	Consistency	Comment
		have been made to service it), and (b) not contain provisions which will reduce the permissible residential density of land.		
3.2	Caravan Parks and Manufactured Home Estates	*Controls* In identifying suitable zones, locations and provisions for caravan parks in a planning proposal, the relevant planning authority must: (a) retain provisions that permit development for the purposes of a caravan park to be carried out on land, and (b) retain the zonings of existing caravan parks, or in the case of a new principal LEP zone the land in accordance with an appropriate zone under the Standard Instrument (Local Environmental Plans) Order 2006 that would facilitate the retention of the existing caravan park.	N/A	The Planning Proposal does not relate to the location or provision for caravan parks or manufactured homes.
3.3	Home Occupations	*Controls* Planning proposals must permit home occupations to be carried out in dwelling houses without the need for development consent.	Yes	The Planning Proposal does not seek to change the permissibility of home occupations in dwelling houses.
3.4	Integrated Land Use and Transport	*Controls* A planning proposal must locate zones for urban purposes and include provisions that give effect to and are consistent with the aims, objectives and principles of: (a) Improving Transport Choice – Guidelines for planning and development (DUAP 2001), and	Yes	The Planning Proposal is informed by a Transport Study undertaken by Better Transport Futures, provided at **Attachment C**. The study considers how a residential development of the site under the proposed planning controls would impact the surrounding transport network. The study concludes that the site is well serviced by public transport infrastructure and that local roads have the capacity to accommodate the additional vehicles that may result from a residential land use and is appropriate for residential development under the relevant

No.	Direction	Application / Controls	Consistency	Comment
		(b) The Right Place for Business and Services – Planning Policy (DUAP 2001).		transport legislation and guidelines. The objective of this Direction is to ensure that urban development, including aspects such as location, design, street layouts and subdivision, all improve access to housing, jobs and services by walking, cycling and public transport; increasing choice of available transport; reducing travel demand; and supporting efficient and viable operation of public transport. The Direction requires consistency with the aims, objectives and principles of Improving Transport Choice – Guidelines for Planning and Development (DUAP 2001) and The Right Place for Business and Services – Planning Policy (DUAP 2001). As this Planning Proposal considers a residential land use, Improving Transport Choice – Guidelines for Planning and Development (DUAP 2001) is the most relevant guideline. The Planning Proposal would locate additional housing in the Fern Bay centre, within walking distance of Fern Bay Public School, Community Hall, Fern Bay Reserve, Fern Bay store, and golf course. While not a major centre or transport node (Principles 1 of Improving Transport Choice – Guidelines for Planning and Development (DUAP 2001), the Planning Proposal does achieve housing in walking distance of key land uses (Principle 2) and public transport (Principle 3). Nelson Bay Road is used as a bus route for regular and for school services. Buses serve Stockton and Fern Bay, and complete a loop via Vardon Road Popplewell Road and Rankin Rod to access Nelson Bay Road for the return journey to Newcastle. In addition, the Planning Proposal seeks to provide housing through Defence Housing Australia, for Defence staff located at Williamtown and Newcastle. Therefore, the

No.	Direction	Application / Controls	Consistency	Comment
				Planning Proposal seeks to reduce travel distance to base. The Planning Proposal demonstrates a concept design in accordance with Principles 5 to 10, as demonstrated in the urban design report that accompanies this Planning Proposal. Streets are designed to be clear, logical and able to make future connections through redevelopment. The concept design includes walking paths and a high level of amenity for pedestrians to open space on site.
3.5	Development Near Licenced Aerodromes	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will create, alter or remove a zone or a provision relating to land in the vicinity of a licensed aerodrome.	Yes	The site is identified on the RAAF Base Williamtown Obstacle Limitation or Operations Surface Map and Height Trigger Map under the Port Stephens DCP 2014. Council considers this to be in the vicinity of a licenced aerodrome. However, the site is not impacted by the ANEF contours from the RAAF base. Consultation should be undertaken with the Department of Defence as part of the planning proposal rezoning process. The Planning Proposal is consistent with the requirements of the Direction.
3.6	Shooting Ranges	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will affect, create, alter or remove a zone or a provision relating to land adjacent to and/ or adjoining an existing shooting range.	N/A	The Planning Proposal does not seek to affect, create, alter or remove a zone or provision relating to land adjacent to or adjoining an existing shooting range.
4	**Hazard and Risk**			
4.1	Acid Sulfate Soils	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will apply to land having a	Yes	The Planning Proposal relates to land with an Acid Sulfate Soil Class of 3, 4 and 5. The site is predominately Class 4, with the whole of the proposed land use zoning change in the Class 4 Acid Sulfate Soils area. This planning proposal does not

No.	Direction	Application / Controls	Consistency	Comment
		probability of containing acid sulfate soils as shown on the Acid Sulfate Soils Planning Maps.		contradict or hinder application of acid sulphate soils provisions in the LEP 2013.
4.2	Mine Subsidence and Unstable Land	*Application* This direction applies to land that: (a) is within a Mine Subsidence District proclaimed pursuant to section 15 of the Mine Subsidence Compensation Act 1961, or (b) has been identified as unstable land.	N/A	The Planning Proposal does not apply to land that is within a mine subsidence district or that has been identified as being unstable.
4.3	Flood Prone Land	*Application* This direction applies when a relevant planning authority prepares a planning proposal that creates, removes or alters a zone or a provision that affects flood prone land.	N/A	The land is not flood prone land, as shown in the Port Stephens Flood Hazard Mapping, Flood Hazard Map – Sheet FHZ_004A.
4.4	Planning for Bushfire Protection	*Application* This direction applies when a relevant planning authority prepares a planning proposal that will affect, or is in proximity to land mapped as bushfire prone land.	Yes	The Planning Proposal is consistent with this Direction. The proposal has been assessed for its compliance with bushfire protection legislation and policy in detail in the Bushfire Risk Assessment Report, provided at **Attachment D**. The report concludes that the planning proposal does not preclude development that meets bushfire protection standards. Consultation should be undertaken with the NSW Rural Fire Service should a Gateway Determination be granted.
5	**Regional Planning**			
5.1	Implementation of Regional Strategies	Revoked	N/A	
5.2	Sydney Drinking Water Catchment	*Application* This Direction applies to the Sydney drinking water catchment in the	N/A	The Planning Proposal does not apply to land in the Sydney drinking water catchment.

No.	Direction	Application / Controls	Consistency	Comment
		following local government areas: - Blue Mountains - Campbelltown - Cooma Monaro - Eurobodalla - Goulburn Mulwaree - Kiama - Lithgow - Oberon - Palerang - Shoalhaven - Sutherland - Upper Lachlan - Wingecarribee - Wollondilly - Wollongong.		
5.3	Farmland of State and Regional Significance on the NSW Far North Coast	*Application* This direction applies to: (a) Ballina Shire Council, (b) Byron Shire Council, (c) Kyogle Shire Council, (d) Lismore City Council, (e) Richmond Valley Council, and (f) Tweed Shire Council, except within areas contained by a "town and village growth boundary" in the Far North Coast Regional Strategy.	N/A	The planning proposal does not apply to land in the nominated Council areas.
5.4	Commercial and Retail Development along the Pacific Highway, North Coast	*Application* This Direction applies to those council areas on the North Coast that the Pacific Highway traverses, being those council areas between	N/A	The planning proposal does not apply to land in the vicinity of the Pacific Highway.

No.	Direction	Application / Controls	Consistency	Comment
		Port Stephens Shire Council and Tweed Shire Council, inclusive, when the relevant planning authority prepares a planning proposal for land in the vicinity of the existing or proposal alignment of the Pacific Highway.		
5.8	Second Sydney Airport: Badgerys Creek	*Application* This direction applies to land shown within the boundaries of the proposed airport site and within the 20 ANEF contour as shown on the map entitled "Badgerys Creek– Australian Noise Exposure Forecast– Proposed Alignment– Worst Case Assumptions", this being found in Appendix U of the Second Sydney Airport Site Selection Program Draft Environmental Impact Statement within Fairfield City Council, Liverpool City Council, Penrith City Council and Wollondilly Shire Council local government areas.	N/A	The planning proposal does not apply to land in the vicinity of Badgerys Creek.
5.9	North West Rail Link Corridor Strategy	*Application* This Direction applies to Hornsby Shire Council, The Hills Shire Council and Blacktown City Council.	N/A	The Planning Proposal does not apply to land within the Hornsby Shire, Hills Shire or Blacktown Council areas.
5.10	Implementation of Regional Plans	Planning proposals must be consistent with a Regional Plan released by the Minister for Planning.	Yes	The Planning Proposal would achieve the goals of the Hunter Regional Plan 2036 by: 2. Supporting strategically important local employment through a relationship with DHA and the Williamtown RAAF base, and contributing to the Hunter region being the leading regional economy in Australia; 3. Protecting a biodiversity-rich natural environment by increasing the sustainability of funding sources for site management and introducing a

No.	Direction	Application / Controls	Consistency	Comment
				zoning which would protect the ecological value of the site; 4. Increasing the diversity and sustainability of the local community by increasing the population and accommodating a broad range of age groups, supporting local retail and services such as the local school at Fern Bay; and 5. Allowing the renewal of the site with controls that facilitate a diverse range of housing typologies, supporting greater housing choice in the region. The consistency of the Planning Proposal with this Direction is further assessed in detail in Section 4.2 of this report.
6	**Local Plan Making**			
6.1	Approval and Referral Requirements	Controls A planning proposal must: (a) minimise the inclusion of provisions that require the concurrence, consultation or referral of development applications to a Minister or public authority, and (b) not contain provisions requiring concurrence, consultation or referral of a Minister or public authority unless the relevant planning authority has obtained the approval of: (i) the appropriate Minister or public authority, and (ii) the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General), prior to undertaking community consultation	Yes	This is a matter for consideration by Council during the assessment of the Planning Proposal. This Planning Proposal does not contravene the objectives of this Direction.

No.	Direction	Application / Controls	Consistency	Comment
		in satisfaction of section 57 of the Act, and (c) not identify development as designated development unless the relevant planning authority: (i) can satisfy the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) that the class of development is likely to have a significant impact on the environment, and (ii) has obtained the approval of the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) prior to undertaking community consultation in satisfaction of section 57 of the Act.		
6.2	Reserving Land for Public Purposes	*Controls* A Planning Proposal must not create, alter or reduce existing zonings or reservations of land for public purposes without the approval of the relevant public authority and the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General). (5) When a Minister or public authority requests a relevant planning authority to reserve land for a public purpose in a planning proposal and the land would be required to be acquired under Division 3 of Part 2 of the Land Acquisition (Just Terms Compensation) Act	Subject to discussion	The purpose of this Direction is to ensure that any land to be dedicated for public use is the result of proper consultation and approved by the relevant authorities. The master plan presents an opportunity to return significant coastal area back to the people, as well as a new park which could be dedicated to Council. DHA has undertaken preliminary design work for areas to be dedicated and undertaken preliminary consultation with Port Stephens Council. At this stage, it is proposed that the coastal area and new open spaces be dedicated to Council. This is subject to further design work and consultation as part of the planning proposal process.

No.	Direction	Application / Controls	Consistency	Comment
		1991, the relevant planning authority must: (a) reserve the land in accordance with the request, and (b) include the land in a zone appropriate to its intended future use or a zone advised by the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General), and (c) identify the relevant acquiring authority for the land. (6) When a Minister or public authority requests a relevant planning authority to include provisions in a planning proposal relating to the use of any land reserved for a public purpose before that land is acquired, the relevant planning authority must: (a) include the requested provisions, or (b) take such other action as advised by the Director-General of the Department of Planning (or an officer of the Department nominated by the Director-General) with respect to the use of the land before it is acquired. (7) When a Minister or public authority requests a relevant planning authority to include provisions in a planning proposal to rezone and/or remove a reservation of any land that is reserved for public purposes because the land is no longer designated by that public authority for acquisition, the relevant planning authority must		

No.	Direction	Application / Controls	Consistency	Comment
		rezone and/or remove the relevant reservation in accordance with the request.		
6.3	Site Specific Provisions	*Controls* A planning proposal that will amend another environmental planning instrument in order to allow a particular development proposal to be carried out must either: (a) allow that land use to be carried out in the zone the land is situated on, or (b) rezone the site to an existing zone already applying in the environmental planning instrument that allows that land use without imposing any development standards or requirements in addition to those already contained in that zone, or (c) allow that land use on the relevant land without imposing any development standards or requirements in addition to those already contained in the principal environmental planning instrument being amended. (5) A planning proposal must not contain or refer to drawings that show details of the development proposal.	Yes	The planning proposal does not propose any unnecessarily restrictive site specific planning controls.
7	**Metropolitan Planning**			
7.1	Implementation of the Metropolitan Plan for Sydney.	*Controls* Planning proposals shall be consistent with: (a) the NSW Government's A Plan for Growing Sydney published in December 2014.	N/A	The planning proposal does not relate to land within the area of Metropolitan Sydney.

4.11 Environmental, Social and Economic Impacts

Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

The Planning Proposal has been informed by an ecological assessment undertaken by Umwelt, provided in full at Attachment A.

Overall, the assessment concludes that the disturbed areas of the Rifle Range (the land to the south of the main cleared track, which was used as the shooting range) and a small pocket of land to the north of the main cleared track are low quality ecological communities. The vegetation primarily to the north of the main track is of a higher quality and should be preserved, as shown in Figure 21.

Five native vegetation community types have been mapped within the subject site, being Frontal Dune Blackbutt-Apple Forest, Mahogany-Balosion Swamp Forest, Coastal Tea-tree – Banksia Scrub, Foredune Spinifex, and Beach Wetlands. The following figure shows the distribution of the identified vegetation communities across the site.

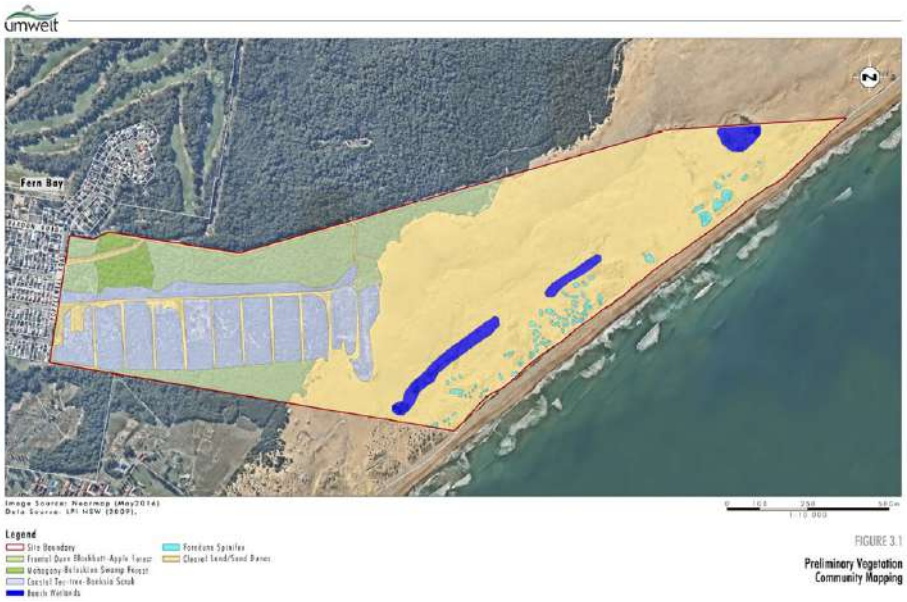


Figure 21 Vegetation Community Mapping
Source: Umwelt, September 2016

Only one ecological community has been identified as likely to confirm to a threatened ecological community, being the Mahogany-Baloskion Swamp Forest occurring in a small part of the site to the north-west.

This Planning Proposal proposed to rezone part of the site from E2 Environmental Conservation to R3 Medium Density Residential zoning. The proposed residential zone would generally include a small area to the north and the land to the south of the main cleared track, which has been assessed to be disturbed and low value ecological communities. This approach retains the E2 Environmental Conservation zoning in the high value, intact ecological communities to the north.

Four threatened fauna species listed under the TSC or EPBC Acts have previously been recorded in the subject site, being:

- The grey-headed flying-fox (Pteropus poliocephalus), listed as vulnerable under the TSC and EPBC Acts;
- Little bentwing-bat (Miniopterus australis), listed as vulnerable under the TSC Act;
- Eastern bentwing-bat (Miniopterus schreibersii oceanensis), listed as vulnerable under the TSC Act;

- East coast freetail-bat (Mormopterus norfolkensis), listed as vulnerable under the TSC Act.

No endangered populations listed under the TSC or EPBC Acts have been recorded within the subject site.

Pre-lodgement consultation with Council identified concerns relating to koala habitat, movement and feed trees. The current Master Plan indicates potential disturbance to 2 koala feed trees. Where possible, koala feed trees will be selectively retained within the development footprint. Furthermore, a Preliminary Koala Plan of Management is included in the Ecological Assessment. There are also no hollow bearing trees are within the current Master Plan development footprint. This would be further assessed at DA stage, and it is noted that the planning proposal does not seek approval for the removal of any trees or works to the site.

Council also noted the potential for habitat for the New Holland Mouse. An assessment of significance has been undertaken for this species in the Ecological Assessment, noting that 'coastal dune vegetation occurring in the Port Stephens LGA is likely to comprise an important population of the species'. However, the species has not been recorded on the site. The species is known to occur in the Worimi Conservation Lands, with the closest record on the NSW BioNet Atlas (from 2013) being within 2 km north of the site. The more detailed assessment in the EPBC Act Referral notes that the species 'is associated with heathlands and vegetation sand dunes and is found to peak in abundance 3 to 5 years following a fire. The last fire to impact the Rifle Range occurred in late 2006 and would have likely resulted in suitable habitat for the species'.

While the development site is not known as a historical or important foraging site for this species, 15.3 hectares of potential forest and shrub habitat is proposed to be impacted by the current Master Plan. However, this has been assessed as not having a significant impact on the species. 29.6 hectares of suitable habitat for the New Holland Mouse will be retained based on the current Master Plan. Avoidance and mitigation measures outlined in the Ecological Assessment would be undertaken to minimise any substantial impacts. Further survey work for the species may be required if determined by the Commonwealth Department of the Environment and Energy after the review of the EPBC Act Referral and/or required under a BAM assessment at the DA stage.

Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

The Planning Proposal is not likely to result in development that will create any significant adverse environmental effects.

A range of technical assessment have been undertaken to ensure that potential impacts of the rezoning are acceptable, including the ecological assessment summarised in the previous section of this report.

Coastal impacts

Changes to the coastal system to the east of the Rifle Range site have been investigated to assess the potential impacts of short and long term erosion, sea level rise, and ongoing recession. The assessment, prepared by BMT WBM, demonstrates three scenarios for erosion by 2100 and the impact of each scenario on the Rifle Range site, considering specifically the concept master plan as an example of a potential residential development of the site.

The three scenarios are as follows:

- An ‘almost certain’ erosion scenario including short and medium term erosion, ongoing recession (due to the Newcastle Harbour breakwaters), but excluding the impacts of sea level rise;
- A ‘likely’ erosion scenario including short and medium term erosion, ongoing recession, and future recession due to sea level rise of 0.4 m by 2100 (equivalent to the current rate of sea level rise); and
- An ‘unlikely’ erosion scenario including short and medium term erosion, ongoing recession, and future recession due to sea level rise of 0.9 m by 2100 (equivalent to highest emission scenario along which we are tracking). The ‘unlikely’ scenario is the typical conservative estimate used for planning purposes in NSW.

In accordance with Council policy and best practice planning for residential subdivision and development potentially at risk from coastal hazards, all residential development in the concept master plan is located well landward of the 2100 ‘unlikely’ hazard line. The report recommends that the proposed rezoning be supported.

Heritage impacts

An assessment of heritage impact was undertaken by Urbis, informing the development of a concept master plan for the site. The site has no associated heritage listings, but does comprise two items which have been assessed to have some heritage significance, being the Anti-Aircraft battery which is located near to the northern boundary of the site, and the remnants of the 1,000 yard rifle range, being the clear access ways from the central road at 100 yards.

The planning proposal is generally supported in principle; with the sympathetic integration of the Links Battery a key element of future works to the site. It is not considered that the site meets the requisite threshold for significance for Commonwealth Heritage listing and is unlikely to meet the criteria for local listing.

Aboriginal cultural heritage and archaeological impacts

Consultation regarding the Aboriginal cultural values associated with the subject site has been undertaken to inform the master planning for the site and this planning proposal by Umwelt (Aboriginal Cultural Heritage and Archaeological Assessment Report, Attachment J). Notifications of work on the site were developed and publicly displayed, with four parties registering their interest in ongoing consultation, being:

- Kuruah Indigenous Corporation;
- Mur-Roo-Ma Inc;
- Nur-Run-Gee Pty Ltd;
- Worimi Local Aboriginal Land Council; and
- Wonn1.

Karuah Indigenous Corporation, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd and Worimi Local Aboriginal Land Council undertook a pedestrian survey of the site late 2016. The registered parties then had the opportunity to provide feedback as a group, provided in full in the report. A key point raised with regard to significance was the importance of the northern side of the current access road, which has storylines attached to it. Key recommendations from this consultation was no development to the northern side of the access road; no impact at the intersection of Braid Road and Popplewell Road due to known burials in the area and no impact in the southwestern corner of the rifle range due to known burials. The planning proposal and indicative master plan is considered to adequately address these recommendations.

The assessment concludes that from an aboriginal cultural heritage and archaeological standpoint, there are no factors that should prevent the rezoning of the site.

Consideration has been given to the ownership and management of land, given the land to the north of the site is owned by the Worimi and managed by NSW Parks. Discussions have been held regarding the potential to dedicate land to the north of the main road, which is intended to remain undisturbed, to the Worimi. The proposed rezoning would support this outcome.

Bushfire risk

An assessment of bushfire risk with respect to the development of the site for residential uses was undertaken by Kleinfelder, demonstrating how the concept master plan could implement appropriate bushfire risk mitigation measures (Rifle Range Bushfire Assessment, Kleinfelder, September 2016). The report found that the predominant bushfire hazard is located to the north and south of the subject site.

The assessment concludes that the master plan and associated design principles can comply with all performance criteria's outlined for integrated (residential subdivision) development and minimum construction requirements at detailed design stages. The assessment also finds that the proposed design provides for suitable access and water provisions for emergency management.

Traffic and transport impacts

A transport study was prepared by Better Transport Futures to assess the high-level potential of the transport network to accommodate residential development of the site (Transport Study Report, Better Transport Futures, November 2016). In order to understand what the impacts of the development might be and what development levels may be possible, a notional development yield of 318 lots, as shown in the concept master plan, has been assumed. The assessment has also considered the cumulative impacts of the potential rezoning of the Fort Wallace site (in Newcastle LGA and subject to a separate planning proposal).

Forecast traffic flows would be in the order of 156 trips AM and 172 trips PM for the Rifle range site. It is concluded that the external road network is more than capable of absorbing these levels of additional trips, while remaining at a very good operational level of service.

It is noted that, with the site intended to provide housing for defence members, trips north towards the Williamtown base are expected to be higher than a usual site, with local traffic from the site expected to be split evenly between north and south bound trips. The performance of right turn movements from the local Fern Bay network to Nelson Bay road under existing access arrangements would be poor and it is recommended that one intersection (either Taylor Road or Vardon Road) be provided with improvements to facilitate safe right run movements, and that the relevant road be upgraded to meet current council standards.

Safe right run movements could be facilitated in a range of ways that should align with the broader work being undertaken by RMS on Nelson Bay Road. These improvements would also benefit the Newcastle Golf Course and Fern Bay primary school. Preliminary engagement has been undertaken with RMS to ensure that they are aware of the planning proposal, but further investigation of the appropriate upgrade response for right run movements should be confirmed during engagement with authorities during the planning proposal process. Improvement works should be aligned with the subdivision and development of the site at a later stage.

Stormwater impacts

The Stormwater Management Plan specifically addresses stormwater quantity and quality. It has addressed the impacts of the development of the site on the existing drainage regime, determined the stormwater discharge constraints and identified proposed stormwater device measures to adequately treat the stormwater prior to discharging to receiving waters (Stormwater Management Plan, ADW Johnson, October 2016).

Based on review of the existing site topography and geotechnical conditions, it has been identified that any surface runoff will infiltrate into the existing sand substrate within the site limits. Stormwater management principles were considered in the development of the concept master plan, resulting in a proposed development footprint, built form typologies, and drainage strategy that will manage stormwater prior to discharging into the natural drainage system.

A MUSIC model was used to simulate pollutant source elements for the proposed development to confirm that the stormwater can be adequately treated within the limits of the development. The results from this study demonstrate that there is adequate capacity within the site to achieve the required performance objectives of the stormwater management.

Servicing impacts

ADW Johnson was commissioned to investigate the capacity of civil services in the area to support a residential use of the site (Servicing Report, Rifle Range, ADW Johnson, June 2017). Conclusions have been drawn using information from Dial Before You Dig (DBYD) services and consultation with Hunter Water Corporation. Potable water supply, sewer, electricity, telecommunications, and gas have been investigated.

The report concludes that:

- Water. There is sufficient capacity in the surrounding water mains for potable water supply. At the development design and application stage, security of supply will need to be addressed in accordance with Hunter Water's design guidelines;
- Sewer. There are multiple locations in the neighbourhood where sewer connections could be made to service a residential development of the site and the Fern Bay 1 Waste Water Pump Station has sufficient capacity to receive waste water from a residential development of the site. It is likely that a small pump will be required on the site to enable the waste water to be transported;
- Electricity. Popplewell Road currently has a high voltage transfer main running north south. It is envisaged that a high voltage connection will be made from the transfer main, with input from an electrical engineer at design stage to confirm the number and location of substations required;
- Telecommunications. Upgrades will be required to the network in line with future NBN roll outs to make services available on the site.
- Gas. There are no domestic gas services in the neighbourhood, although a gas main runs along Nelson Bay Road. It is expected that extensions to the network may be made by providers for commercial reasons.

The site could support residential development with adequate civil services.

Has the planning proposal adequately addressed any social and economic effects?

The Planning Proposal is expected to deliver a range of social and economic benefits to the existing and future community in the area, including:

1. Opening the site to the public. No access to the site is currently available to the public, including access from the beach. The Planning Proposal would enable the site to be opened to the public with a particular focus on access to the beach for the Fern Bay community, as well as the intended provision of public open space on the site;
2. Employment through construction and maintenance of residential development. The Planning Proposal would facilitate increased residential development opportunity on the site, which would contribute to local employment opportunities and may result in investment in the local economy through both construction and ongoing services (in services such as handiwork, bush and garden care, etc). However, it is noted that development of the site also has the potential to result in impacts to local residents such as noise and dust. Conditions of development consent should be applied to any future development approvals on the site to manage such potential impacts;
3. Increased demand for local shops and services. Preliminary community consultation indicates that neighbourhood shops and services, such as the Fern Bay Primary School and the Fern Bay Store, would benefit from the increased residential density and development of the site with increased demand. Increased demand resulting from more local residents may result in healthier local business and services and allow a broader range of services to be provided in the local area.
4. Housing for Defence staff. DHA provides housing and services to staff members of the Defence Force and their families. The two sites are located close to the Royal Australian Air Force (RAAF) Base Williamtown which lies 11 to 12 kilometres to the north of the sites. The Planning Proposal will provide essential housing for DHA through delivery of a range of dwelling types, and allow for private housing to subsidise the housing to be developed and delivered to Defence staff and their families. The Planning Proposal will also provide for a range of key workers to be accommodated in the area close to their employment, with excellent amenity.

Social and community infrastructure in the area has been reviewed and mapped as shown in the following figures. The site is in proximity to essential emergency services, including a fire station and police station, in Stockton Town Centre, and also benefits from local services such as the Fern Bay Store and Primary School.

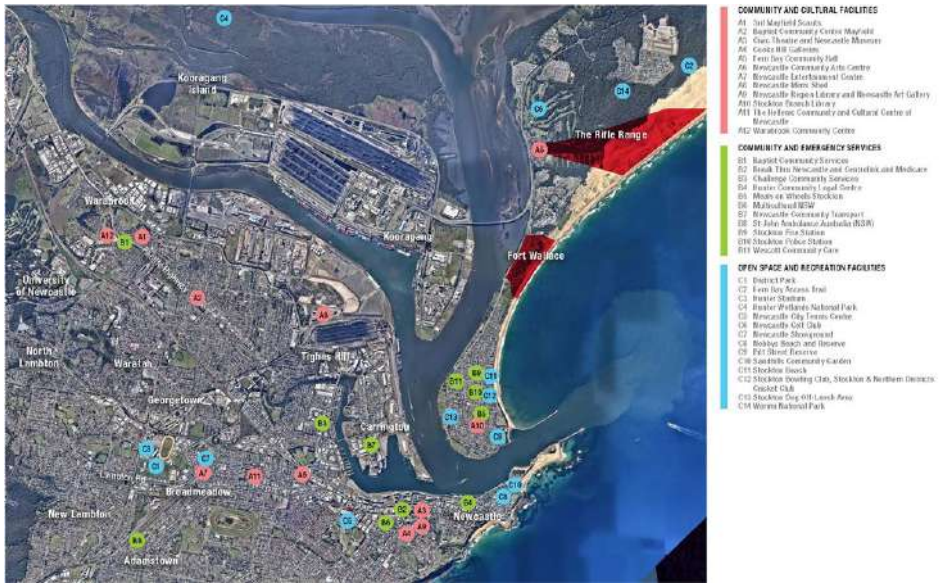


Figure 22 Social Infrastructure – Community and Cultural, Emergency and Recreation Facilities
Source: GHD

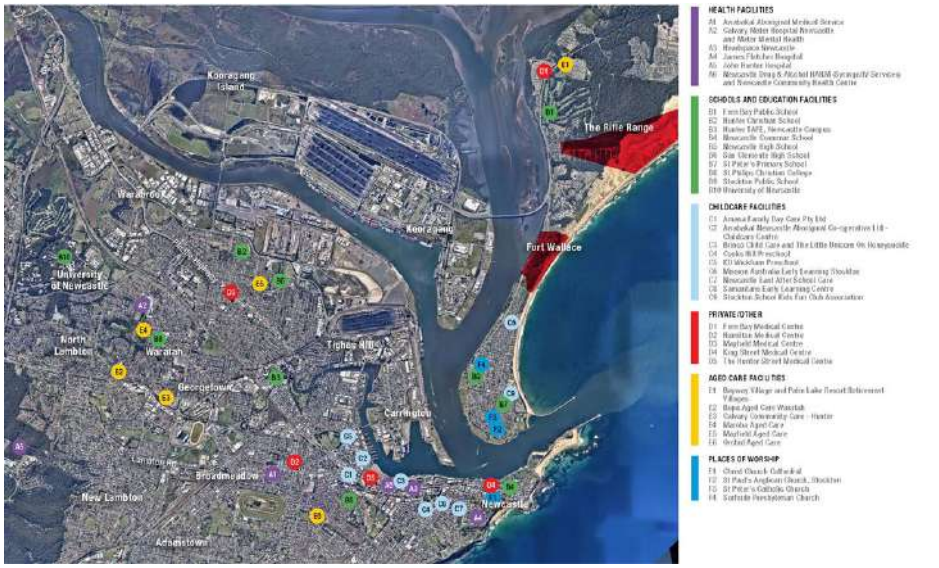


Figure 23 Social Infrastructure – Health, Education, Care and other facilities
Source: GHD

4.12 State and Commonwealth Interests

Is there adequate public infrastructure for the planning proposal?

It is considered that the planning proposal will be well serviced by public infrastructure. We note that the planning proposal will seeks to enable increased residential uses on a portion of the site, with a land use zone that allows for detached, semi-detached and attached dwellings. An indicative site master plan has been developed to demonstrate the site's potential, illustrating how approximately 318 dwellings could be facilitated.

This master plan has been used to undertake a preliminary assessment of civil infrastructure, including water, sewer, electricity, telecommunications and gas services, as summarised in Part 4.1. This report, provided in full at **Attachment K**, has concluded that there is capacity in the essential civil services to provide for a residential development of the site. While gas services are not currently available to the Fern Bay community, it is considered that the residential development of the site may increase the feasibility for the providers to extend this service.

The availability of public transport infrastructure has been considered. Newcastle Buses bus route 118 serves Fern Bay and Stockton, while buses to Williamtown are available through Port Stephens Coaches. The Newcastle to Stockton Ferry provides access to Newcastle CBD from Stockton centre.

The Stockton Cycle way, which runs parallel to Fullerton Street from near the Stockton Bridge, was opened by Council in 2013, connecting the peninsula from Stockton Bridge in the north to the Stockton Ferry terminal in the south. It is constructed as high standard concrete pavement dual use path.

What are the views of State and Commonwealth public authorities consulted in accordance with the Gateway determination?

The Gateway Determination will identify the public authorities to be consulted as part of the planning proposal process and any views expressed will be included in this planning proposal following consultation.

Preliminary consultation has been undertaken with Roads and Maritime Services (RMS), as summarised in the Transport Study.

The applicant is a commonwealth authority. As such, a referrals process to the Department of the Environment and Energy in relation to the site heritage and ecology has been initiated. This referral is expected to run concurrently to the Planning Proposal.

5. Mapping

5.1 Land Zoning

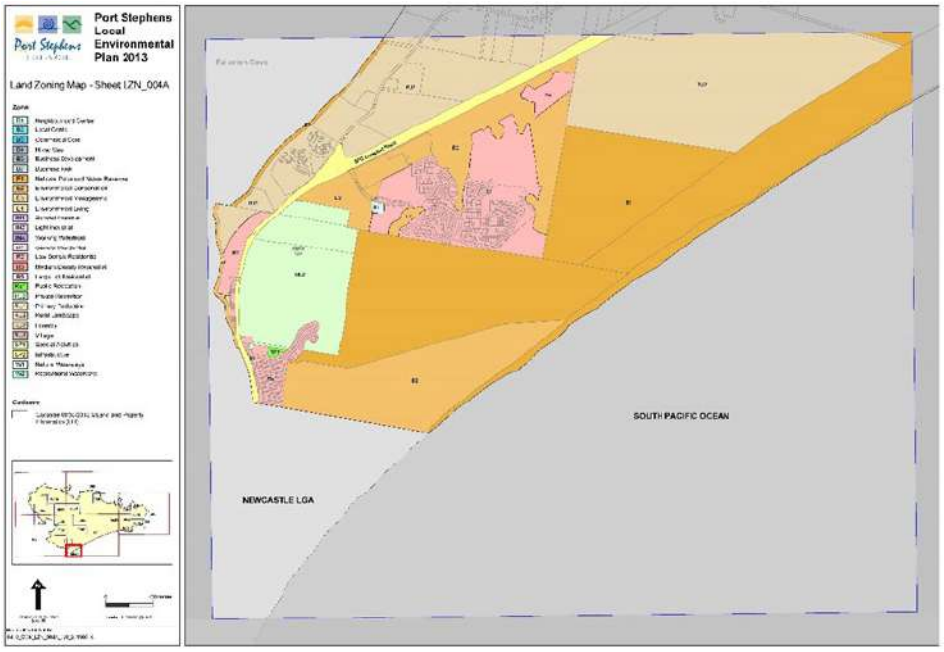


Figure 24 Existing Land Use Zoning Map
Source: Port Stephens Council

Figure 25 Proposed Land Use Zoning Map
Source: Architectus

5.2 Height of Buildings

Figure 26 Existing Height of Buildings Map
Source: Port Stephens Council

Figure 27 Proposed Height of Buildings Map
Source: Architectus

5.3 Lot Size

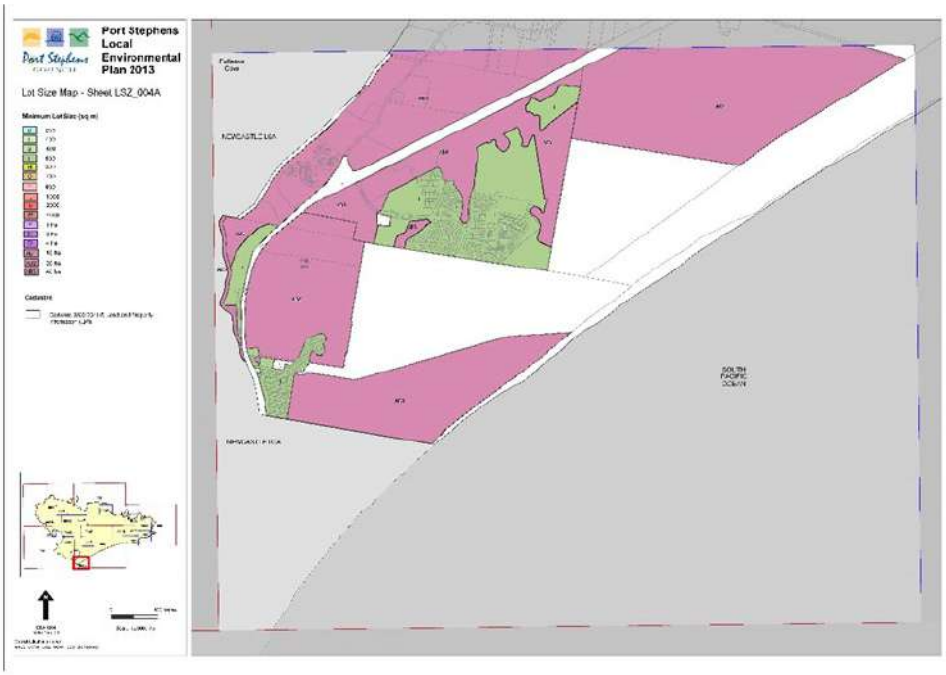


Figure 28 Existing Lot Size Map
Source: Port Stephens Council

Figure 29 Proposed Lot Size Map
Source: Architectus

6. Consultation

6.1 Community Engagement

Initial community engagement on the master planning and planning proposal for the site was undertaken between July 2016 and December 2016.

During this period, a number of different consultation activities were undertaken, including in person meetings, distribution of newsletters, online activities, a dedicated phone and email.

Two key community information and feedback sessions were run in the area, with one at Newcastle Golf Course, Vardon Road, Fern Bay on Thursday 28th of July and one at Stockton IGA, 53 Mitchell Street, Stockton, on Thursday 11th August 2016. Staff from DHA, Elton, and Architectus attended the sessions to engage with the community.

The aims of consultation activities at this stage were to inform the community about DHA, the site history, the investigation of the site, the planning stage and process, and to encourage people to engagement with the project team at later stages.

Generally, feedback was positive, with most people appreciating the proactive approach to engagement. Many people felt that the developments would create positive benefits for the local area such as improved public amenity, improved employment, and economic growth as well as making the site more accessible to the public.

Feedback was also received about community concerns such as traffic management along Fullerton Street and Nelson Bay Road, parking and the status of a sea wall proposed at Stockton.

A further information and consultation session was undertaken on the 8th of December at Newcastle Golf Course. The aim of this session was to open the draft master plans for the site to feedback, including the residential typologies and landscape strategy. Staff from DHA, Elton, Spackman Mossop Michaels and Architectus attended the session to engage with the community.

A range of questions were received by staff about the plans for the site, generally focused around the sites heritage and access for the public. Feedback was received around a broad range of issues including traffic and parking and erosion.

Further public consultation will be undertaken in accordance with the requirements of the Gateway Determination. Consultation with relevant NSW agencies and authorities and other relevant organisations will be undertaken in accordance with the Gateway Determination.

6.2 Port Stephens Council

The project team, including representatives from DHA, Architectus, Spackman Mossop Michaels, Better Transport Futures, Umwelt and Kleinfelder met with Port Stephens Council officers on the 11th October 2016 to informally discuss the preliminary request to amend the Port Stephens LEP 2013 for the Rifle Range site. Draft documentation from the technical consultants had been provided to Council prior to the meeting for consideration.

Subsequently, a presentation was made to Port Stephens Council at a Council briefing session on Tuesday 22nd November 2016. The briefing documentation consisted an introduction of DHA and the subject site, an overview of constraints and opportunities, and the concept master plan and landscape strategies. Questions were received around the housing typologies, DHA's housing model and ecology. These issues have been addressed in various sections of this report and attachments.

A pre-lodgement meeting was held with Port Stephens Council on the 25th May 2017, with representatives from across Council including social and strategic planning, traffic and

transport, and environmental. Key issues discussed included local area traffic management, stormwater and drainage, and koala management.

6.3 Aboriginal Parties

Consultation regarding the Aboriginal cultural values associated with the subject site has been undertaken to inform the master planning for the site and this planning proposal. Notifications of work on the site were developed and publicly displayed, with four parties registering their interest in ongoing consultation, being:

- Kuruah Indigenous Corporation;
- Mur-Roo-Ma Inc;
- Nur-Run-Gee Pty Ltd; and
- Worimi Local Aboriginal Land Council.

Karuah Indigenous Corporation, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd and Worimi Local Aboriginal Land Council undertook a pedestrian survey of the site late 2016. Subsequently, feedback was prepared by the group with key recommendations.

The Aboriginal Cultural Heritage and Archaeological Report was reviewed by the registered parties before finalisation.

7. Project Timeline

The following project timeline is intended to assist with tracking the progress of the planning proposal through its various stages of consultation and approval. It is estimated that this amendment to Port Stephens LEP 2013 would be completed by March 2018.

Table 6 Project Timeline

Stage	Timeframe
Assessment of the rezoning request by Council officers and preparation of planning proposal	March 2019
Resolution of Council to proceed to Gateway	April 2019
Submit planning proposal to Department of Planning and Environment seeking a Gateway Determination	April 2019
Receive Gateway Determination	May 2019
Public exhibition and public authority consultation of planning proposal and DCP Amendment	June 2019
Review of submissions received during public exhibition and public authority consultation	July-August 2019
Drafting of instrument and finalisation of mapping	September 2019
Amendment to Port Stephens Local Environmental Plan 2013 legally drafted and made	October 2019

8. Conclusion

The Planning Proposal facilitates a sensitive, high quality and responsible development of in line with the changing nature of the site.

In its current situation, the site is a disused rifle range, with a central road dividing relatively disturbed area of vegetation to the south and intact vegetation area adjoining Worimi lands to the north. A significant portion of the site to the east comprises coastal dune system, approximately 600m from the proposed area of residential zoning. The site is subject to illegal access by recreational vehicles, while not facilitating appropriate access to the beach and bushland for the public. Being one of the few vacant, developable areas within range of the Williamstown RAAF base and centres such as Newcastle CBD, Stockton, and Fern Bay, the site is significantly underutilised.

Strategic and technical assessments of the site were undertaken to consider the potential of the site to deliver housing, including urban design and planning; landscape; ecological; indigenous heritage; bushfire; European heritage; coastal engineering; civil engineering; and traffic and transport. This consultant team has consulted with local Council, State Government, the community, RMS, and local aboriginal groups in the preparation of these assessments.

A concept master plan was developed to demonstrate how a sensitive residential development could be achieved in the context of the rezoning, facilitating approximately 318 lots and associated infrastructure such as green space, roads and footpaths. To facilitate the delivery of the master plan and deliver approximately 50% of housing to defence members and 50% to the private market, a rezoning is required.

The proposed LEP controls are intended to strike the right balance between development and conservation of the site's significant features. Sensitive ecological communities, heritage items and vulnerable coastal lands are proposed to be protected and enhanced, whilst the flatter, mostly featureless parts of the site are to be made available for housing and community amenities. Through new development, the historic site can be opened up to the public, new open space can be provided and degraded relics and vegetation communities can be restored.

For the reasons discussed within this report, the Planning Proposal offers site specific and strategic merit, providing a unique opportunity to deliver a sensitive, socially sustainable and diverse community in a high amenity ecological setting.

The Planning Proposal is strongly supported and recommended to Council for endorsement.

11 Recommendations

The proposal is the result of engagement with a range of technical specialists, including coastal erosion, traffic, heritage, and archaeology, to develop a master plan that achieves the best practice planning and urban design principles in line with the changing vision for the future of the site.

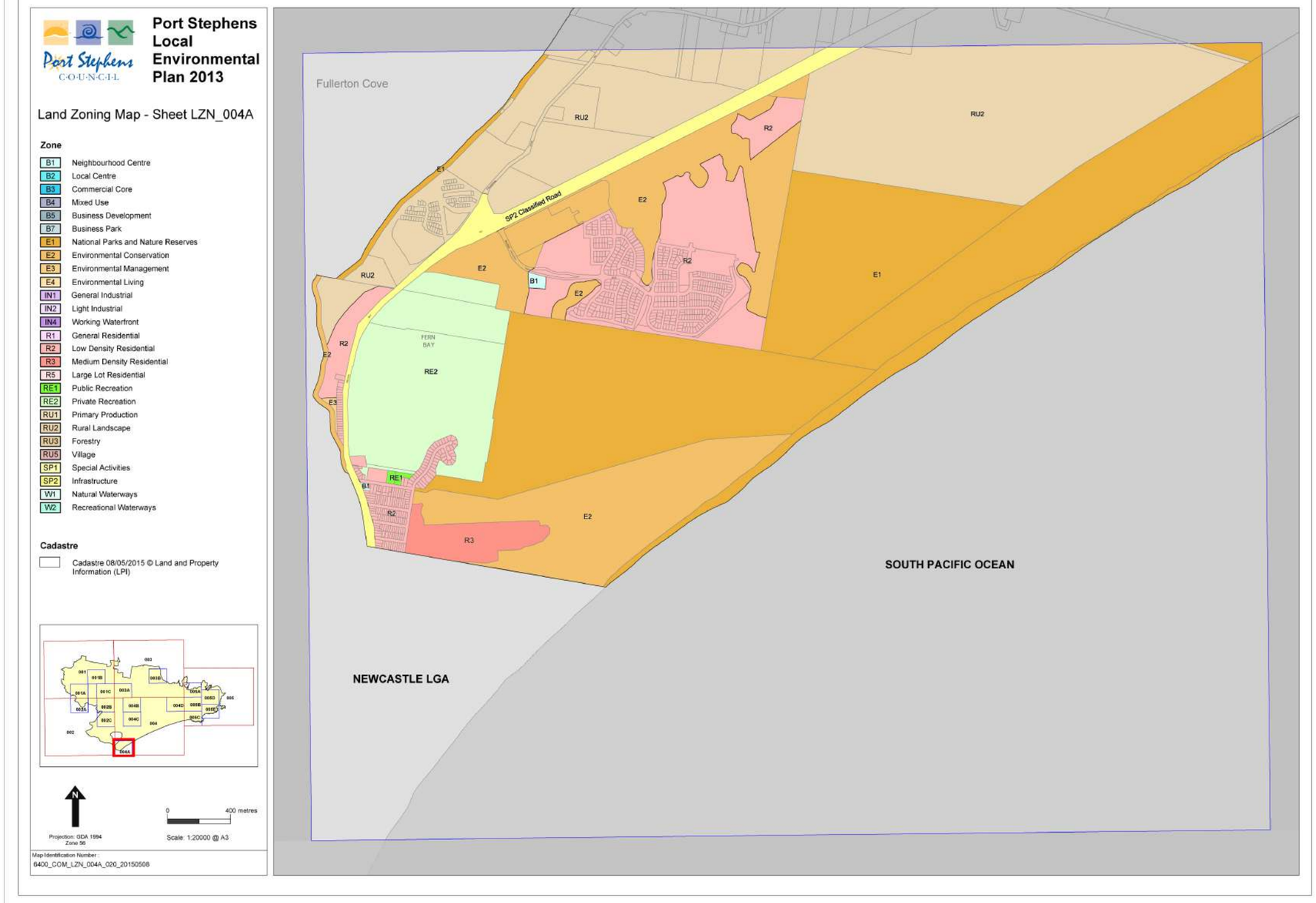
Having investigated the site and its context in detail, Architectus and Spackman Mossop Michaels are confident that the master plan, further refined and tested in detail, represents the best design and public domain outcome for the site.

11.1 Planning controls

The proposed LEP controls are intended to strike the right balance between development and conservation of the site's significant features. Sensitive ecological communities, heritage items and vulnerable coastal lands are proposed to be protected and enhanced, whilst the flatter, mostly featureless parts of the site are to be made available for housing and community amenities. Through new development, the historic site can be opened up to the public, new open space can be provided and degraded relics and vegetation communities can be restored.

An amended lot size map is also proposed, as set out in the Planning Proposal report. The lot size map reflects the indicative concept master plan.

MAP 1 - Proposed Land Zoning Map



MAP 2 - Proposed Height of Buildings Map

Prepared for:
Defence Housing Australia

Date:
22 November 2018

Urban Design and Landscape Report

Former Rifle Range, Popplewell Road, Fern Bay

spackman mossop michaels architectus™

Architectus Group Pty Ltd
ABN 90 131 245 684

Nominated Architect
Managing Director
Ray Brown
NSWARB 6359

Adelaide
Lower Ground Floor
57 Wyatt Street
Adelaide SA 5000
Australia
T +61 8 8427 7300
adelaide@architectus.com.au

Melbourne
Level 7, 250 Victoria Parade
East Melbourne VIC 3002
Australia
T +61 3 9429 5733
F +61 3 9429 8480
melbourne@architectus.com.au

Sydney
Level 18, MLC Centre
19 Martin Place
Sydney NSW 2000
Australia
T +61 2 8252 8400
F +61 2 8252 8600
sydney@architectus.com.au

architectus.com.au

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SITE AND IMMEDIATE CONTEXT

Aerial showing the 115 ha Rifle Range site
Source: Nearmap

Executive summary

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This Urban Design and Landscape Report is to accompany the Former Rifle Range Poppelwell Road, Fern Bay Planning Proposal to Port Stephens Council.

This report has been prepared by Architectus for Defence Housing Australia, the owner of the Former Rifle Range site at Fern Bay. The purpose of this report is to test the preferred urban design concepts to accompany the planning proposal to demonstrate typical street layouts, dwelling mix and development impact on the highly sensitive coastal site.

The objective of this study is to highlight key relevant issues to be addressed as part of the future master plan for the site. Key issues concerning the sites are:

- coastal dune location
- bushfire
- ecology
- indigenous heritage
- heritage
- access

The Fern Bay Rifle Range site is one of two sites on the Stockton Peninsula owned by Defence Housing Australia seeking amendments to their respective Local Environmental Plans (LEP) through a Planning Proposal. The other site being the Fort Wallace site located 2 km south of the Rifle Range. The Rifle Range and Fort Wallace sites are located in separate local government areas, being Port Stephens and Newcastle City respectively. Accordingly, a separate Planning Proposal and accompanying master plan and Urban Design Report will be submitted to each Council in order to amend the different LEPs.

The sites

The Fort Wallace and Fern Bay Rifle Range sites are located on the Stockton peninsula approximately 5km and 7km north of Newcastle CBD respectively. Although, relatively close to Newcastle, they are separated by the Hunter River with road access to Newcastle via the Stockton Bridge and ferry access between Newcatle and Stockton at the southern tip of the peninsula. Both sites have great amenity being located between Stockton Beach and the Hunter River.

The vision

The vision is to create a new place for the public and future residents to enjoy without compromising the site's unique history and coastal landscape character. The following planning and design principles underpin any future development of the site:

1. Touch lightly on the land

2. Embrace the coastal ecology

3. Celebrate history and cultural heritage

4. Open the gates to the public

5. Utilise interesting architectural forms

An indicative master plan has been developed (and included within this report) that embodies these best practice planning and design principles.

Site location plan showing both Defence Housing Australia sites - Fort Wallace to the south is within a separate local government area (Newcastle City Council) and is subject to a separate Planning Proposal.

Master Plan Vision -

“Stockton Rifle Range and Fort Wallace will be unique coastal communities with strong links to Newcastle CBD and a growing Hunter region.

The communities will be a place where the natural coastal landscape prevails over the built environment and a rich layer of cultural heritage is celebrated and made accessible to the public.

New buildings will be contemporary in design and character, with references to traditional coastal forms and materiality. Development will ‘touch lightly’ on the ground and minimise impacts on the site.”

Character images

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Indicative Landscape Master Plan

LEGEND

01/ Extended road network from existing neighbourhood
02/ Cluster Homes
03/ Single Eco Home
04/ Courtyard Homes
05/ Townhouses
06/ Dune Apartments
07/ Central access spine (shared path)
08/ Shared path to dunes
09/ Vegetated detention basin
10/ Community park
11/ Potential play area
12/ Firetrail / bushwalk
13/ Dune boardwalk
14/ Dune access car park
15/ Worimi Conservation Lands

Scale:1:2000 @ A3
0 50 100m

ARTIST'S IMPRESSION OF THE PROPOSED DEVELOPMENT

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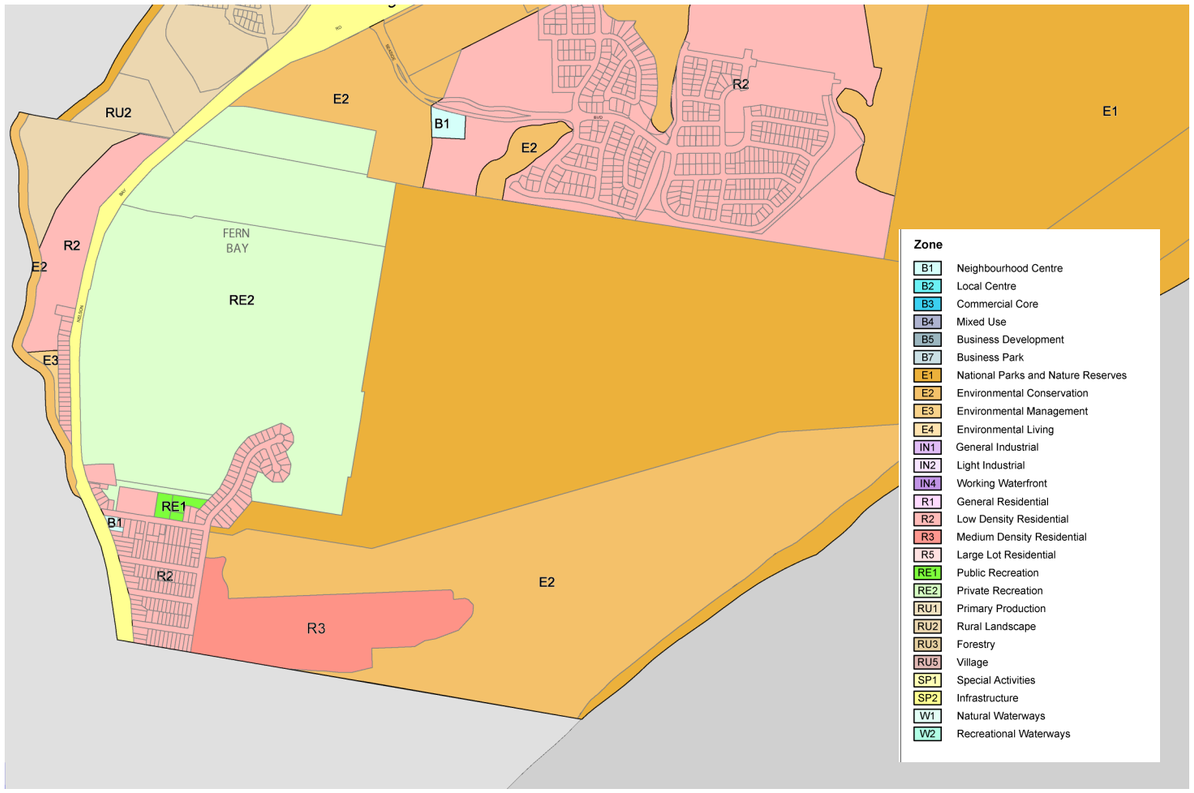
Proposed LEP Mapping

The proposed LEP controls are intended to strike the right balance between development and conservation of the site's significant features. Sensitive ecological communities, heritage items and vulnerable coastal lands are proposed to be protected and enhanced, whilst the flatter, mostly featureless parts of the site are to be made available for housing and community amenities. Through new development, the historic site can be opened up to the public, new open space can be provided and degraded relics and vegetation communities can be restored.

An amended lot size map is also proposed to reflect the indicative master plan.

MAP 1 - Proposed Land Zoning Map



MAP 2 - Proposed Height of Buildings Map

Introduction

THE SITE IS PART OF THE STOCKTON PENINSULA, WITH THE TOWN CENTRE OF STOCKTON SITING ON THE HEADLAND LOCATED APPROXIMATELY 4.5KM TO THE SOUTH.

1 Introduction

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1.1.1 The site

The Rifle Range site is approximately 115 hectares in area and is located on the Stockton Peninsula approximately 7km north of Newcastle CBD. Much of the eastern half of the site is taken up by the extensive dune system behind Stockton Beach, however, there are strong traces within the landscape of its former use as a rifle range.

Fern Bay Rifle Range is within Port Stephens LGA.

The site is accessible from its west via Popplewell Road which links back to Newcastle via Nelson Bay Road across the Hunter River.

The site is bound by the Worimi Conservation Lands to the north, the Stockton Centre and Stockton Cemetery to the south, existing residential subdivision to the west and Stockton Beach and dune system to its east.

Key site features include:

– Historically used as a rifle range with the operational layout of the firing mounds still evident.

– The site topography is characterised by a large flat areas previously used as the range with steep dunes that block views to the east and low lying areas of regrowth to the north.

– Larger areas of remnant vegetation regrowth to the north of the site bordering the Worimi Conservation Lands and to the south bordering the Stockton Centre.

1.1.2 Purpose of this report

This report has been prepared by Architectus on behalf of Defence Housing Australia (DHA) for land at 14 Popplewell Road, Fern Bay, known as the Rifle Range site.

The site was formerly owned and utilised by Defence for training and has, at some points in its history, been open for public uses. The site is no longer required for Defence purposes and was purchased by DHA. The purpose of this report is to prepare concept options for the site that test the site's development potential in line with its changing uses and vision for the future of the site.

The concept options developed are intended to inform a planning proposal to Port Stephens Council by demonstrating the capacity of the site to accommodate development while responding to the site constraints.

1.1.3 Objectives of the master plan

Objectives of the master plan are:

– facilitate housing for defence personnel;

– provide a scheme that is supported by stakeholders;

– protect and improve the ecological condition of the site;

– create a master plan that provides public benefit eg. public parks, beach access, cycleways;

– provide a mix of dwelling types that will meet a variety of housing needs;

– locate density on already scarred landscape (minimise building in bush);

– provide housing types that sit lightly within the landscape;

– connect to the great open space network from the mountains to the sea;

– connect with and extend the great coastal walks of Newcaslte eg. Merewether Baths/Anzac Memorial Walk/ Fort Scratchley;

– manage bushfire and APZs.

1.1.4 The team

This report was prepared in consultation with a team of technical specialist consultants in order to understand the site opportunities and constraints in detail.

The team included:

– Spackman Mossop Michaels, landscape architecture;

– Umwelt, ecological advice and indigenous heritage;

– Klienfelder, bushfire advice;

– Urbis, european heritage;

– BMT WBM, coast engineering advice;

– ADW Johnson, civil engineering;

– Better Transport Futures, traffic and transport; and

– Elton Consulting, community consultation.

Architectus worked collaboratively with specialists to ensure that the concept master plan was informed and feasible. Detailed reports from these consultants are provided as part of the Planning Proposal to Council.

To Maitland

Thornton

To Raymond Terrace

RAAF
Williamstown

To
Port Stephens

Fern Bay

Kooragang

RIFLE RANGE

Stockton Centre

FORT WALLACE

To Sydney

University of Newcastle

Waratah

Stockton

Wickham

Broadmeadow

Newcastle CBD

Adamstown

Cardiff

Kotara

Merewether

To Sydney

To Charlestown

THE SITE IS IN CLOSE PROXIMITY TO THE AMENITY AND SERVICES OF STOCKTON AND THE NEWCASTLE CBD. THE SITE IS ALSO WELL LOCATED TO THE WILLIAMTOWN RAAF BASE.

Site context

2.1 Site analysis

A comprehensive analysis of the site, its context, constraints and opportunities has been undertaken to inform development potential and a framework from which the master plan was developed. The following analysis underpins the structure of the master plan and identifies more broadly the developable and undevelopable areas on this highly ecologically sensitive site. The extensive analysis ranges from broad contextual analysis to detailed site analyses.

Contextual analysis includes:

- Environmental context
- Coastal processes
- Local context and destinations
- Transport
- Open space network

Detailed site analysis looks at:

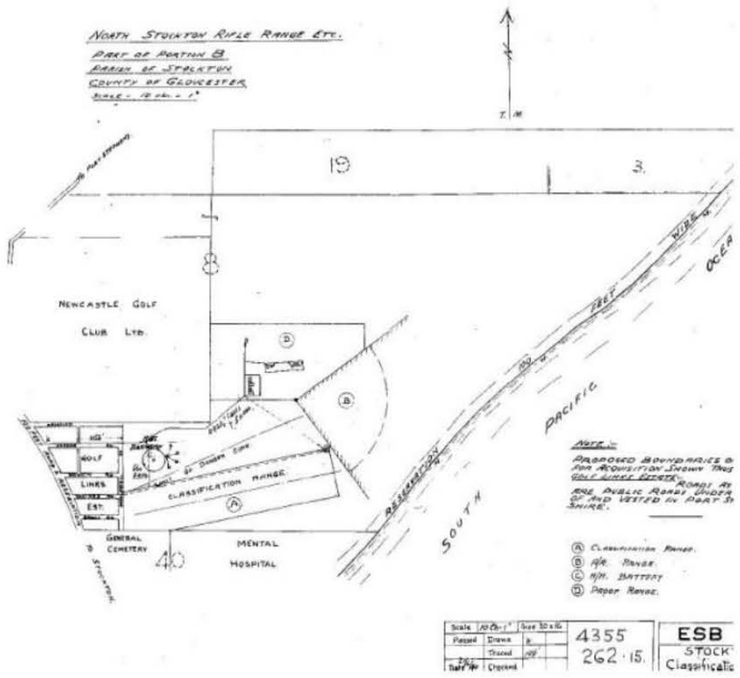
- Topography
- Ecology
- Landscape
- Coastal erosion
- Heritage
- Access and circulation
- Views
- Built form

The key site analysis findings are condensed into a combined constraints and opportunities diagram. Further detail regarding site analysis is provided in seperate consultant reports undertaken specifically for this planning and urban design process.

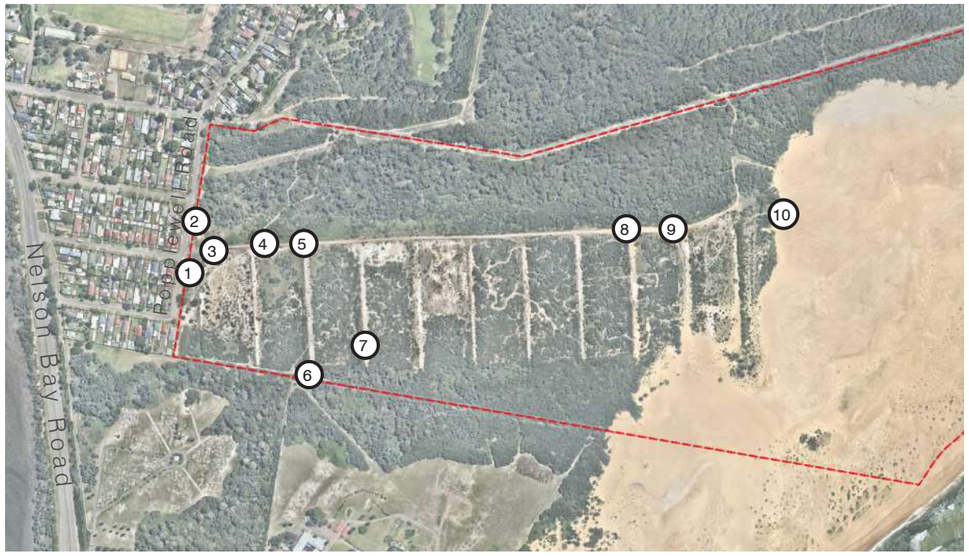
2.2 Existing built form

There is little existing built form on the site from the historical use of the site by Defence. Items include part of the Anti-Aircraft Battery; Links Battery and firing markers. The operational layout of the firing mounds is still evident.

The location of each item has been surveyed as part of the Urbis site heritage study.



Site photographs



Fencing to site frontage on Popplewell Rd

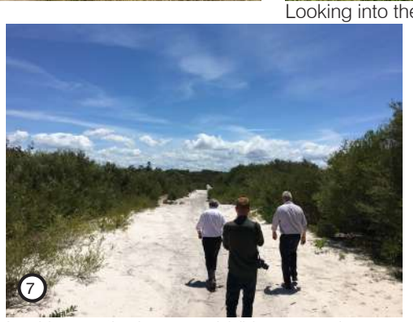
Looking south along Popplewell Rd

Looking east along the alignment of the old range

Looking west back to site access on Popplewell Road

Looking into the bush areas north of the old range

Informal track along southern site boundary



Looking north along an old firing mound

Looking west along the alignment of the old range

Looking north towards the old stop butt and dunes

View from the top of the dunes south accross Stockton Beach towards Newcastle

2.3 Stockton Peninsula History

Aboriginal Heritage
The Stockton Peninsula was originally the land of the Worimi Tribe, who knew this place as “Burrinbingon”. Evidence of Aboriginal occupation is available throughout the region, extending back several tens of years. A series of Aboriginal archaeological and cultural / historical sites are situated along the peninsula, and are now known as the “Fern Bay Complex”. These sites indicate traditional Aboriginal hunting, fishing, and cultural activities occurring throughout this area.

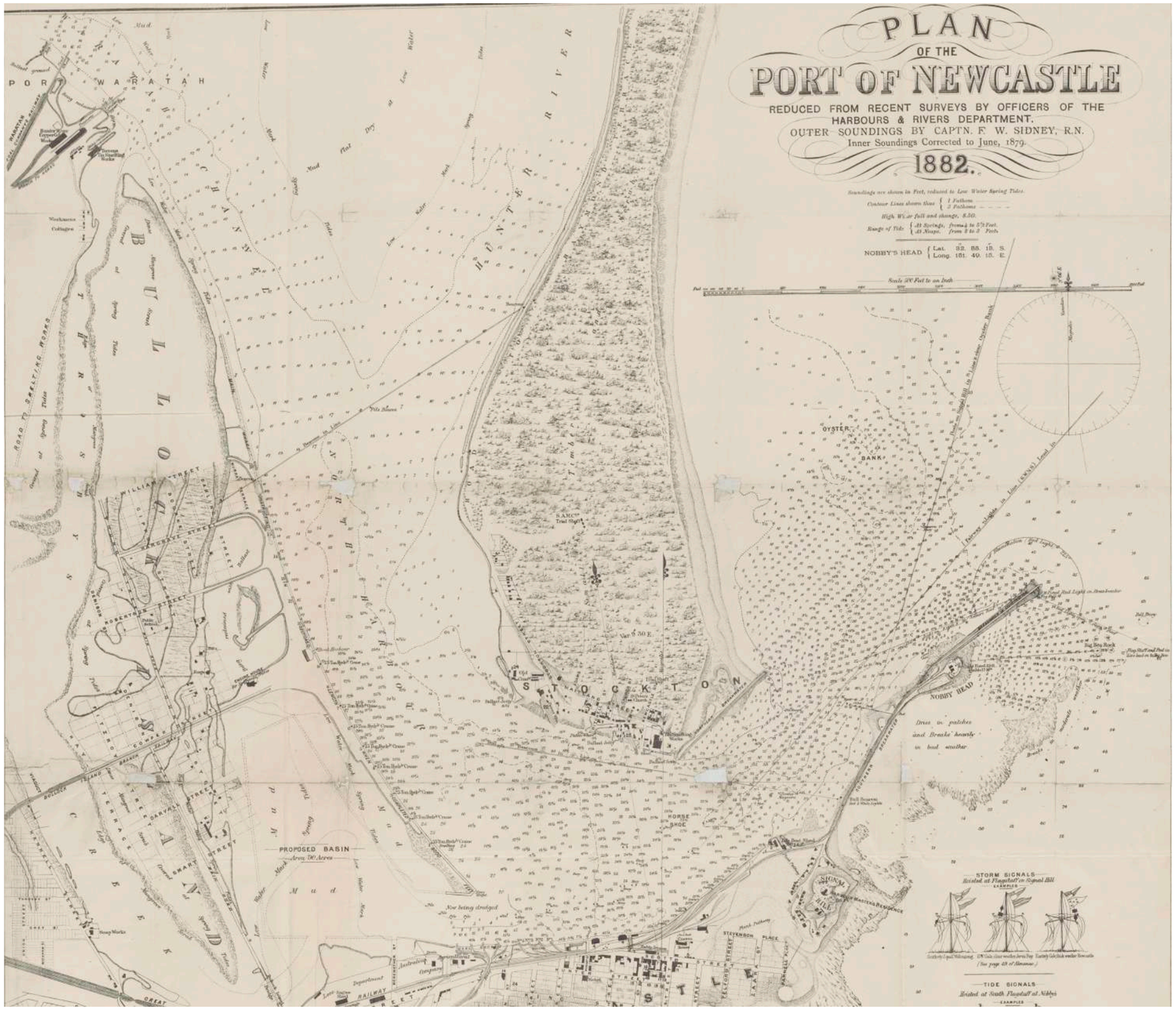
European Heritage
Lieutenant John Shortland stumbled upon Newcastle Harbour and the Hunter River while searching for escaped convicts in 1797. He named the Stockton Peninsula “Point Kent”.

From October 1800, Stockton became known as “Pirate Point”, when convicts escaping from Broken Bay in the Norfolk were wrecked on the southern point of the peninsula.

Newcastle was settled in June 1801, closed in February 1802 and later resettled in March 1804. From this time onwards, parts of the peninsula were granted to settlers, with the southernmost end of the peninsula generally becoming known as the “Private Township of Stockton”. Early industries in this area included saw milling, lime burning, salt works, an iron foundry, a tweed mill, a chemical plant, a tin smelter, coal mining, and ship building.

The Stockton residential suburb emerged from subdivisions made by the State Government in 1887. Vehicular and passenger ferries provided the only means of access across the harbour (aside from a long journey inland via Hexam) until the Stockton Bridge opened in 1971.

While the Stockton Peninsula may now be considered as the northern suburbs of Newcastle, it has its own distinctive seaside character.



Plan of the Port of Newcastle, National Library of Australia
http://nla.gov.au/nla.obj-231510237/view

2.4 Rifle Range

Aboriginal Heritage
The Rifle Range site has eight recorded sites of Aboriginal heritage: six on the mobile dune to the east side of the range (subsequently destroyed by sand mining activities), and two extant sites of scattered stone artefacts in the central portion of the range. It is possible that there are further Aboriginal archaeological deposits, including burials, on the site.

It is recommended that the following development principles are adopted:

- Restrict development in vegetated portion to south of the site, allowing a buffer to the Stockton Hospital and Cemetery.
- Avoid development in the northern vegetated portion of the site as this area has the highest archaeological potential.
- Investigate the possibility of minimising excavation works within the site in order to reduce potential to interact with sub-surface deposits.
- Consideration of Aboriginal cultural heritage awareness through interpretive signage, sympathetic plantings, use of open space etc. to recognise/ promote heritage values.
- Aboriginal party consultation will need to be undertaken with reference to cultural values (outside archaeology).

European Heritage
The site remained undeveloped until range construction began in 1939-40, although the site was not formally acquired by the Commonwealth until 1942. The dunes and ocean were utilised as a safe background area, but nevertheless, substantial earthworks were required to develop the range's topography that exists today.

Constructed just prior to and during WWII, Fern Bay Rifle Range was a firing range used by military personnel due to the demand for shooting that could not be met by Adamstown Rifle Range. The range was constructed as a classification range of 50 targets in a concrete gallery, firing mound at 900 yards, a telephone service, wind flags, storage facilities and a workshop.

The site has no associated heritage listings on any level. However, it does comprise two items with some heritage significance: the Anti-Aircraft battery and the remnants of the 1000 yard Rifle Range whcih constitutes cleared access ways from the central road at 100 yard intervals which are now overgrown.

The remnant Links Battery located to the north of the classification range was completed around 1940. The Links Battery comprised four Vickers 3.7 inch anti-aircraft guns. It consisted of four gun emplacements and a central command post in a standard layout. The battery contributed to the Newcastle Fortress coastal defence system against air combardment and particularly to protect Fort Wallace.

A series of upgrades were undertaken from 1942 as a result of the arrival of two new types of fighter planes from Britain which were ordered to oppose the Japanese over Darwin. These planes utilised 20mm Hispano Cannons. New firing ranges were required to test these weapons and in response the Stockton range was equipped with a 20mm Accuracy Range.

After the war the Rifle Range was used for military, police, cadets, and civilian club rifle training until the range was closed in 1997. Mining of sand from the dunes took place from the 1950s until the present.

Opportunities for Future Uses
While the Rifle Range site has significant historic associations, the historic remains on site are in poor condition. There is the potential for the retention of undisturbed bushland areas for their spiritual context (aside from their ecological value), for heritage interpretation, and potentially for the structural pattern of the range to be incorporated in the master plan.

Images of parts of the Anti-Aircraft battery. (Source: GML)

Strategic planning framework and controls

3 Strategic planning context

3.1 Hunter Regional Plan

Architectus on behalf of Defence Housing Australia (DHA) prepared a submission on 23 March 2016 to the NSW Draft Hunter Regional Plan (DHRP) and Draft Plan for Growing Hunter City (DPGHC) 2015.

The DHRP sets out a 20-year plan prioritising the growing and diversifying of the Hunter economy as NSW's largest regional economy, and identifies subregional landscapes being the Western Hunter, Northern Tops, North East Coast and Hunter City (including Inner Newcastle) districts.

The DPGHC supplements the Regional Plan and follows the 20-year time frame, reinforcing the City as the gateway to the region by capitalising on assets for greater growth via its identified districts, Inner Newcastle, Inner West, Maitland-New England Highway Corridor, Northern Gateways and Northern Lake Macquarie.

The Stockton Rifle Range site (Port Stephens LGA, currently zoned E2 – Environmental Conservation) also has significant redevelopment potential. In both studies, the area is shown as 'Non-Urban Area' which may have the effect of precluding a future rezoning of the site. It was recommended that both plans show the site as 'Urban Area' or "Urban Area – For Investigation" to make way for the full assessment of the site's redevelopment potential.

The Fort Wallace site (Newcastle LGA, currently zoned SP2 - Defence) is shown as an 'Urban Area' in the DHRP, but as 'Non-Urban Area' in the DPGHC. It was submitted that the site's potential for renewal be recognised and shown as 'Urban Area' consistently in both documents.

Additionally, it was recommended that the Department of Planning and Environment consider the inclusion of both DHA sites within the Inner Newcastle District to recognise their strategic and visual relationship with the city and their potential to contribute to the goals for Hunter City.

Map showing extended 'Inner Newcastle District'

3.2 Port Stephens Planning Strategy (PSPS) 2011

Areas identified as Fern Bay - Fullerton Cove, to the north and west of the Rifle Range, have been identified as future growth areas within the Strategy. This area, including the subject sites, comprise the Eastern Growth Corridor identified within strategic planning for Port Stephens. The area has been recommended to increase in density over the next 15-20 years since the Strategy's release, with potential for:

42 infill residential dwellings; and

1,396 dwellings within green field residential zoned land.

The Strategy also recommends the opportunity to maximise access to existing infrastructure through density increases.

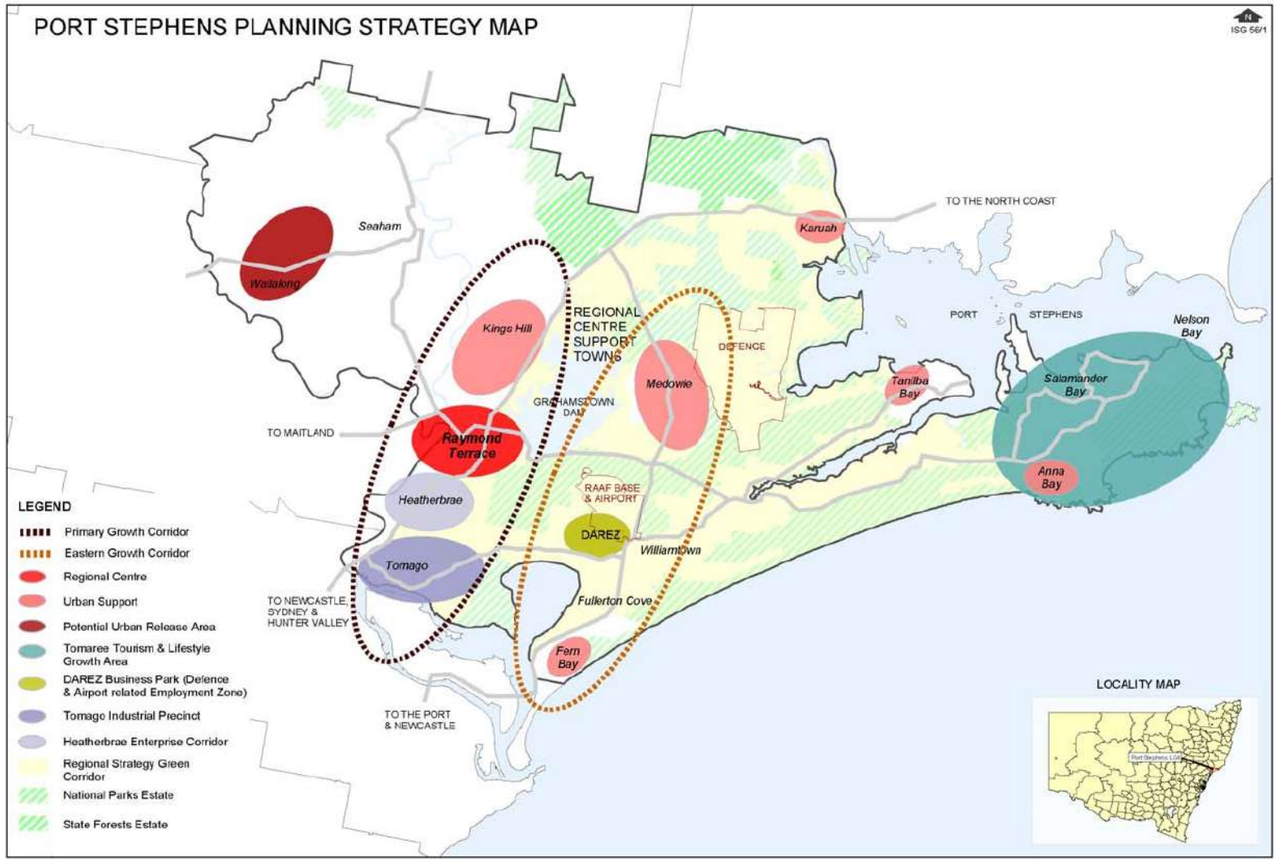
As the suburb (of Stockton or Fern Bay) is among the LGA's small centres with no available commercial floorspace, the need for commercial rezoning has also been identified.

The Strategy predicts a need for an indicative 14,441 additional dwellings throughout the LGA, including infill and within rural areas.

3.3 Port Stephens Commercial and Industrial Lands Study

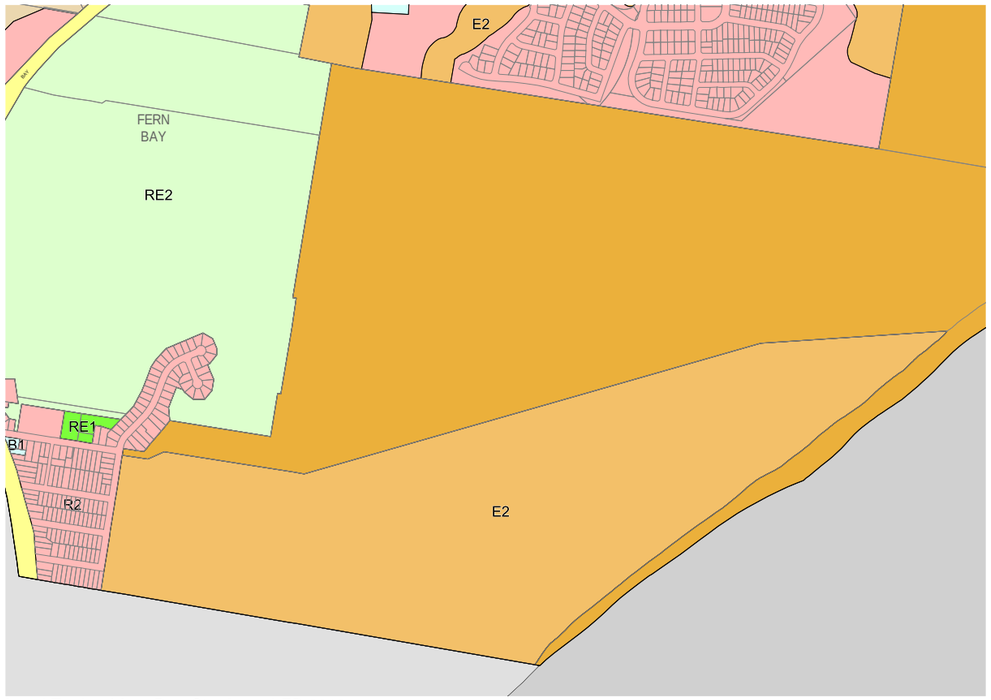
Fern Bay has been highlighted as one of the small centres within Port Stephens that will experience greater residential growth. It has been recommended within the Study for rezoning from 2A Residential to B1 Neighbourhood Centre. In consideration of the Newcastle Centre across the peninsula to the south, this is to accommodate the day-to-day needs of the local residents.

PSPS 2011 - Fern Bay - Fullerton Cove - Future Growth Area. The site is in close proximity to these future growth areas.



PSPS 2011 - Port Stephens Planning Strategy Map. The site is part of the Eastern Growth Corridor.

4 Local planning context



Land Zoning Map, Port Stephens LEP 2013

The subject site is zoned E2 Environmental Conservation. The E2 zone permits dwelling houses and dual occupancies. The beach to the east and large lots to the north are zoned E1 National Parks and Nature Reserves.

Land to the west is zoned R2 Low Density Residential, with some areas of public and private recreation.

B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
B4	Mixed Use
B5	Business Development
B7	Business Park
E1	National Parks and Nature Reserves
E2	Environmental Conservation
E3	Environmental Management
E4	Environmental Living
IN1	General Industrial
IN2	Light Industrial
IN4	Working Waterfront
R1	General Residential
R2	Low Density Residential
R3	Medium Density Residential
R5	Large Lot Residential
RE1	Public Recreation
RE2	Private Recreation
RU1	Primary Production
RU2	Rural Landscape
RU3	Forestry
RU5	Village

Height of Buildings Map, Port Stephens LEP 2013

The subject site has no maximum height of buildings control. The adjoining residential areas are subject to a maximum height of J 9m.

I	8
J	9
M	12
O	15
Q	19

Minimum Lot Size Map, Port Stephens LEP 2013

The minimum lot size applicable to the subject site is AB3 40ha. The adjoining residential areas are zoned I 500sqm.

B	200
F	400
G	450
I	500
M	600
Q	700
T	900
U	1000
V	2000
W	4000
Y	1 ha
Z1	2 ha
Z2	4 ha
AB1	10 ha
AB2	20 ha
AB3	40 ha

Site analysis

THE SITE'S WESTERN INTERFACE WITH POPPLEWELL ROAD

Opportunities and constraints

5.1 Purpose and scope

The project team has undertaken a thorough study of the physical site and its history in order to understand the site's unique and special characteristics. This examination has included site walks, document research and desktop review, site mapping, future projections relating to climate change and other studies by a range of specialist consultants.

Properly understanding the site is a crucial step in ensuring the creation of a sensitive, site-responsive and sustainable master plan. By clearly identifying the site's constraints and opportunities we are able to conserve areas of the site that are of special environmental and cultural value, and areas that could be suitable for new development, which could include public open space and amenities, streets, housing or other physical changes to the existing site.

The detailed site analysis includes:

- Topography
- Ecology
- Landscape
- Coastal erosion
- Heritage
- Access and circulation
- Views
- Built form

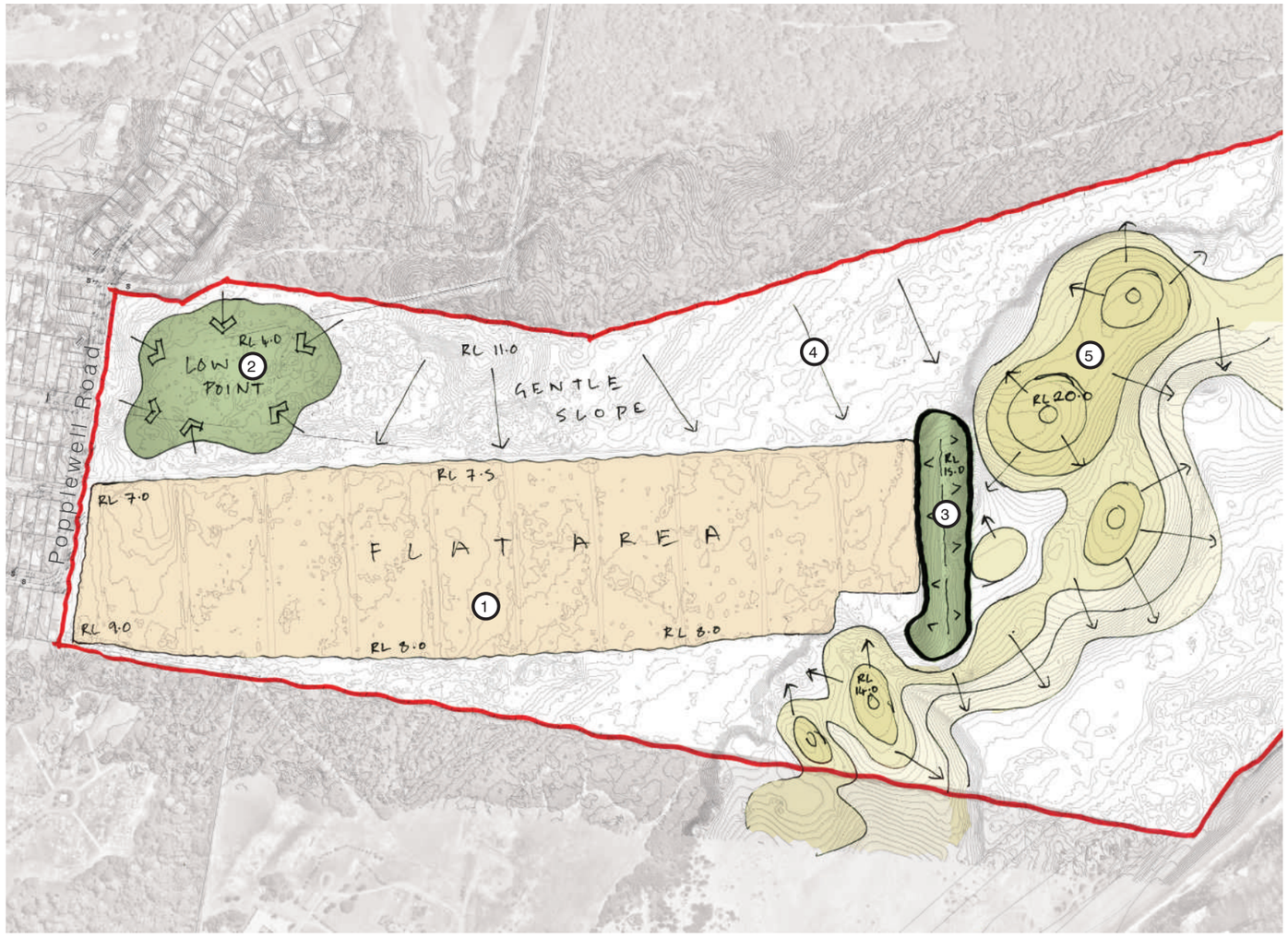
The detail of these analysis are presented in seperate consultant reports. This section summarises technical inputs where relevant to the recomended master plan for the site.

Aerial view of the site

SITE INTERFACE WITH POPPLEWELL ROAD

LOOKING EAST ALONG THE ALIGNMENT OF THE OLD RANGE

5.2 Topography



1. Large, partially open flat area formed by remnant rifle range provides opportunity to accommodate residential development.

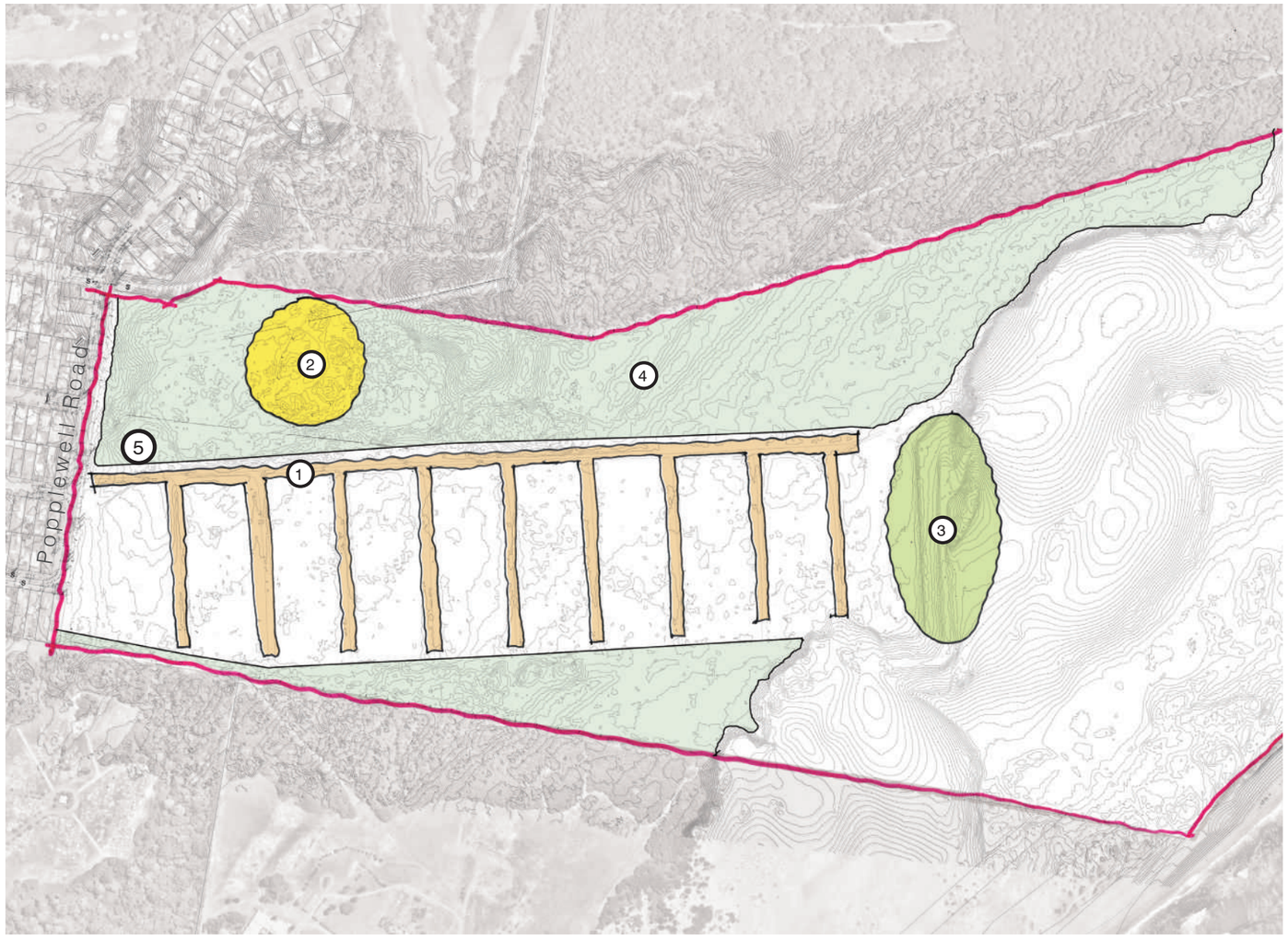
2. Vegetated low point in north-west corner of the site - potential opportunity to accommodate drainage feature.

3. Large mound/'Stop Butt' to east of the site provides a visual and physical barrier to the dunes and beach.

4. Northern vegetated portion of the site slopes gently toward the flat rifle range ground.

5. Existing dunes to Stockton Beach rise approximately 12m from the Rifle Range. These are transient landforms that may require some vegetated stabilisation adjacent to any new development.

5.3 Heritage



1. Consider the set-out of the old firing mounds as a heritage item for interpretation.

2. Potential restoration, access and interpretation of the remnant anti aircraft battery.

3. Consider the heritage and interpretation opportunities associated with the range stop butt and remnant target facilities.

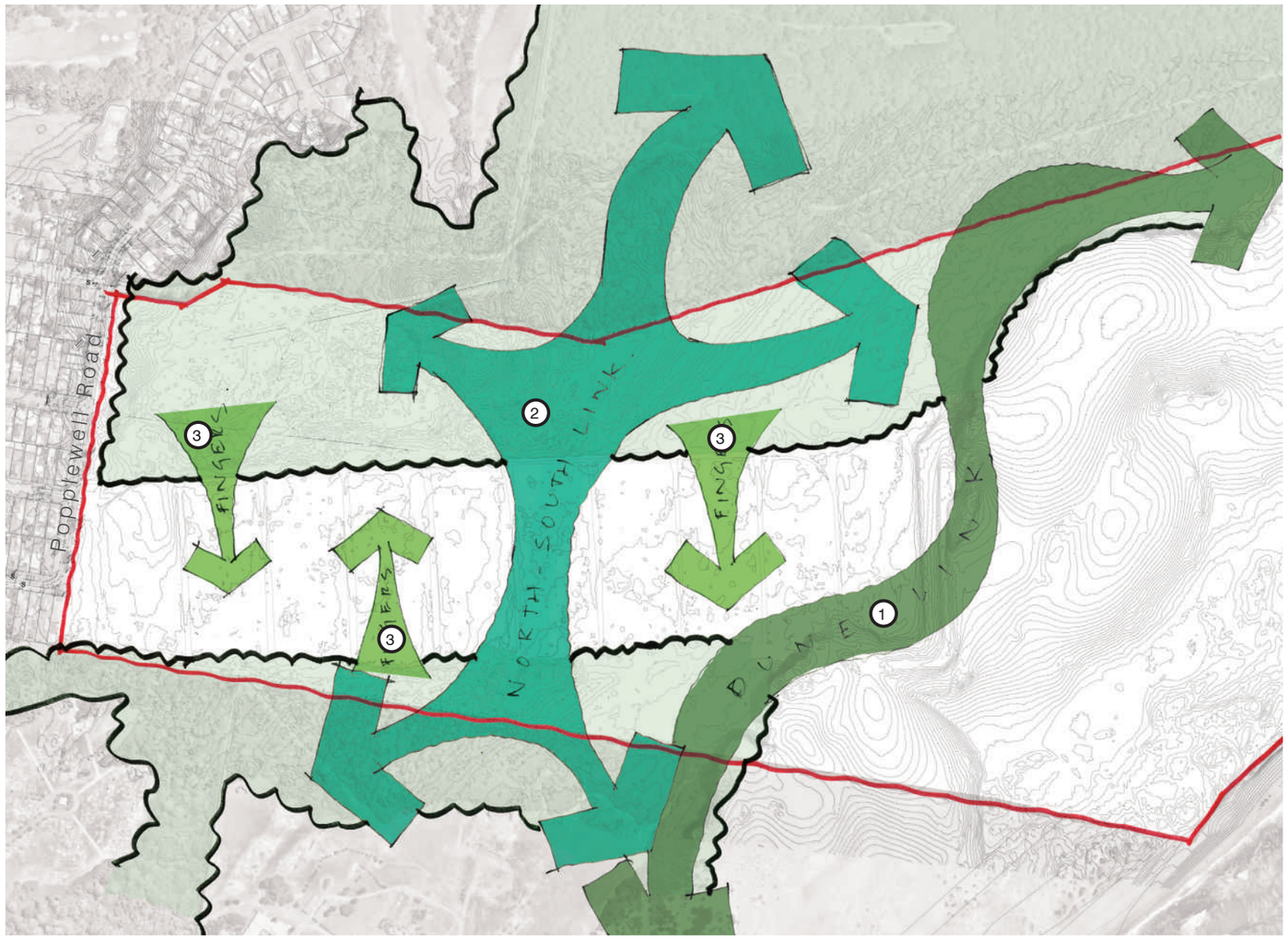
4. Buffer zone to the north of the old range to protect areas of archaeological potential.

5. Buffer zone adjacent to Popplewell Road to protect areas of Aboriginal archaeological potential.

Refer to the Urbis heritage report.

Image: Urbis

5.4 Ecology



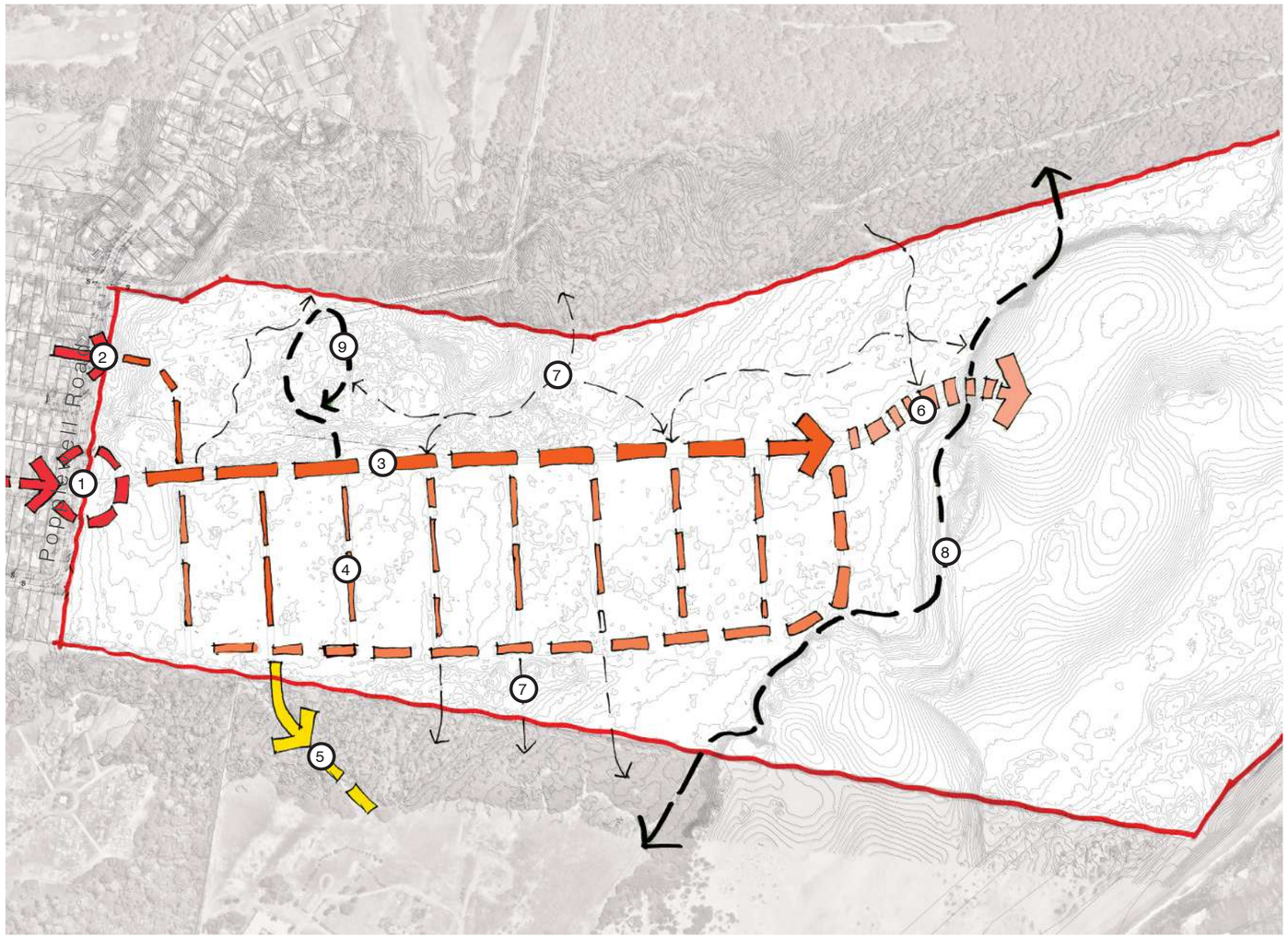
1. Opportunity to retain and enhance the north-south coastal dune ecology.

2. Potential to increase north-south ecological links through the site to connect the National Park land with isolated vegetation to the south.

3. Opportunity to encourage coastal vegetation communities into the future development site.

Refer to the Umwelt ecology report.

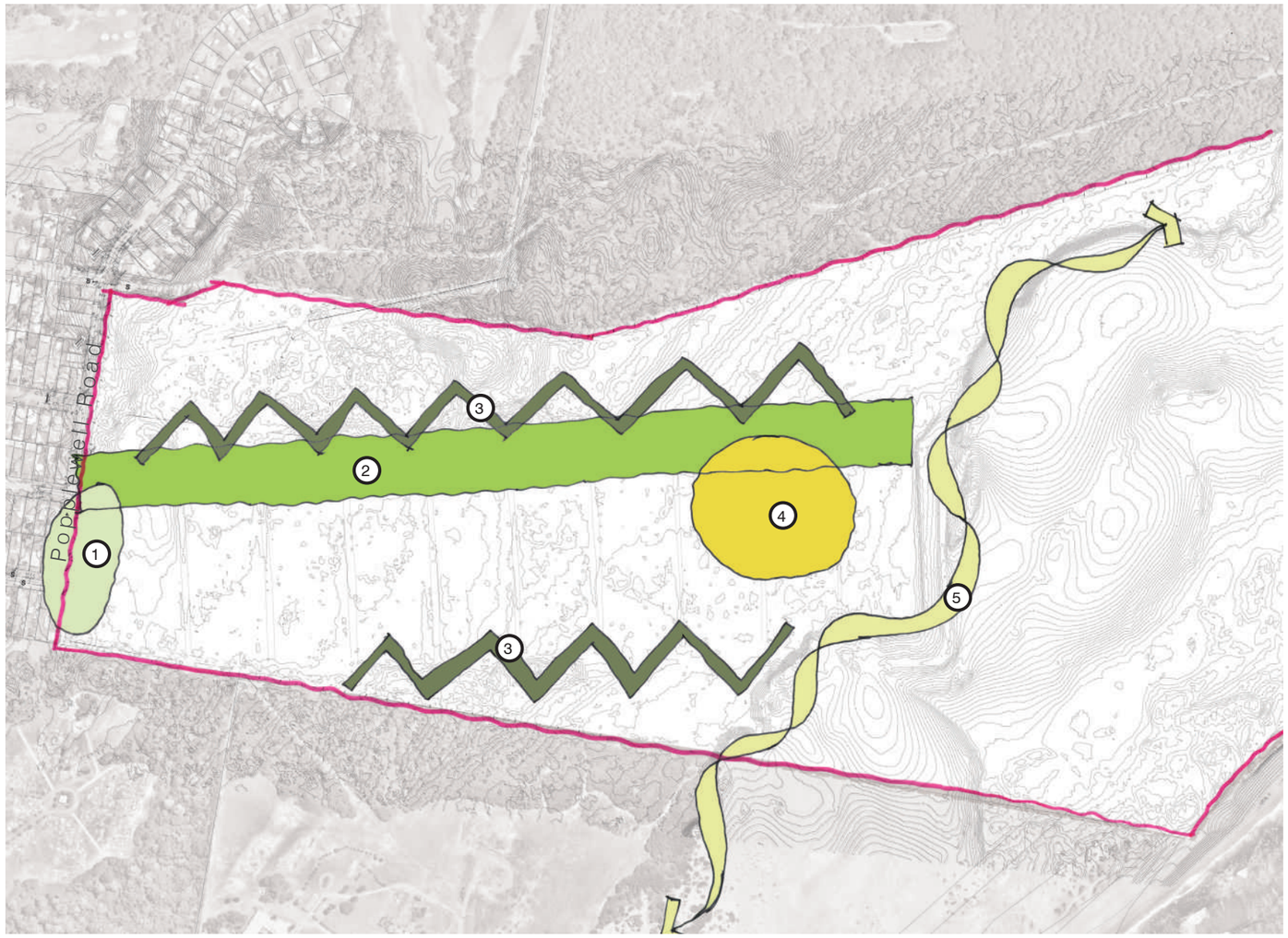
5.5 Access and circulation



1. Existing site access from Popplewell Road via Taylor Road.
2. Potential additional access point via Popplewell Road.
3. Potential use of existing rifle range layout/ tracks to create primary axis (vehicular and/ or pedestrian).
4. Potential use of existing rifle range layout/ tracks to create secondary street network.
5. Potential future connection into future development site (Stockton Centre) to the south.
6. Potential public dune access where existing informal access exists.
7. Pedestrian tracks/bush links to land to north and south.
8. Potential north-south pedestrian dune connection - could connect with Stockton to the south and Fern Bay to the north.

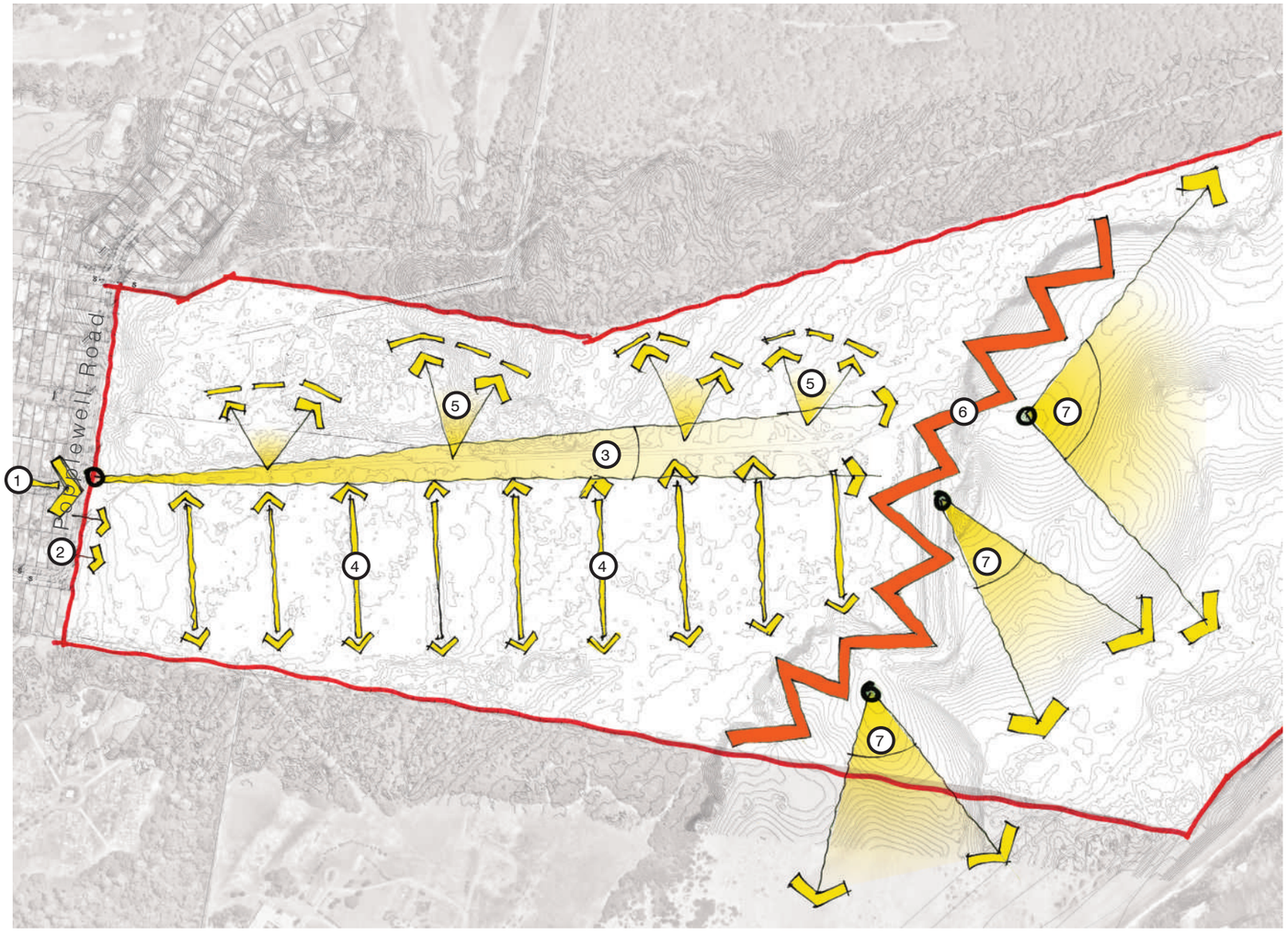
Refer to the Better Transport Futures report.

5.6 Landscape



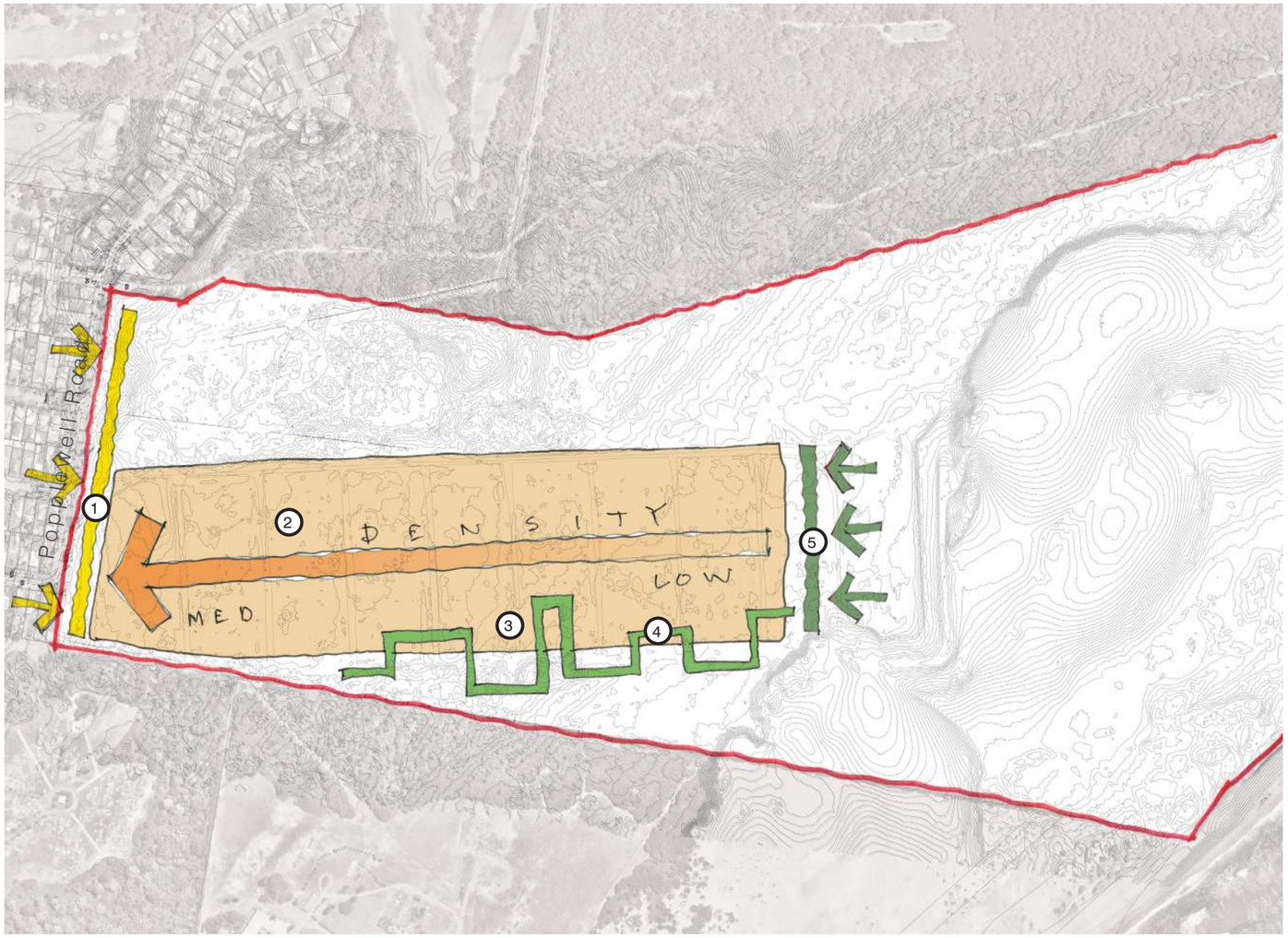
1. Potential for a landscape interface to Popplewell Street.
2. Consider a public domain/landscape link to the dunes and Stockton Beach.
3. Managed bushland edge to reinforce coastal character.
4. Consider a new public open space located within new development.
5. Potential north-south coastal dune link/bush walk/boardwalk.

5.7 Views



1. View along Taylor Road to site from Fullerton Street.
2. Short range views into the site from adjacent street and properties.
3. Long view east-west along rifle range to dunes and range target/'Stop Butt'.
4. View corridors north-south along range firing mounds.
5. Localised views north into existing bushland areas.
6. Major dune formations block views from the rifle range east toward the ocean.
7. Expansive elevated views over Stockton beach from tops of dunes.

5.9 Built form



1. Address the existing surrounding residential streets with the appropriate setback/built form.

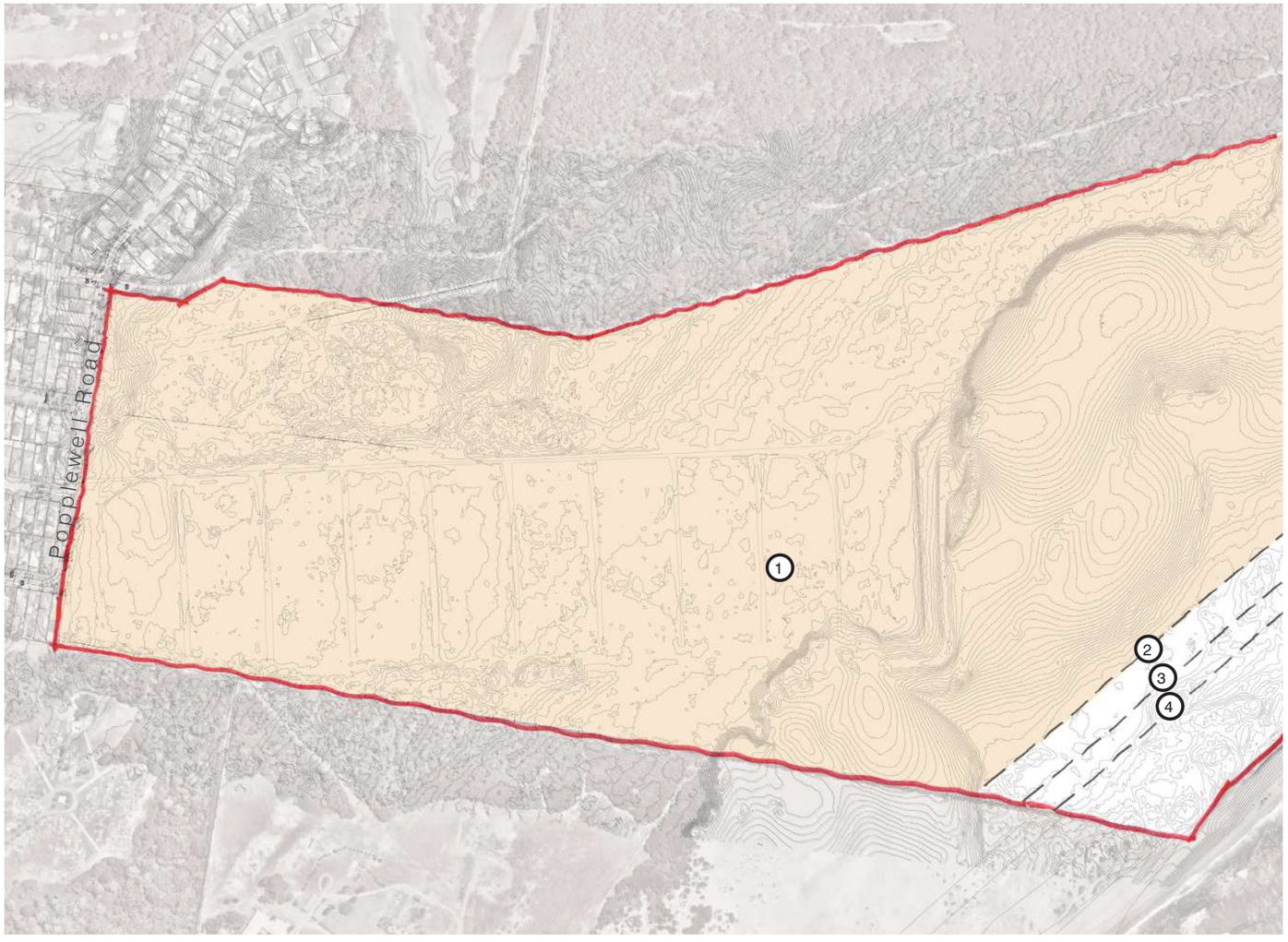
2. Utilise the disturbed flat areas of the rifle range for residential development.

3. Utilise housing typologies that sit lightly on the ground and require minimal earthworks - such as raised slab, steel frame construction.

4. Moderate the edge conditions to the surrounding bushland areas to increase ecological value and the sense of the coastal location.

5. Set the development back from the Dune environment to allow for ecological corridors and natural dune migration.

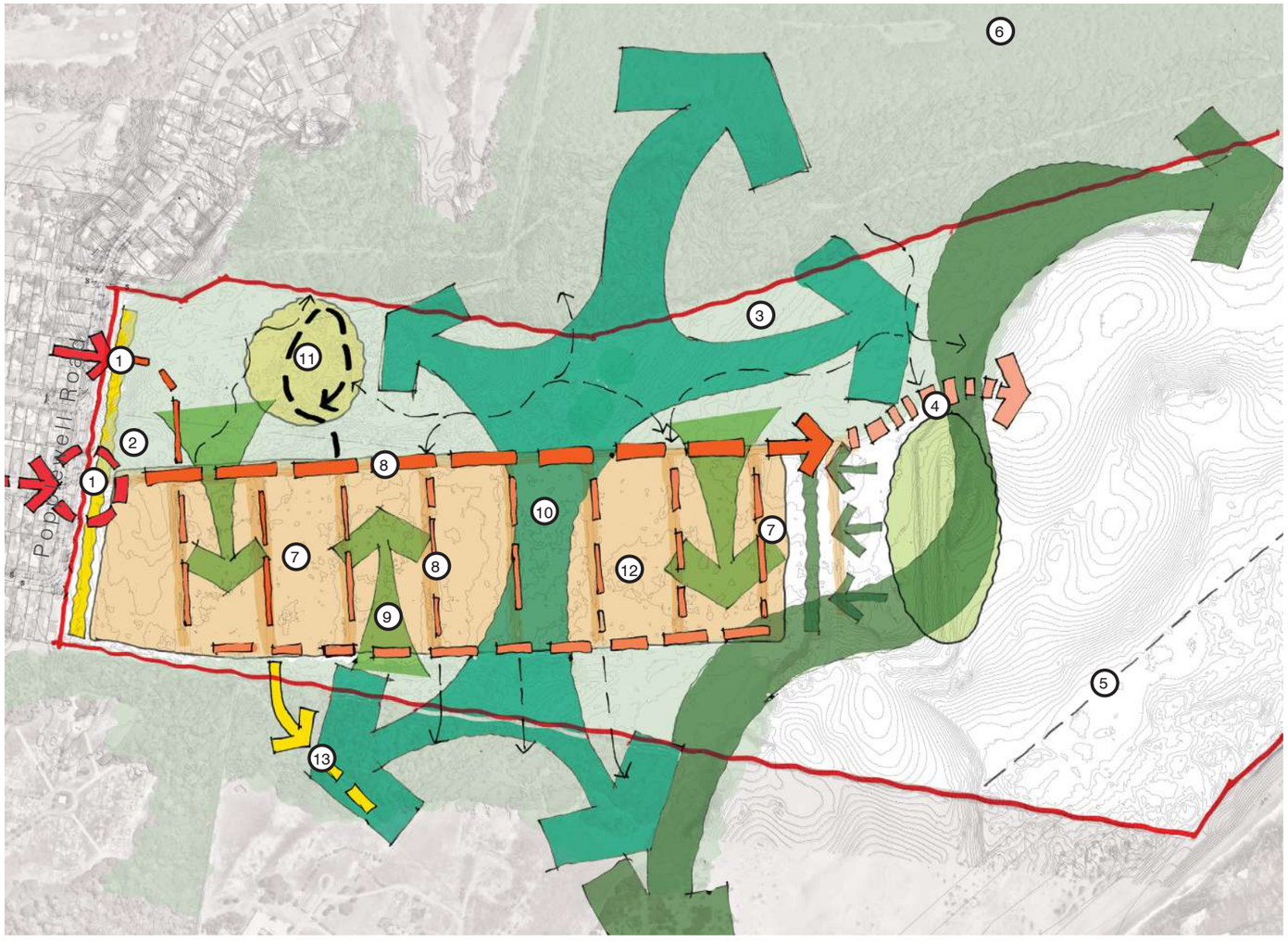
5.8 Coastal Erosion



1. Develop westward of the 'Best Estimate' 2100 Erosion Hazard Line
2. 'Best Estimate' 2100 Erosion Hazard Line (0.9m sea level rise)
3. 'Likely' 2100 Erosion Hazard Line (0.4m sea level rise)
4. 'Almost Certain' 2100 Erosion Hazard Line (No sea level rise)

Refer to the BMT WBM coastal engineering report.

5.10 Consolidated constraints and opportunities



1. Existing site access from Popplewell Road via Taylor Road. Potential second access point via Popplewell Road.
2. Opportunity for a landscape interface to Popplewell Road to provide a green setback to new development and protect areas of Aboriginal archaeological potential.
3. Existing vegetation communities retained and protected.
4. Opportunity to retain and replant the degraded north-south coastal dune ecology. Potential for a public domain link to Stockton Beach where existing informal access is located.
5. 'Best Estimate' 2100 Erosion Hazard Line (0.9m sea level rise).
6. Worimi Regional Park north of the site.
7. Potential development in disturbed areas free from significant vegetation, heritage items and medium/high/extreme potential coastal erosion risks. Set the development back from the Dune environment to allow for ecological corridors and natural dune migration.
8. Potential use of existing rifle range layout/tracks to create street network.
9. Opportunity to encourage coastal vegetation communities into the future development site.
10. Potential to increase north-south ecological links through the site to connect Worimi bushland with more isolated vegetation to the south. Opportunity for new public open space within the development.
11. Potential restoration and interpretation of the remnant anti aircraft battery. Opportunity to provide walking tracks for public access to the heritage site.
12. Adopt sensitive housing designs that are lightweight in appearance, have a strong coastal character and minimise changes to natural water flows and drainage.
13. Potential future connection into future development site (Stockton Centre) to the south.

The proposal

6 The master plan

6.1 The vision

Stockton Rifle Range and Fort Wallace will be unique coastal communities with strong links to Newcastle CBD and a growing Hunter region.

The communities will be a place where the natural coastal landscape prevails over the built environment and a rich layer of cultural heritage is celebrated and made accessible to the public.

New buildings will be contemporary in design and character, with references to traditional coastal forms and materiality. Development will 'touch lightly' on the ground and minimise impacts on the site.

6.2 Master plan principles

Touch lightly on the land

Buildings elevated (no slab on ground).

Streets to be to be as informal as possible (no kerb and gutter or avenue trees, informal parking).

Work with the existing natural topography to minimise earthworks (cut and fill).

Minimise areas of hard standing.

Create a diverse community

A mix of building typologies that provide for defence, private and affordable housing needs.

A range of open spaces that cater for a variety of resident requirements.

New recreation opportunities that appeal to visitors from Stockton, Newcastle and wider Hunter region.

Embrace the coastal ecology

Regenerate natural vegetation. Endemic sp. only.

Buildings sit within the natural landscape and vegetation.

Minimise private open space and boundary fences.

Maximise views to the ocean, dunes, river and the bush.

Manage beach access to avoid further dune erosion.

Open the gates to the public

Provide public access via the local road, pedestrian and cycle networks.

Explore opportunities for improved public transport links to Newcastle CBD.

Establish new controlled pedestrian access to Stockton Beach and dune system.

Connect to greater public domain and open space networks eg Anzac Memorial Walk

Celebrate history and cultural heritage

Retain heritage structures as site features where ever possible.

Interpret the site history through its landscape.

Explore opportunities to connect with the Worimi reserve.

Utilise interesting architectural forms

Staggered building heights.

Natural materials and finishes.

Articulated façades.

Vaulted and skillion roofs.

Varied street setbacks

6.3 Indicative master plan

The indicative master plan for Rifle Range demonstrates a best practice outcome within the proposed LEP controls. The master plan responds to the site's natural and historic constraints, proposes a diverse mix of housing to accommodate a real community and includes high quality public open space and streets.

The master plan respects the site's unique history and environmental character by reducing the development footprint to areas of the site with relatively few constraints. Rather than covering the site with low density development, the master plan proposes more energy efficient, environmentally-sensitive and higher density development with a smaller development footprint. Significant vegetation communities and historic elements will be retained and opened up to the public for their use and enjoyment.

The development will feel distinctly public, with access for all to streets, open space and the beach, as opposed to a gated community.

The development will be highly walkable and well vegetated throughout. Housing will generally recede into the landscape, allowing the natural environment to dominate.

The master plan envisages housing that not only nestles into the landscape but also responds to the site's coastal landscape character. Buildings will vary in height and type but all will adopt a coastal architectural vernacular and use natural materials and finishes typically found in coastal settings, such as timber, corrugated aluminium and natural stone.

The new community at Rifle Range will benefit from the unique and special qualities of the site but the wider public will benefit also through development of the site. Historic relics will be conserved, new public open space provided and existing vegetation communities will be protected and enhanced. The public realm and housing will be attractive, responsive to the locale and robust in design and construction.

Indicative Master Plan

7

Public domain

Incorporate robust local materials

Use timber, concrete, stone, gravel, steel and other locally available materials that relate to the site's coastal setting.

Select materials that are durable and lower maintenance.

Enhance habitat

Select indigenous plant species to encourage local fauna.

Where practical plant native shrubs and native grasses in place of turf.

Protect existing dune areas from walking and trampling through fencing and sigange.

Create a green canopy

Reduce ambient air temperatures through generous planting of street trees and shade trees in public spaces.

Ensure trees have sufficient area for root growth when planted next to streets and footpaths.

Create a public place

Design streets to feel public and accessible to all.

Avoid use of estate-style landscape elements such as entry walls and domestic landscape materials.

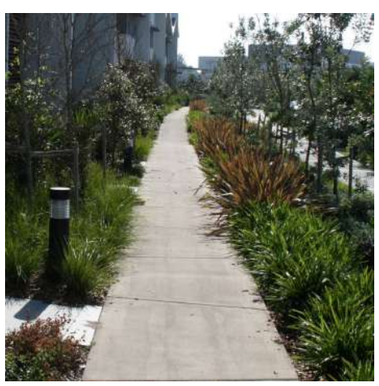
Encourage the public to walk and cycle through the development by providing pathways and signage.

Maximise natural drainage

Maximise soft areas and use of permeable materials with high infiltration rates.

Use planted swales to collect and cleanse stormwater.

Minimise road area and consider use of permeable road materials.



Promote safety

Provide pedestrian and vehicle lighting.

Maintain clear sight lines.

Maximise passive surveillance by encouraging walking and outdoor activity.

Select non-slip materials and finishes.

Indicative Landscape Master Plan

LEGEND

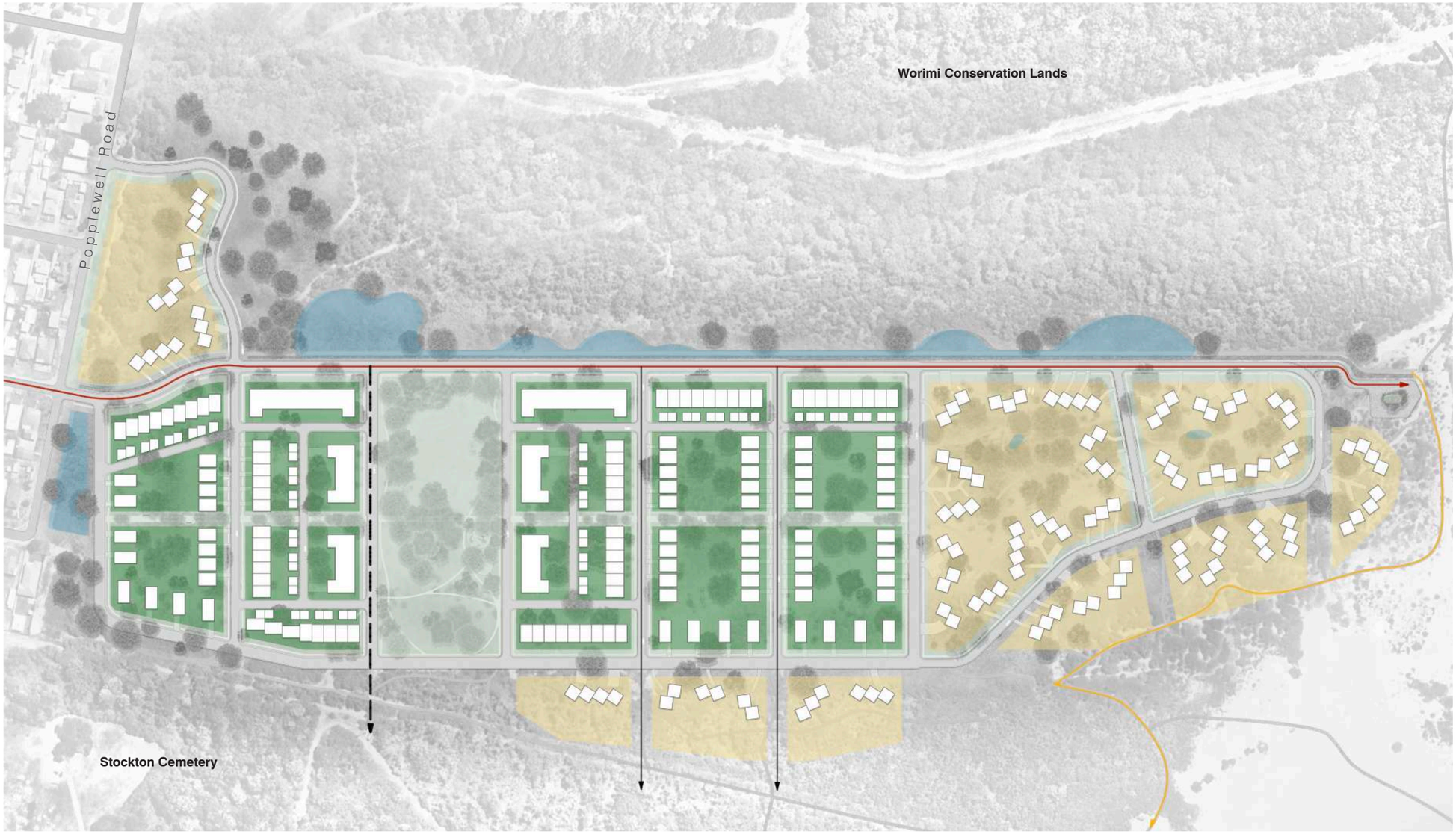
01/ Extended road network from existing neighbourhood
02/ Cluster Homes
03/ Single Eco Home
04/ Courtyard Homes
05/ Townhouses
06/ Dune Apartments
07/ Central access spine (shared path)
08/ Shared path to dunes
09/ Vegetated detention basin
10/ Community park
11/ Potential play area
12/ Firetrail / bushwalk
13/ Dune boardwalk
14/ Dune access car park
15/ Worimi Conservation Lands

Scale:1:2000 @ A3

0 50 100m

ARTIST'S IMPRESSION OF THE PROPOSED DEVELOPMENT

Landscape hierarchy



LEGEND

- Public open space
- Private open space
- Communal open space
- Stormwater detention
- Dune boardwalk / footpath
- Site entrance - connection to beach and dune lookout
- Connection to Stockton Town Centre
- Potential future vehicle connection to Stockton Town Centre

Scale:1:2000 @ A3

0 50 100m

7.1 Community Interface

Permeable Edges

The Rifle Range development will tie into the neighbouring community fabric through an extension of the existing road network and infrastructure. A permeable edge condition will be achieved through clear sightlines, foothpaths, and trails. Within the new Rifle Range community planting and firebreaks will delineate property boundaries rather than fences and other hard barriers. The intent is to create a neighbourhood character that emphasizes qualities of connectedness, community, and integrated with the surrounding bushland and coastal ecology.

Key Features

01/ Shared path to dunes

02/ Vegetated stormwater detention basin

03/ Extension of existing road infrastructure

04/ Central pedestrian access spine

05/ Firetrail / bushwalk

Scale:1:1000 @ A3

0 25 50m

Community Interface section

Indicative planting palette

Swamp Mahogany
Eucalyptus robusta

Tukeroo
Cupaniopsis anacardioides

Red Gum
Angophora costata

Old Man Banksia
Banksia serrata

Kangaroo Grass
Themeda australis

Eggs and Bacon
Dillwynia retorta

Flax Lily
Dianella caerulea

Scale:1:300 @ A3
0 5 10m

7.2 Community Park

Community Park

The public parklands emphasize openness, flexibility, and principles of “nature play” through the selection of play facilities, materials, and native planting palette. A large, open field will be complemented by picnic areas and shade structures constructed of natural materials and situated within the coastal heath landscape. These structures will provide spaces for community gathering and passive recreation near the centre of the Rifle Range development. The large field can be used for a range of activities, such as picnics, dog walking, organised sports, and outdoor exercise. Feature trees and native planting will provide cover from the sun. Robust, low-maintenance plants and flowers will blend play areas into the surrounding coastal heath landscape.

Key Features

01/ Open lawn / field to accommodate potential sports uses

02/ "Nature play" playground

03/ Picnic area and shelters

04/ Feature tree planting

05/ Central access spine

06/ Neighbourhood access to walking trail

Scale:1:1000 @ A3

0 25 50m

Community Park section

Indicative planting palette

Swamp Mahogany
Eucalyptus robusta

Tukeroo
Cupaniopsis anacardioides

Red Gum
Angophora costata

Old Man Banksia
Banksia serrata

Coastal Tea Tree
Leptospermum laevigatum

Pigface
Carpobrotus glaucescens

Hardscape palette

Stabilized sand path

Oyster shell aggregate concrete

Timber boardwalk

Timber shade structure

Scale:1:300 @ A3

0 5 10m

7.3 Great Streets

Key to great urban environments and places are great streets. Streets connect our communities and our homes, provide us with essential services for living, and present everyday opportunities for exercise and socialising.

Designing streets for people

The Master Plan envisages several types of streets that respond to future access requirements and the existing street network on the site. All streets will be:

- Publicly accessible, with footpaths and wayfinding signage.
- Well vegetated with local plant and tree species.
- Low-key and informal in appearance.
- Designed to accommodate all modes of transport (cars, pedestrians and bicycles)
- Designed appropriately for emergency and council maintenance vehicles.

The following pages show indicative designs and locations for the each type of roads within the proposed development. The designs will be the subject of further review and adjustment as the project progresses and information becomes available.

Road hierarchy

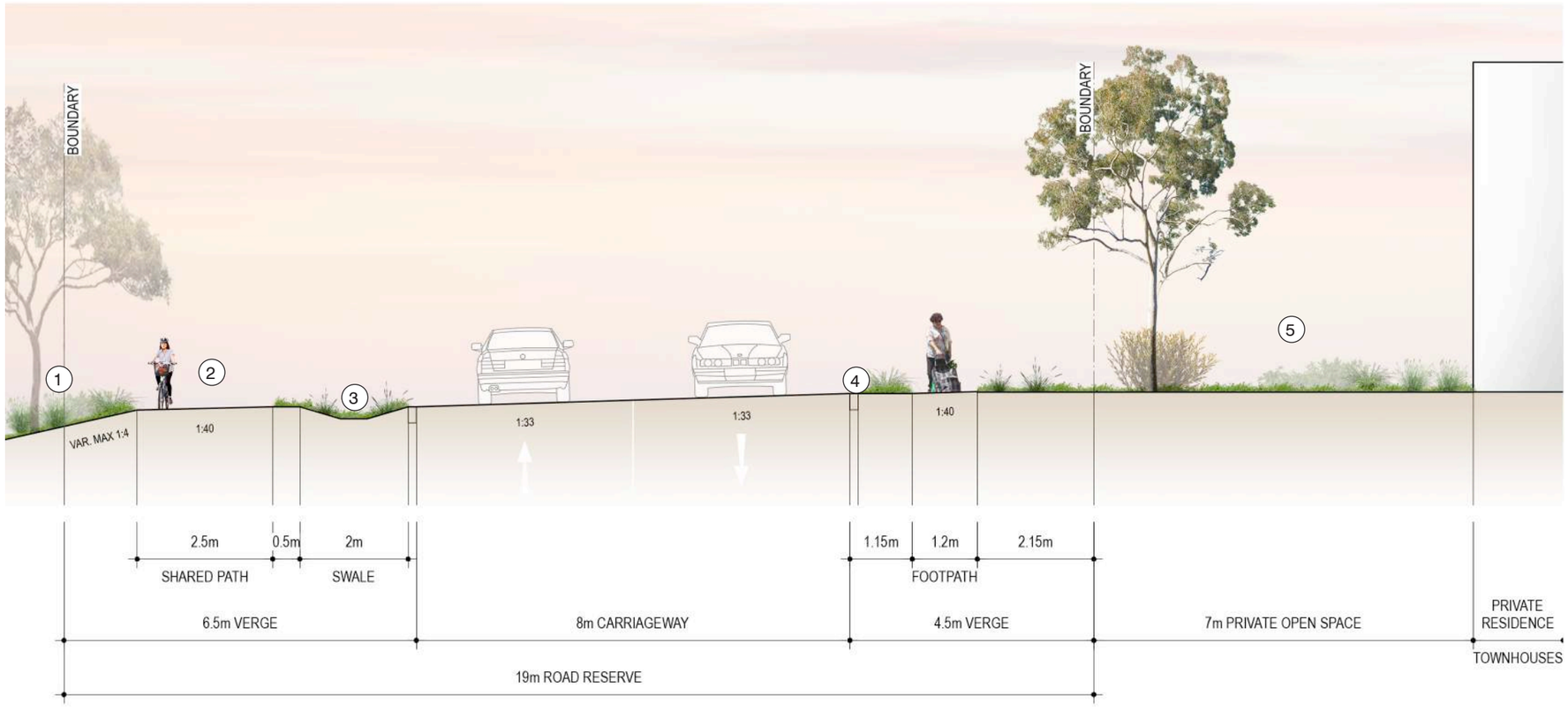
LEGEND

- Road Type #1
- Road Type #2
- Road Type #3
- Road Type #4
- Road Type #5
- Road Type #6

Scale:1:2000 @ A3

0 50 100m

Road type 1 section



01/ Slope to drainage basin

02/ Shared path

03/ Kerbside vegetated swale

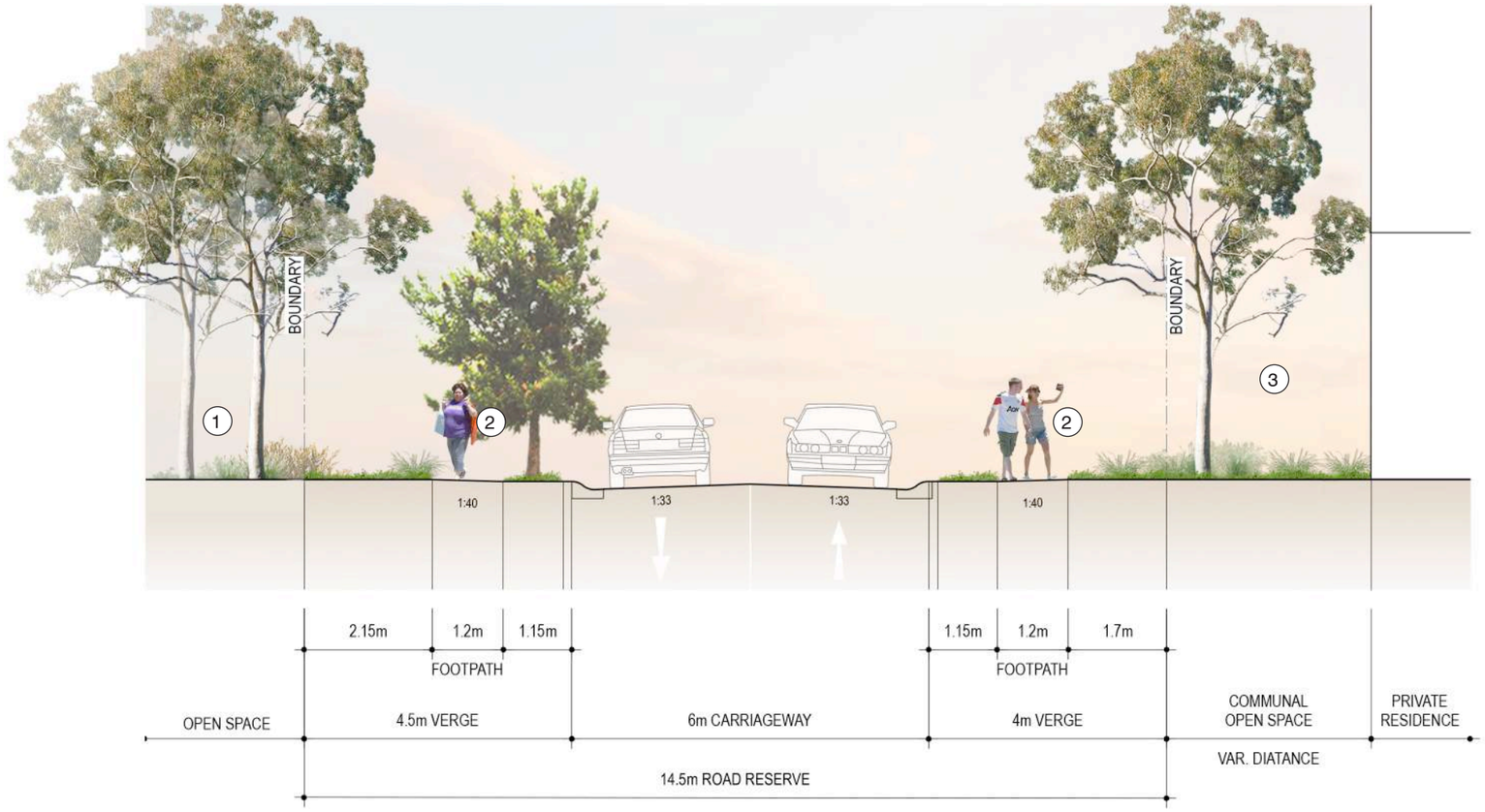
04/ Flush kerb

05/ Private yard (Single Eco Home)

Scale:1:200 @ A3

0 1 2 3m

Road type 2 section



01/ Open space

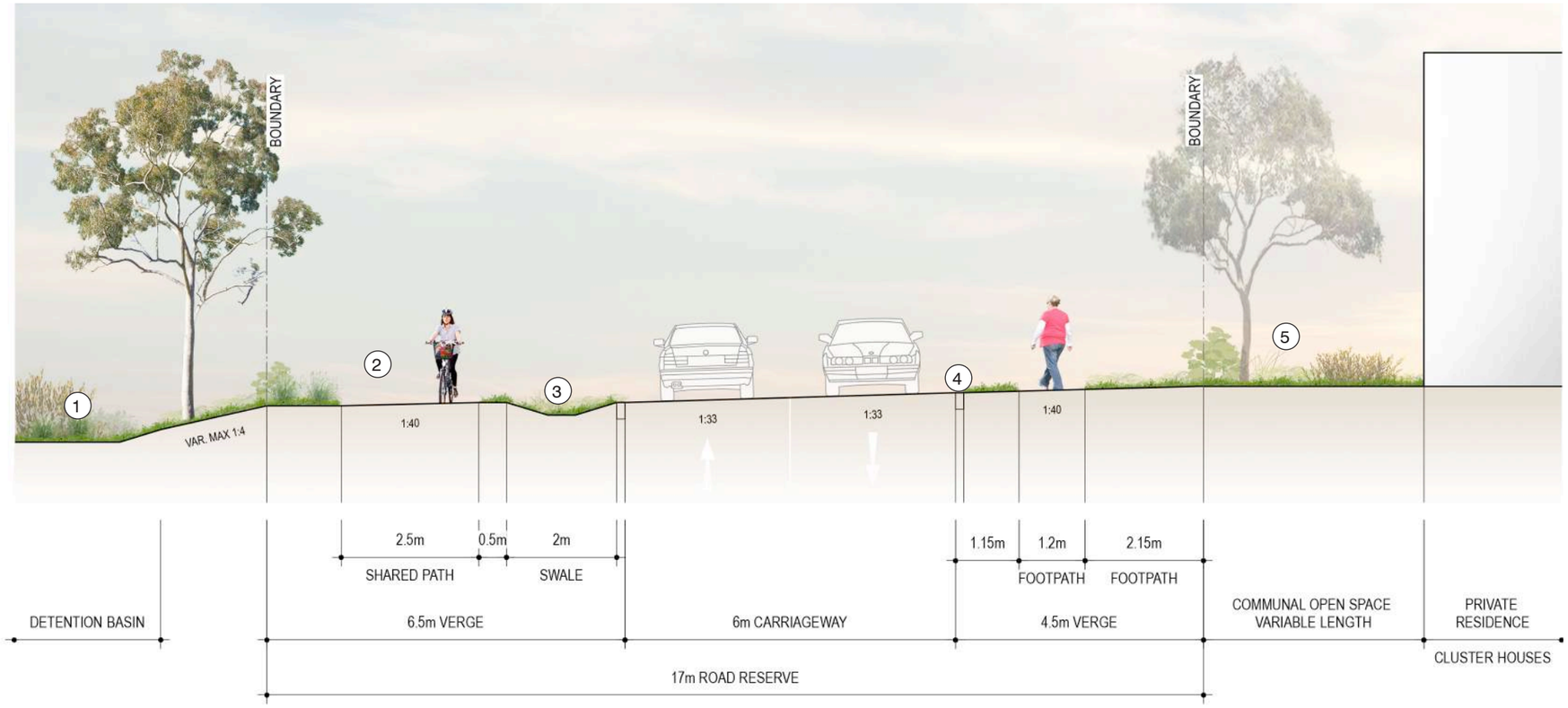
02/ Footpath

03/ Eco Home / Dune Apartments

Scale:1:200 @ A3

0 1 2 3m

Road type 3 section



01/ Slope to drainage basin

02/ Shared path

03/ Kerbside vegetated swale

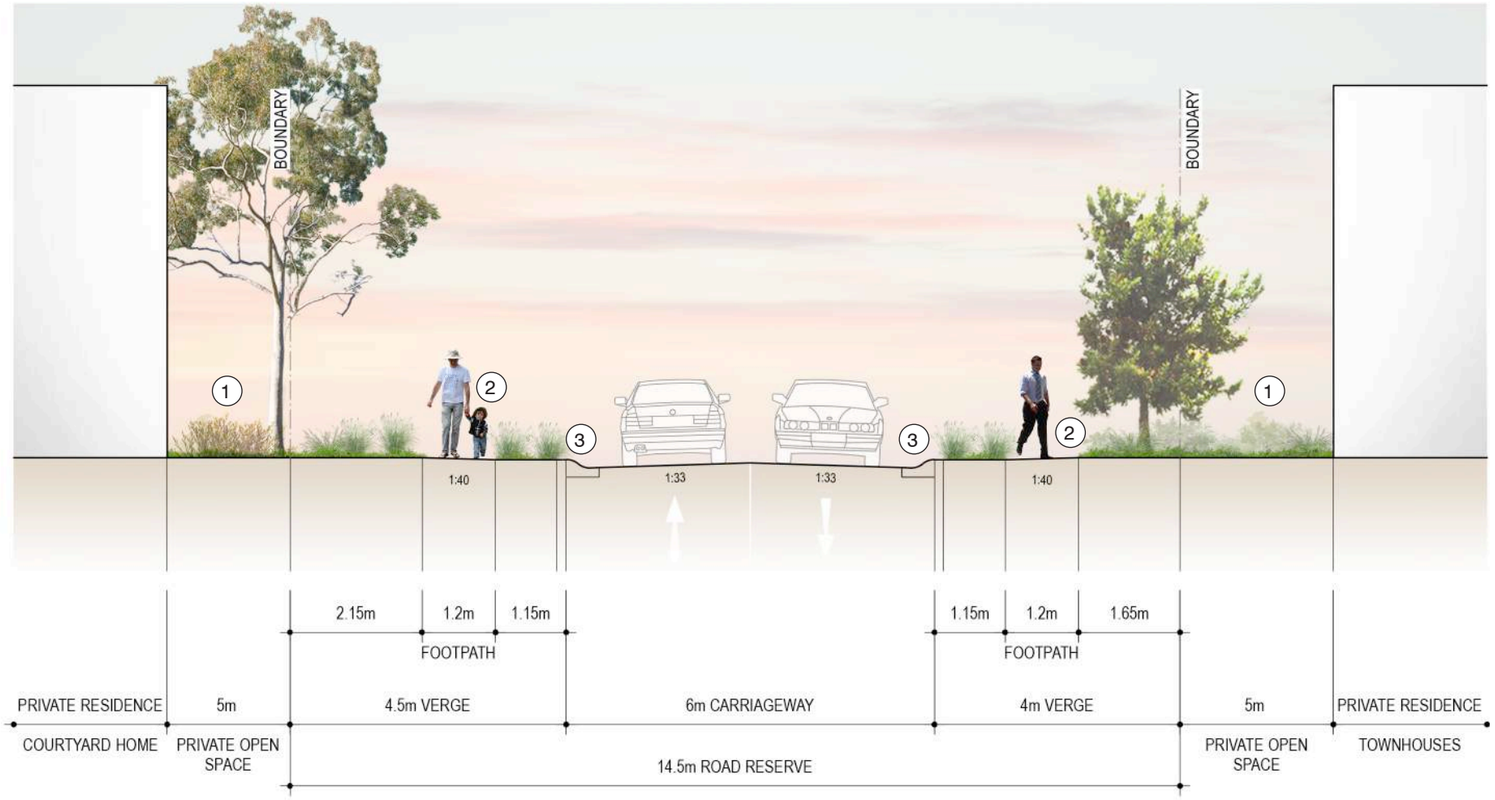
04/ Flush kerb

05/ Private yard (Single Eco Home)

Scale:1:200 @ A3

0 1 2 3m

Road type 4 section



01/ Private open space

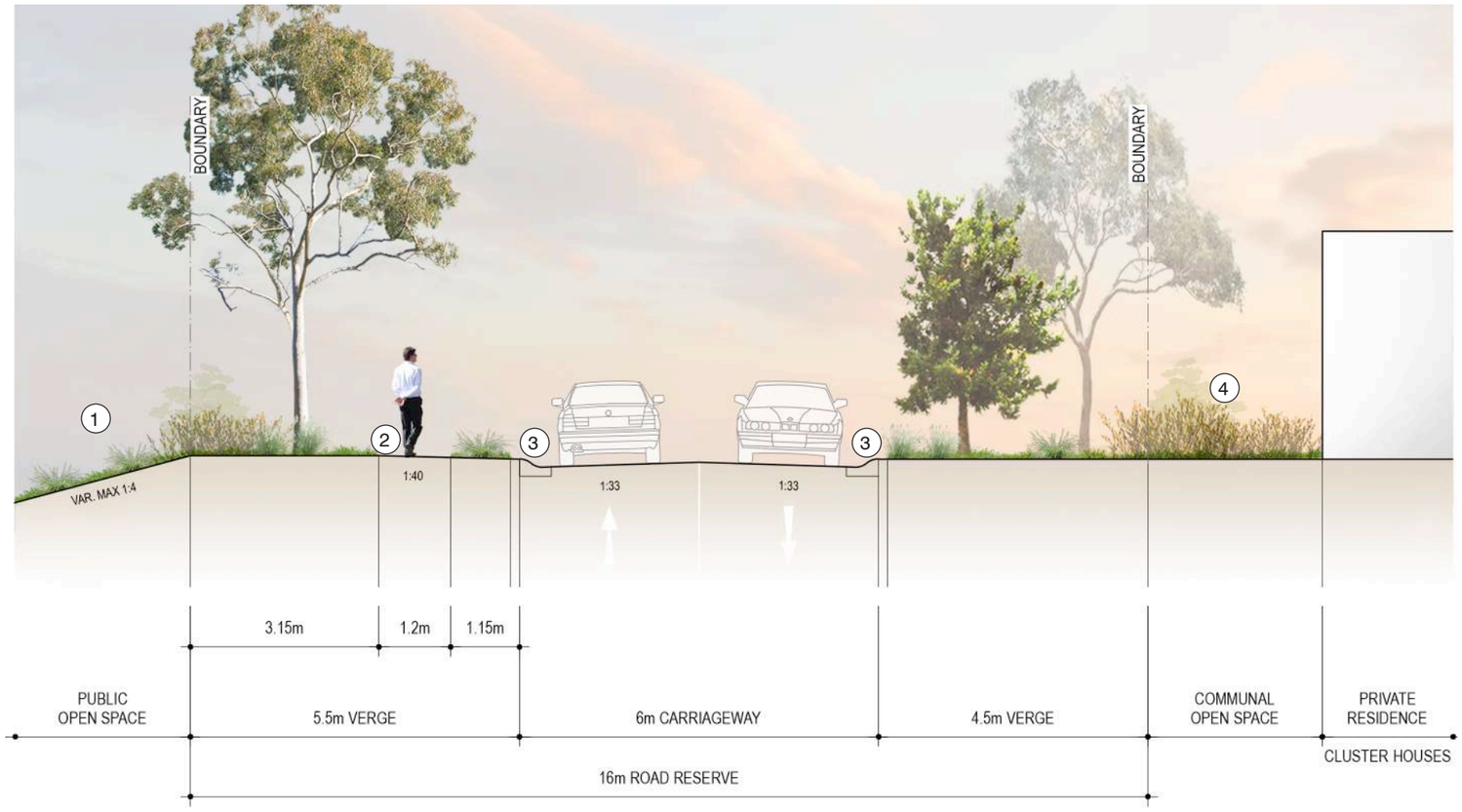
02/ Footpath

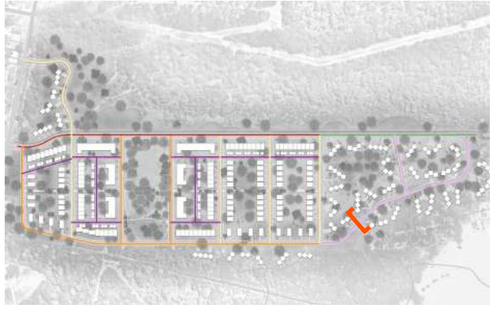
03/ Roll kerb

Scale:1:200 @ A3

0 1 2 3m

Road type 5 section





01/ Public access to parklands

02/ Footpath

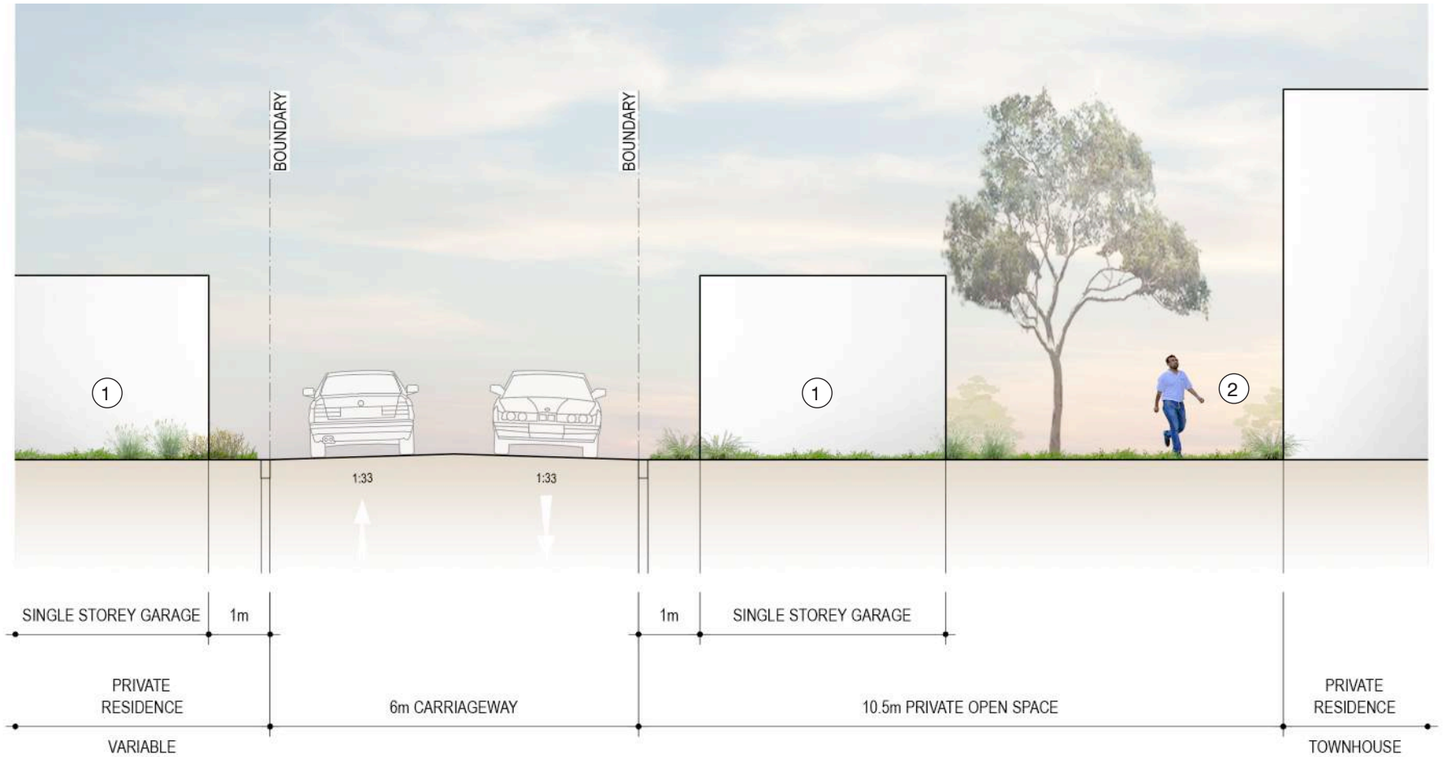
03/ Roll kerb

04/ Communal open space (Cluster Houses)

Scale:1:200 @ A3

0 1 2 3m

Road type 6 section



01/ Indicative single storey garage structure

02/ Private yard (Townhouse)

Scale:1:200 @ A3

0 1 2 3m

8 Master plan housing mix

The design principles set out in the previous section were used to develop a range of residential typologies that would respond to the unique nature of the site. While these typologies are used only to inform the structure of the master plan, it is intended that the key outcomes of the the typologies will be established in a site specific to guide the future development of the site.

Four dwelling typologies have been developed to support the master planning of the site. The typologies demonstrate how the design principles can be achieved in a range of densities in order to deliver a diversity of housing on the site, including dwelling size, configuration and tenure.

The typologies include coastal cluster homes, single eco-homes, courtyard homes, and townhouses / row houses.

The key features of each dwelling type, including approximate heights, density, materials and sustainability mechanisms have been set out on the following pages. Indicative floor plans and lot plans have also been developed to show how the typologies could achieve the requirements of the market.

Single eco-homes

Currawong - Pittwater, NSW - by Architectus

Lake Crackenback, NSW

Coastal cluster homes

Bundeena masterplan - by Architectus

Courtyard homes

Little Bay, NSW

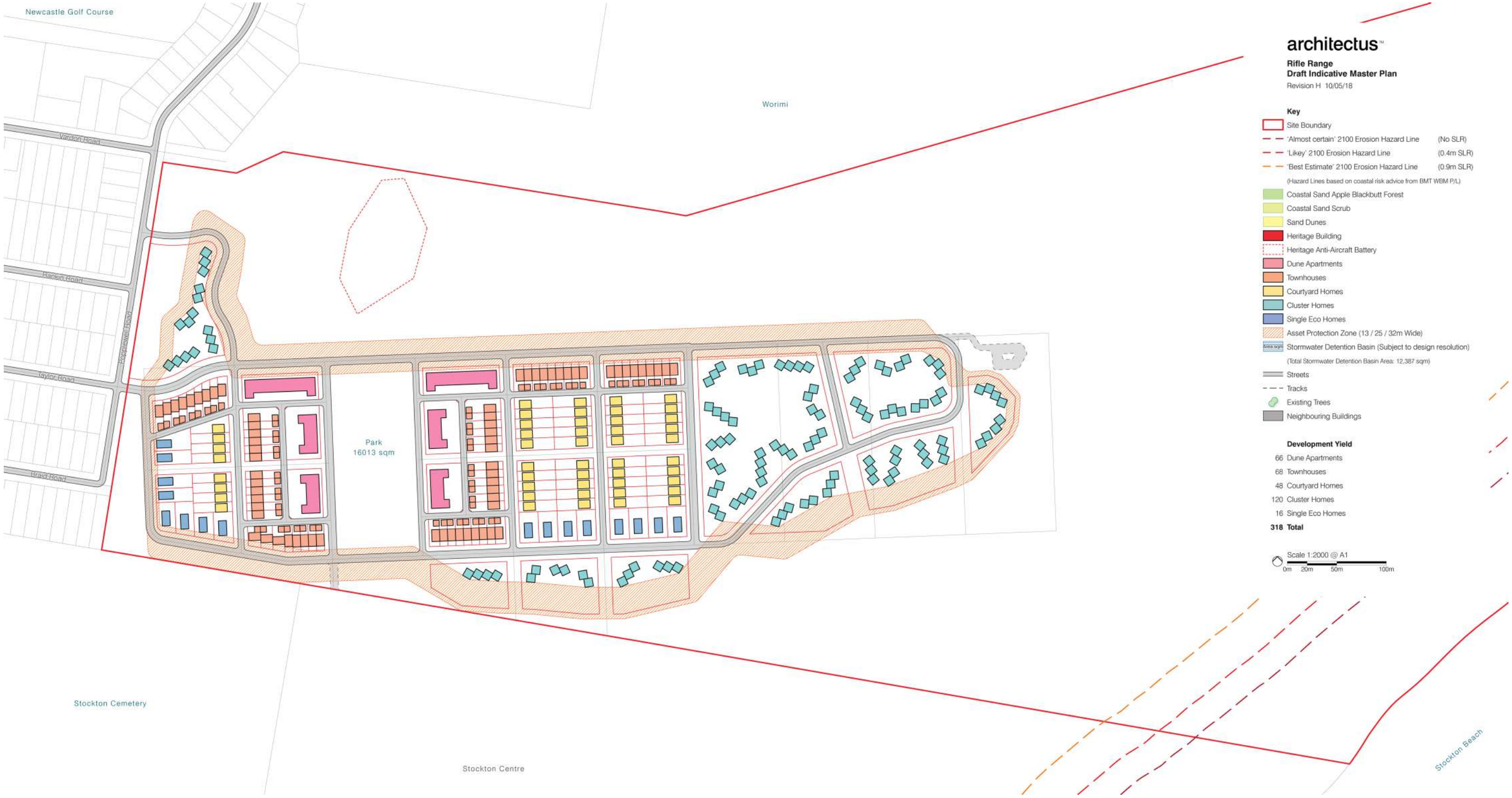
Townhouses / row houses

Tubbs View + Hamilton Corner, Lindfield NSW - by BatesSmart

Dune Apartments

Viridian Noosa Residences - by JMA Architects

Indicative Housing Typology Diagram



8.1 Coastal cluster homes

Description: This dwelling typology provides an alternative to traditional towns houses or attached houses. By breaking down the layout into clusters of 2,3 and 4 they provide views through the development to natural to the bush and increase the sense of a connection with the surrounding landscape.

Building heights: 2 Storey

Dwelling Size: 3 bed = 120m^2

Approx density: 20-30 dw/ha

Construction: Steel or timber frame with suspended composite concrete slab, skillion/vaulted roof.

External materials: Combination of corrugated metal sheet, timber panel cladding.

Sustainability: Passive solar design, locally sourced materials, naturally ventilated, high thermal performance, rain water harvesting, solar PV cells, minimise cut and fill, native drought tolerant species.

Bundeena masterplan - by Architectus

Typical layout 1:750

Outer Protection Area (OPC) - this area is outside the lot boundary and is to be managed an maintained by the local authority to RFS specifications (maximum tree cover 30%).

Inner Protection Area (IPC) - this area is within the lot boundary and is maintained as part of the communal landscape area in accordance with RFS specifications (maximum tree cover 15%)

Fire Trail - a 6m gravel fire trail is to be located within the OPC

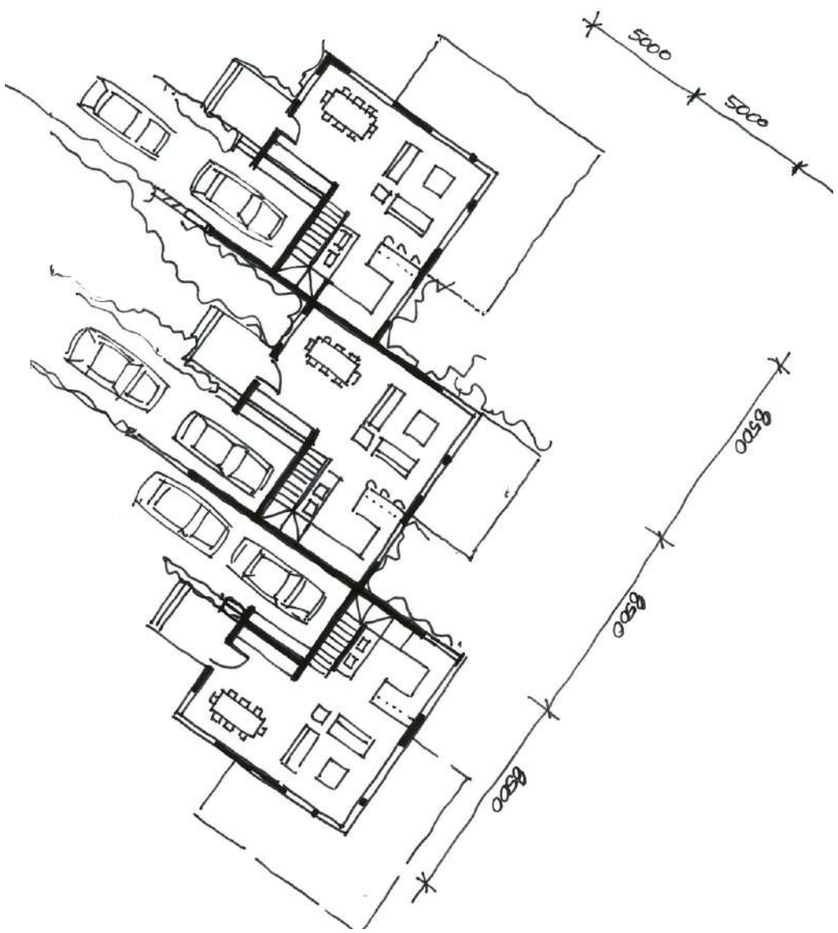
Parking - All dwellings will have a car port or parking space with additional storage space to meet DHA requirements.

Lot boundaries - lot boundaries are to be defined with vegetation only. In general each lot will contain 3-6 dwellings which will take on collective responsibility for the maintenance of the communal open space areas.

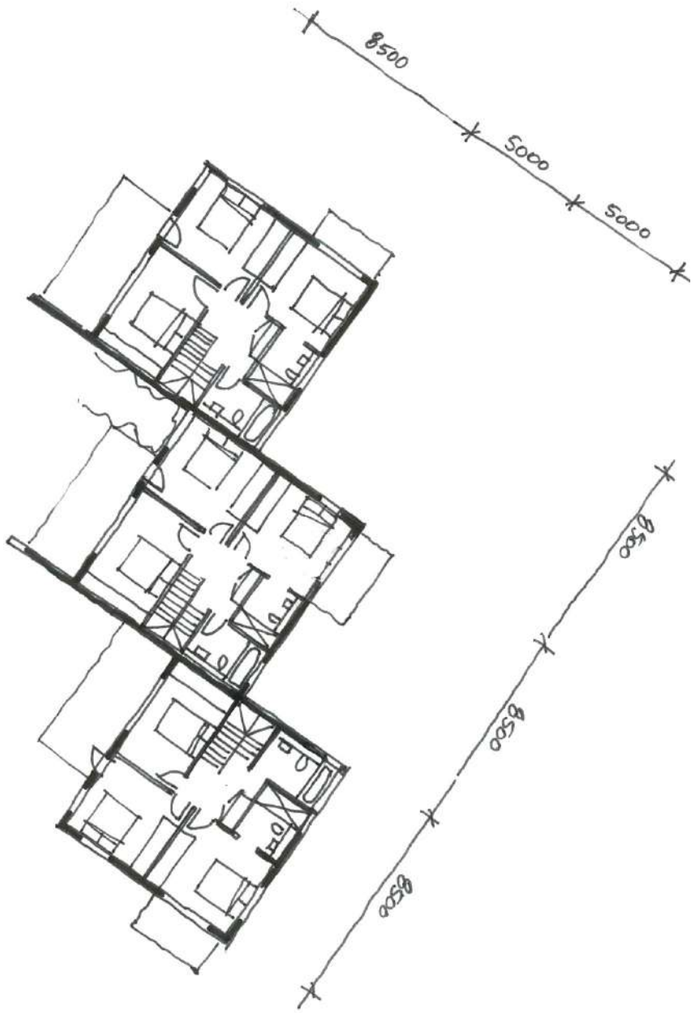
Communal open space - These areas are to be maintained as native bush gardens with contributions from each of the dwelling owners.

Private open space - A principle private open space is to be a minimum 35m^2 and maximum 50m^2. Fencing to contain pets is allowed but is restricted to 1.2m high timber post and wire mesh with native shrub planting to help reduce its visual impact.

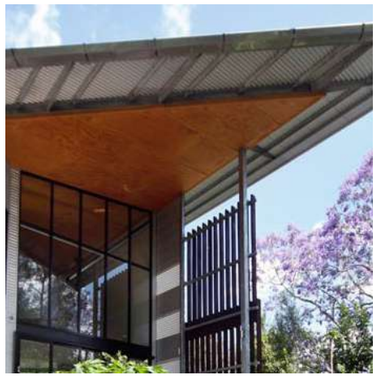
Indicative ground floor plan 1:250



Indicative first floor plan 1:250



Indicative exterior finishes



Indicative dwelling sizes (exc external space):

3 bed = 110m^2

1:250 @ A3

0 1 2 5 10m

CLUSTER HOUSES WILL NESTLE INTO A LANDSCAPE OF LOCAL NATIVE PLANT SPECIES

8.2 Single eco-homes

Description: These homes are intended to be lightweight, climate responsive individual homes set within generous lots that are managed and maintained to contribute to the overall natural characteristics of the site.

Building heights: 1-2 Storey

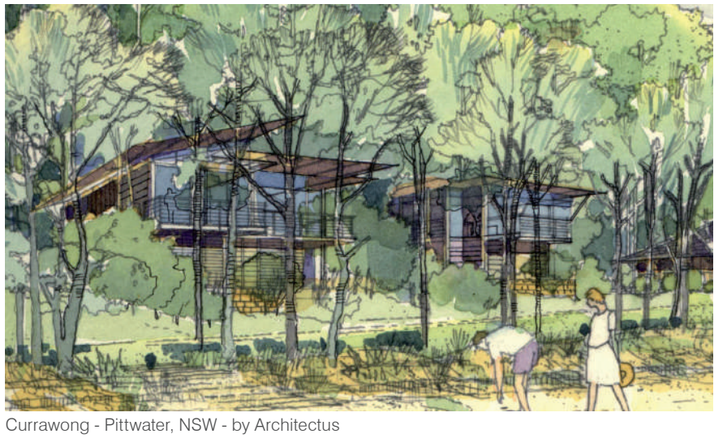
Approx density: 10-12 dw/ha

Construction: Steel or timber frame with suspended composite concrete slab, skillion/vaulted roof.

External materials: Combination of corrugated metal sheet, timber panel cladding.

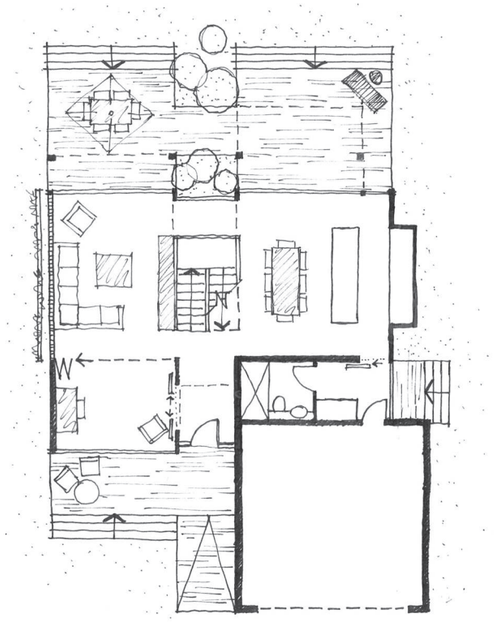
Sustainability: Passive solar design, locally sourced materials, naturally ventilated, high thermal performance, rain water harvesting, solar PV cells, minimise cut and fill, native drought tolerant species.

Murrays Beach - Lake Maquarie

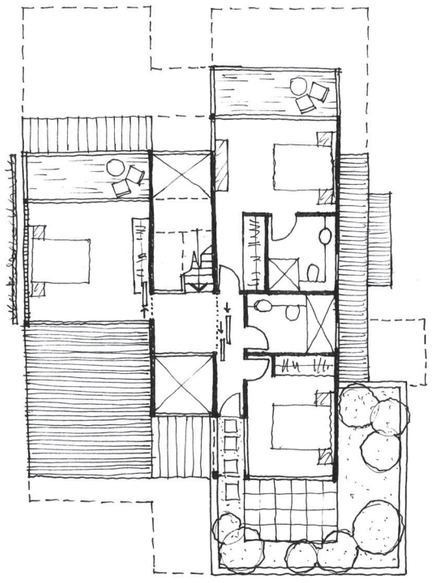


Currawong - Pittwater, NSW - by Architectus

Indicative ground floor plan 1:200



Indicative first floor plan 1:200



Indicative dwelling sizes (exc external space and garage): 3 bed = 160m²

Indicative exterior finishes

1:200 @ A3

0 2 4 10m

8.3 Courtyard homes

Description: This typology provides for a large family home including 4 bedrooms, 3 bathrooms, open plan living space, single garage and an ample rear garden. Dwellings are to be constructed on a zero lot line always on the same side with a 1.5m setback along the opposite boundary. This allows for a side pathway to access the rear garden and improves natural light and ventilation for the dwelling.

Building heights: 2 Storey

Lot Size: 380m^2 Dwelling Size: 4 Bed 200m^2

Approx density: 20 dw/ha

Construction: Steel or timber frame on concrete slab, skillion/vaulted roof.

External materials: Combination of corrugated metal sheet, timber panel cladding and rendered masonry.

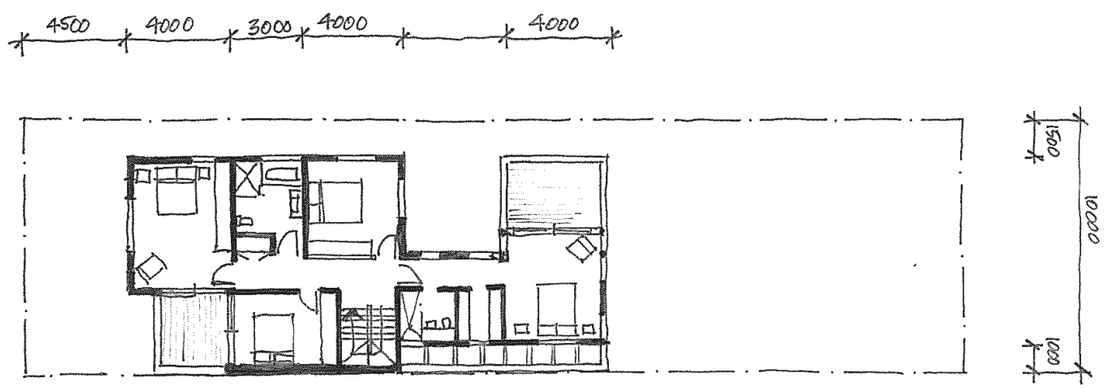
Sustainability: Passive solar design, locally sourced materials, naturally ventilated, high thermal performance, rain water harvesting, solar PV cells, minimise cut and fill, native drought tolerant planting.

Little Bay, NSW

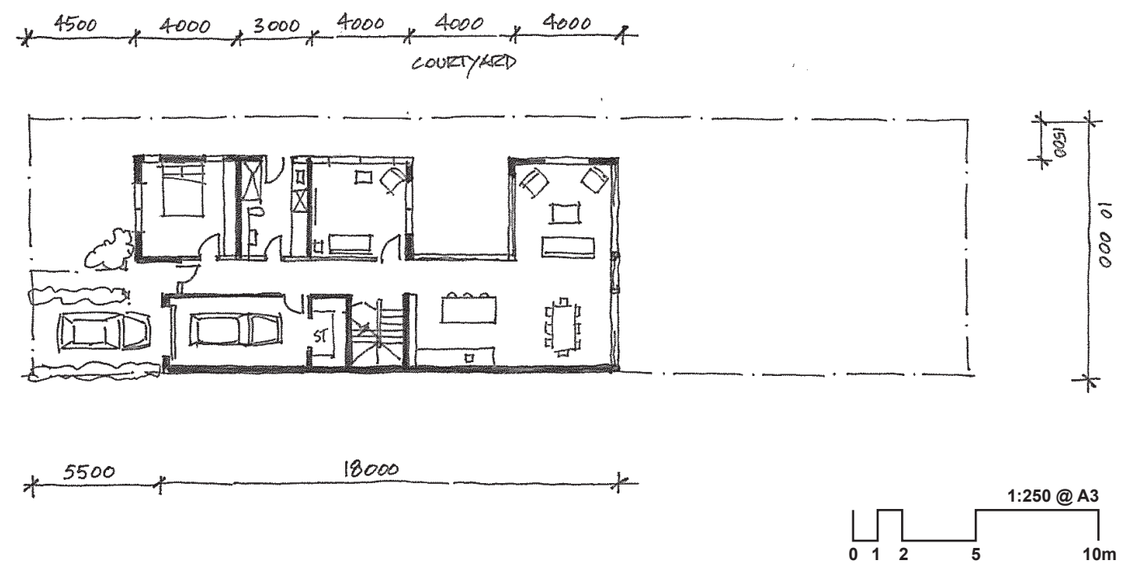
Little Bay, NSW

Example courtyard space

Indicative first floor plan 1:250



Indicative ground floor plan 1:250



8.4 Townhouses / row houses with ‘fonzie flat’ (rear lane access)

Description: These 3 bedroom homes provide a compact attached dwellings in locations where increased densities are appropriate. The rear lane access allows the front elevation of the house to be free from garage doors and parked cars which promotes good passive surveillance and an attractive street frontage. Above the rear double garage it is possible to have a secondary dwelling or ‘Fonzie Flat’ that provides a self contained studio apartment that can provide additional family or guest accommodation, home occupation or rental return. The ‘fonzie flat’ also activates the laneway increasing safety and security through passive surveillance.

Building heights: 2 Storey

Lot Size: 240m^2 (varies) Dwelling Size: 3 bed = 150m^2, 1 Bed Stuidio = 30m^2

Approx density: 25 dw/ha

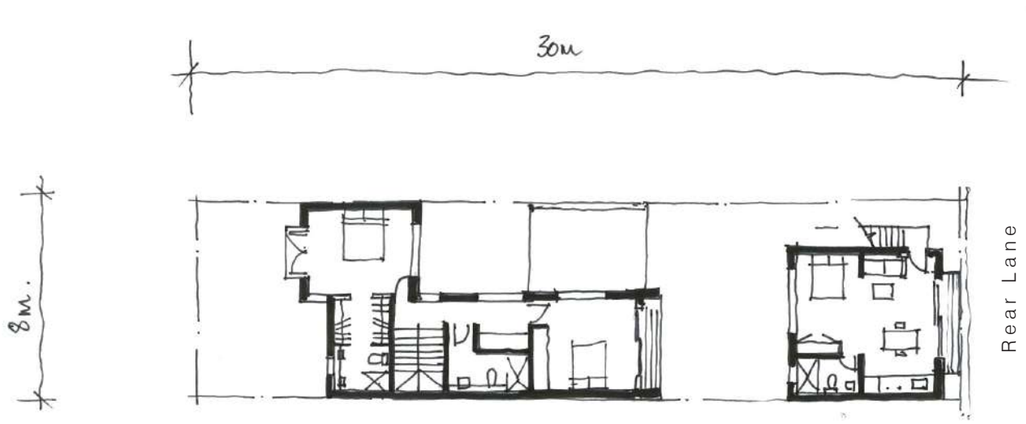
Construction: Steel or timber frame on concrete slab, skillion/vaulted roof.

External materials: Combination of corrugated metal sheet, timber panel cladding and rendered masonry.

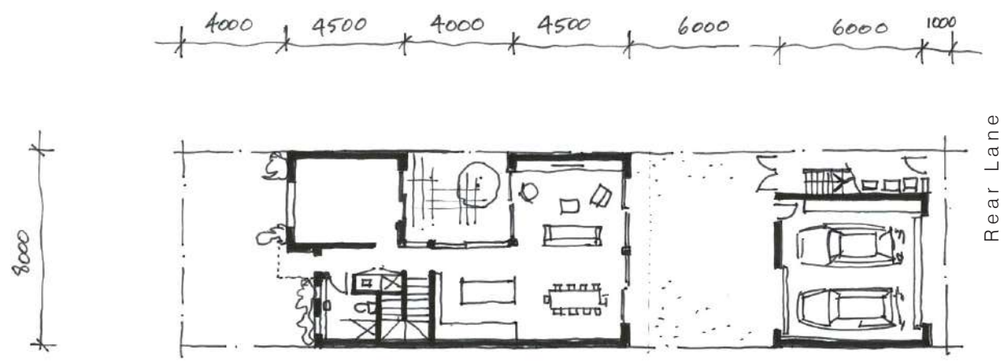
Sustainability: Locally sourced materials, naturally ventilated, high thermal performance, rain water harvesting, solar PV cells, minimise cut and fill, native drought tolerant planting.

DHA’s Hamilton Corner delopment Designed by Batessmart

Indicative first floor plan 1:250



Indicative ground floor plan 1:250



1:250 @ A3

0 1 2 5 10m

8.5 Dune apartments

Description: These apartment typologies are designed to minimise the overall building footprint and bulk and maximise visual connections with the surrounding landscape. Small footprints allow for up to 4 units per floor with the potential to allow for open under croft spaces at ground floor and open stairwells and vertical circulation.

Building heights: 1-4 Storey

Approx density: 50-60 dw/ha

Construction: Steel frame concrete slab, skillion/vaulted roofs

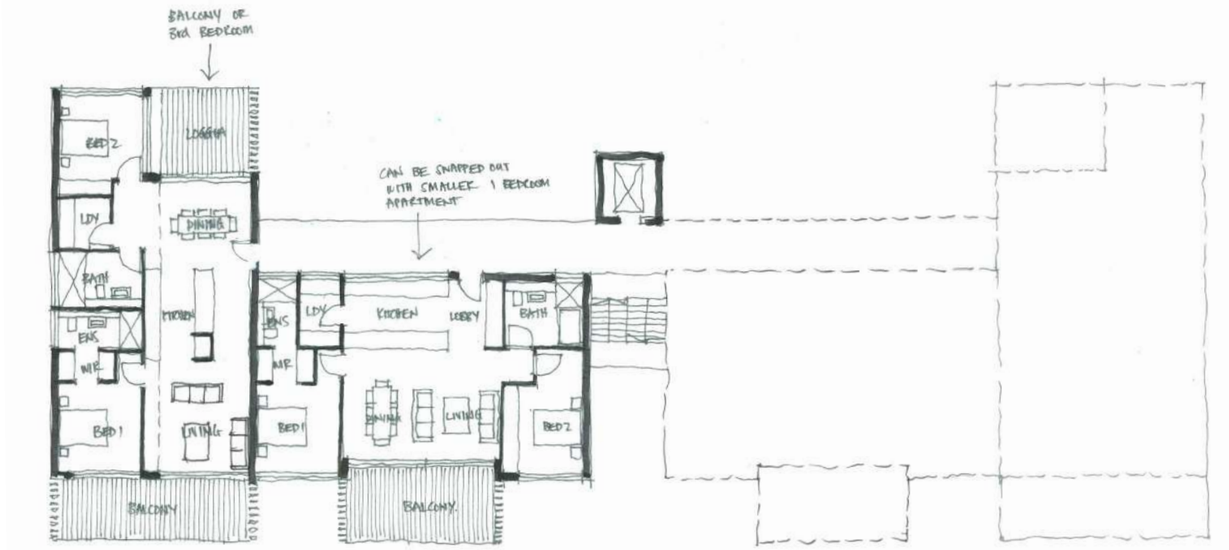
External materials: Combination of corrugated metal sheet, timber panel cladding.

Sustainability: Passive solar design, locally sourced materials, naturally ventilated, high thermal performance, rain water harvesting, solar PV cells, minimise cut and fill, native drought tolerant species.

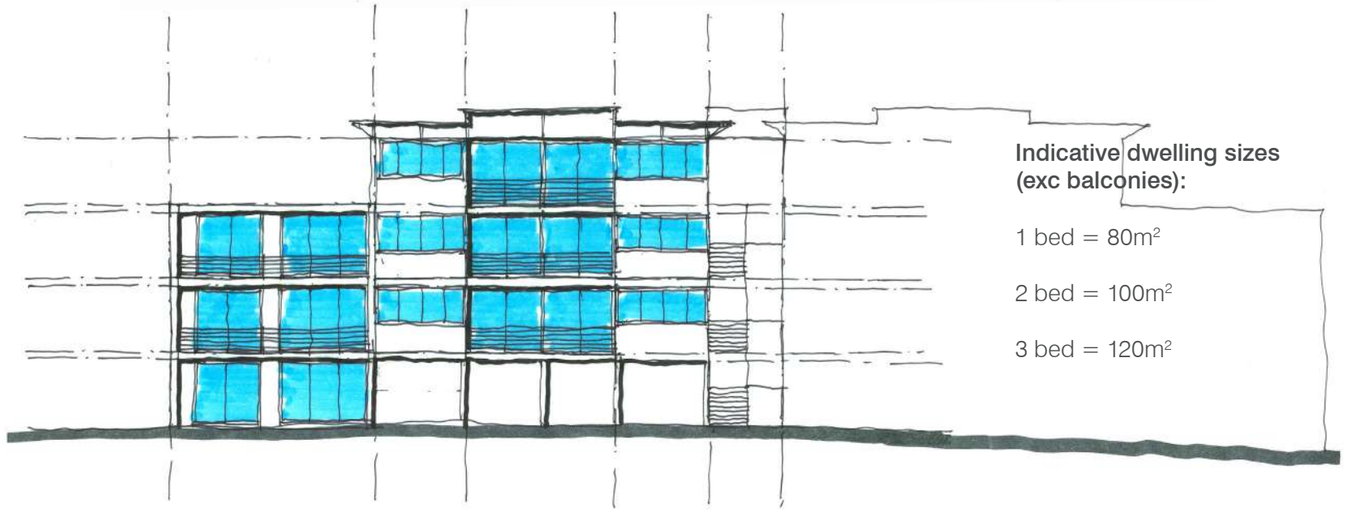
Viridian Noosa Residences - by JMA Architects

Timber coastal apartments - Wood Solutions

Indicative floor plan 1:250



Indicative front elevation 1:250



Indicative dwelling sizes (exc balconies):

1 bed = 80m²

2 bed = 100m²

3 bed = 120m²

HOUSING MATERIALS WILL COMPLIMENT THE LOCAL ENVIRONMENT

APARTMENTS WILL EXPRESS LIGHTNESS AND OPENNESS

Assessment

9 Design assessment

Justification and supporting design detail for the master plan have been provided throughout this report, with technical specialist assessments attached under separate covers as part of the Planning Proposal package. This section summarises the key urban design assessment criteria and key elements of technical reports to demonstrate the likely impacts and benefits of the proposal.

9.1 Compliance

Local planning controls

The proposal facilitates housing for a mix of defence members and the public. While housing for defence meets the objectives of the existing SP2 (Defence) zone with respect to land use, it is considered that the proposal would be better facilitated under a R2 Low Density Residential and RE1 Public Recreation zoning to ensure that the future vision for the land is clear.

A 9m height limit is proposed within R2 Low Density Residential areas. No height controls are currently applicable to the site.

Coastal Erosion

All dwellings shown in the master plan are west of the coastal hazard line in accordance with Council's policy position.

State Environmental Planning Policy 65 (SEPP 65)
SEPP 65 is not applicable as there are no apartments proposed on the site.

9.2 Access and movement

The proposal would increase the opportunity for the local community and visitors to move within and through the site, appreciating both the site's heritage values and filling in a 'missing link' from Fern Bay to the beach. The landscape strategy proposes pedestrian pathways that connect Popplewell Road, the key heritage items, proposed open space and the beach.

The proposed street network is based on the historic rifle range layout which has a grid-like pattern. The streets will provide direct access to the beach and views to adjacent bushland. The north-south street orientation will facilitate excellent solar access to dwellings.

A clear street hierarchy has been developed to encourage legibility, wayfinding and a sense of address for each building, as well as supporting the diversity of dwelling forms.

All streets have been designed to meet minimum road widths under Council's controls and relevant technical standards, and are intended to be dedicated to Council.

9.3 Character and context

The following features of the proposal aim to establish a coastal character and ameliorate any potential impacts of the development:

- develop will be concentrated on already disturbed areas in order to retain as much coastal vegetation as possible, and the urban layout will reinterpret the historic rifle range pattern;

- vegetation and landscape will provide a buffer between development and adjoining lands, including Popplewell Road and the beach, in order to visually contain the development;

- the development will softly transition into vegetated areas, with bushfire risk being managed by an appropriately designed APZ;

- streets will be kept as narrow as possible and verges will be generously planted with local shrubs and trees;

- a proposed coastal park will provide a visual, physical and ecological link between bushland areas in the north and south of the site;

- more compact dwelling typologies, such as terraces, allow for the site to be developed in a smaller footprint, with a view to retaining as much vegetated and items of heritage value as possible;

- the proposal limits dwelling heights to 9m in response to the visually sensitive nature of the site and the low-scale character of surrounding urban areas;

- the proposal facilitates an appropriate setback to key heritage items on the site, enabling views to and from the public domain.

9.4 Issues to be resolved through detailed master planning

The final design and area of public open spaces for dedication should be determined through consultation with Council and the community.

A site-specific DCP, Stage 1 DA or adopted master plan should be developed to lock in key objectives in the master plan for the development of the site. Appropriate flexibility should be allowed to enable new design approaches to be facilitated where they meet objectives.

Indicative Master Plan

Conclusion

11 Recommendations

The proposal is the result of engagement with a range of technical specialists, including coastal erosion, traffic, heritage, and archaeology, to develop a master plan that achieves the best practice planning and urban design principles in line with the changing vision for the future of the site.

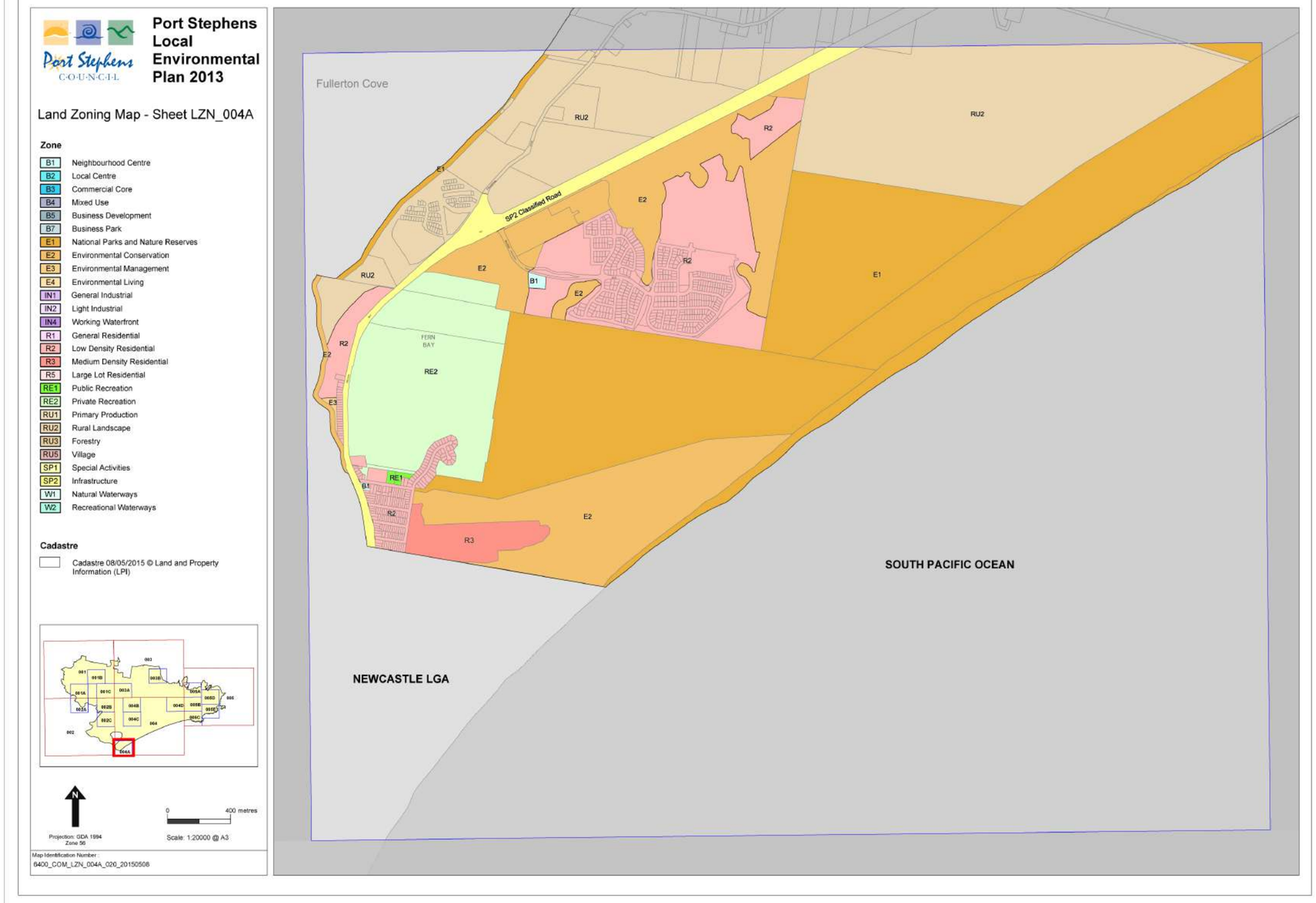
Having investigated the site and its context in detail, Architectus and Spackman Mossop Michaels are confident that the master plan, further refined and tested in detail, represents the best design and public domain outcome for the site.

11.1 Planning controls

The proposed LEP controls are intended to strike the right balance between development and conservation of the site's significant features. Sensitive ecological communities, heritage items and vulnerable coastal lands are proposed to be protected and enhanced, whilst the flatter, mostly featureless parts of the site are to be made available for housing and community amenities. Through new development, the historic site can be opened up to the public, new open space can be provided and degraded relics and vegetation communities can be restored.

An amended lot size map is also proposed, as set out in the Planning Proposal report. The lot size map reflects the indicative concept master plan.

MAP 1 - Proposed Land Zoning Map



MAP 2 - Proposed Height of Buildings Map

Appendix A
Master plan options

Master plan options

The final recommended master plan was the result of the development and testing of a range of options for the sites development. These are included in the following pages to demonstrate the various benefits and constraints of each plan and highlight the reasoning for the final recommended master plan as set out in this report.

The master plans showed on the following pages are not recommended and are intended only to provide additional information on the urban design process undertaken.

Option one - ‘Bush Streets’

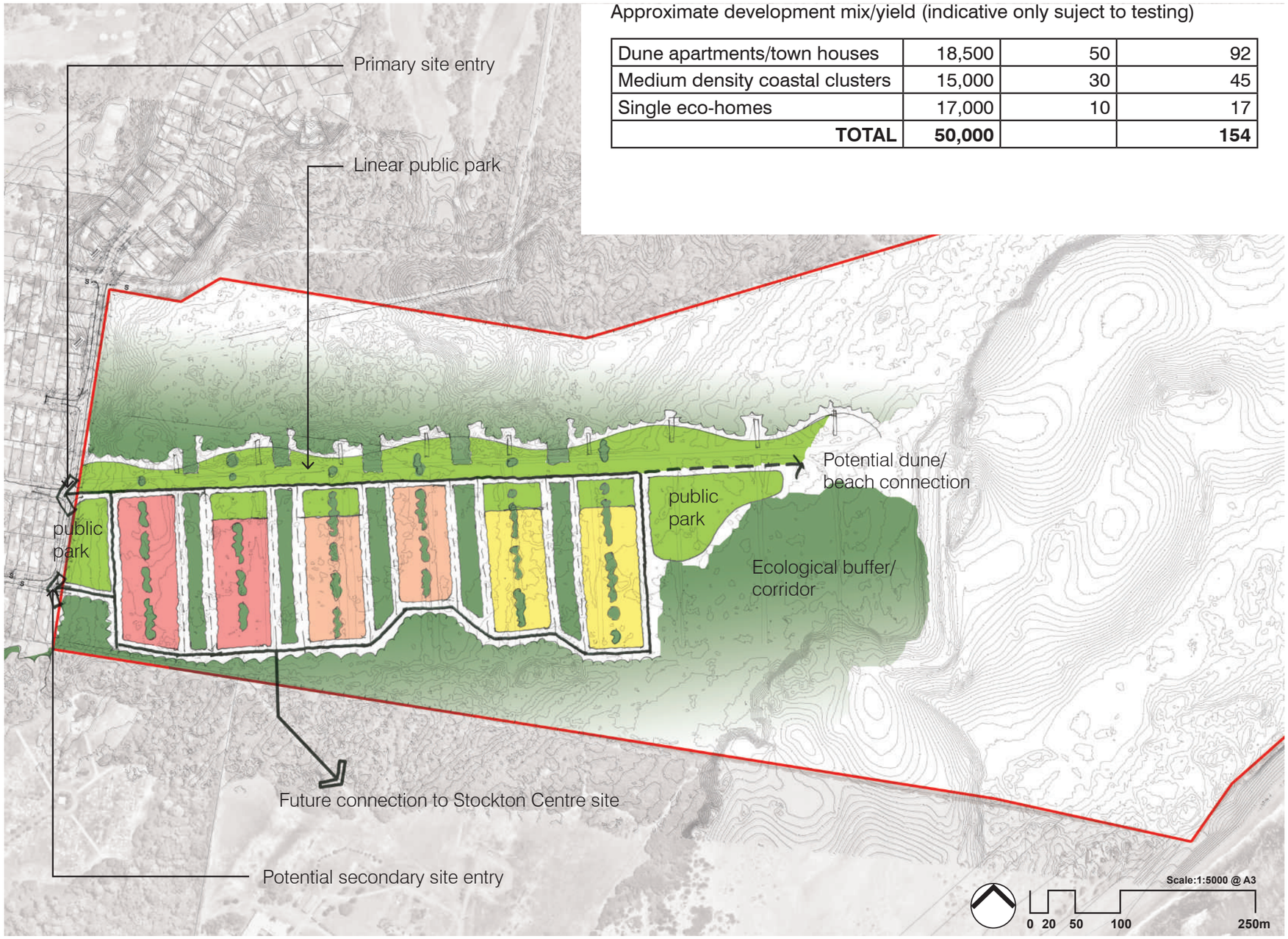
Oversized medians within the streets (15m+) allow the native coastal vegetation to permeate the development.

Development is restricted to previosly disturbed areas of the site (the old range).

A public linear park connects to the back of Stockton beach and dunes and could provide opportunities for cultural heritage interpretation.

Approximate development mix/yield (indicative only suject to testing)

Dune apartments/town houses	18,500	50	92
Medium density coastal clusters	15,000	30	45
Single eco-homes	17,000	10	17
TOTAL	**50,000**		**154**



Legend

- Dune apartments/town houses
- Medium density coastal clusters
- Single eco-homes
- Public Open Space
- Native bush/vegetation

Option two - ‘Community clusters/ pods’

A number of individual residential precincts or ‘pods’ within the bush setting. Each pod could have its own central communal space/park.

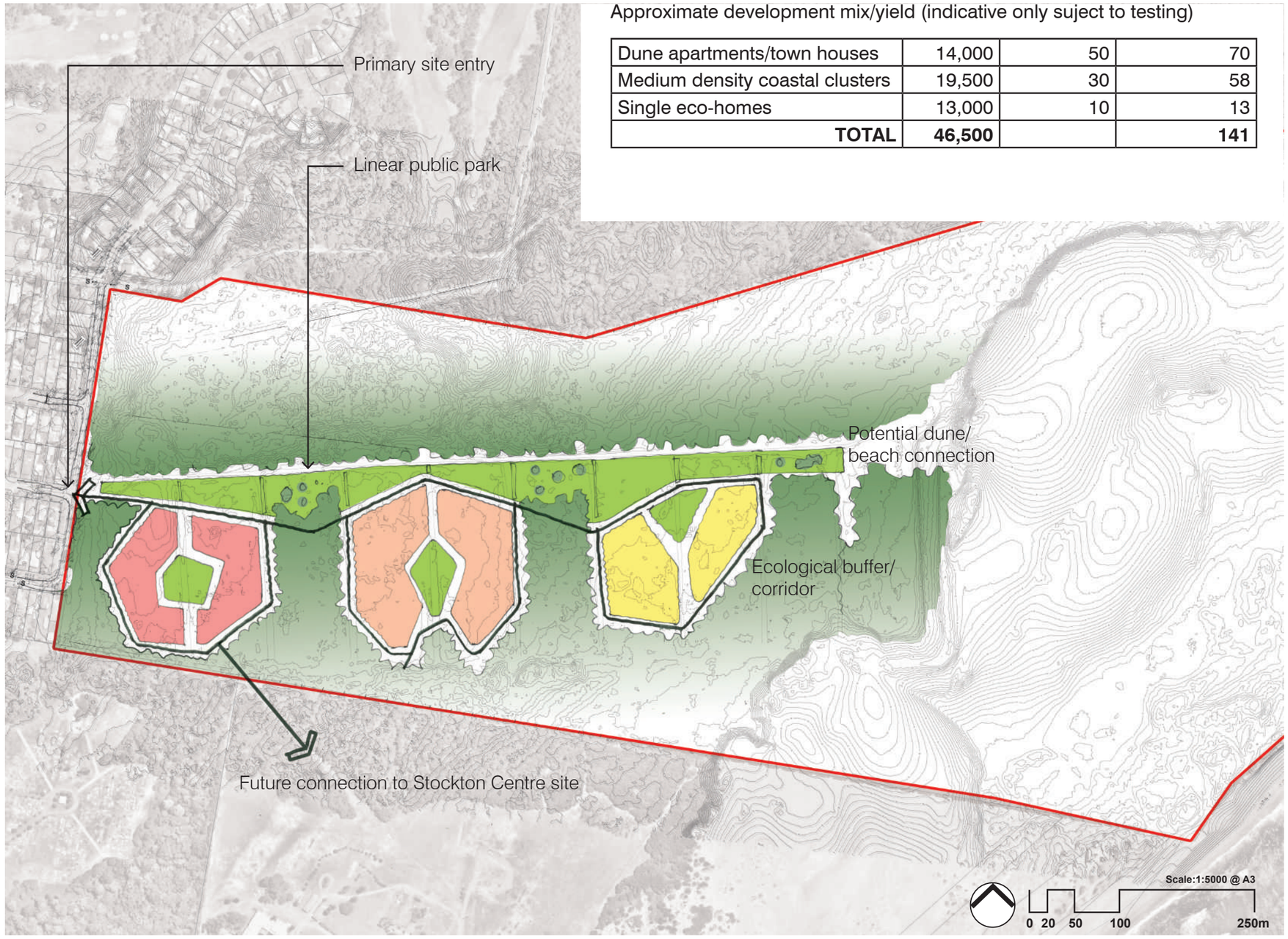
The road network moves away from the regularity of the range setout.

Development is restricted to previosly disturbed areas of the site (the old range).

A public linear park connects to the back of Stockton beach and dunes and could provide opportunities for cultural heritage interpretation.

Approximate development mix/yield (indicative only suject to testing)

Dune apartments/town houses	14,000	50	70
Medium density coastal clusters	19,500	30	58
Single eco-homes	13,000	10	13
TOTAL	**46,500**		**141**



Legend

- Dune apartments/town houses
- Medium density coastal clusters
- Single eco-homes
- Public Open Space
- Native bush/vegetation

SPACKMAN MOSSOP AND MICHAELS

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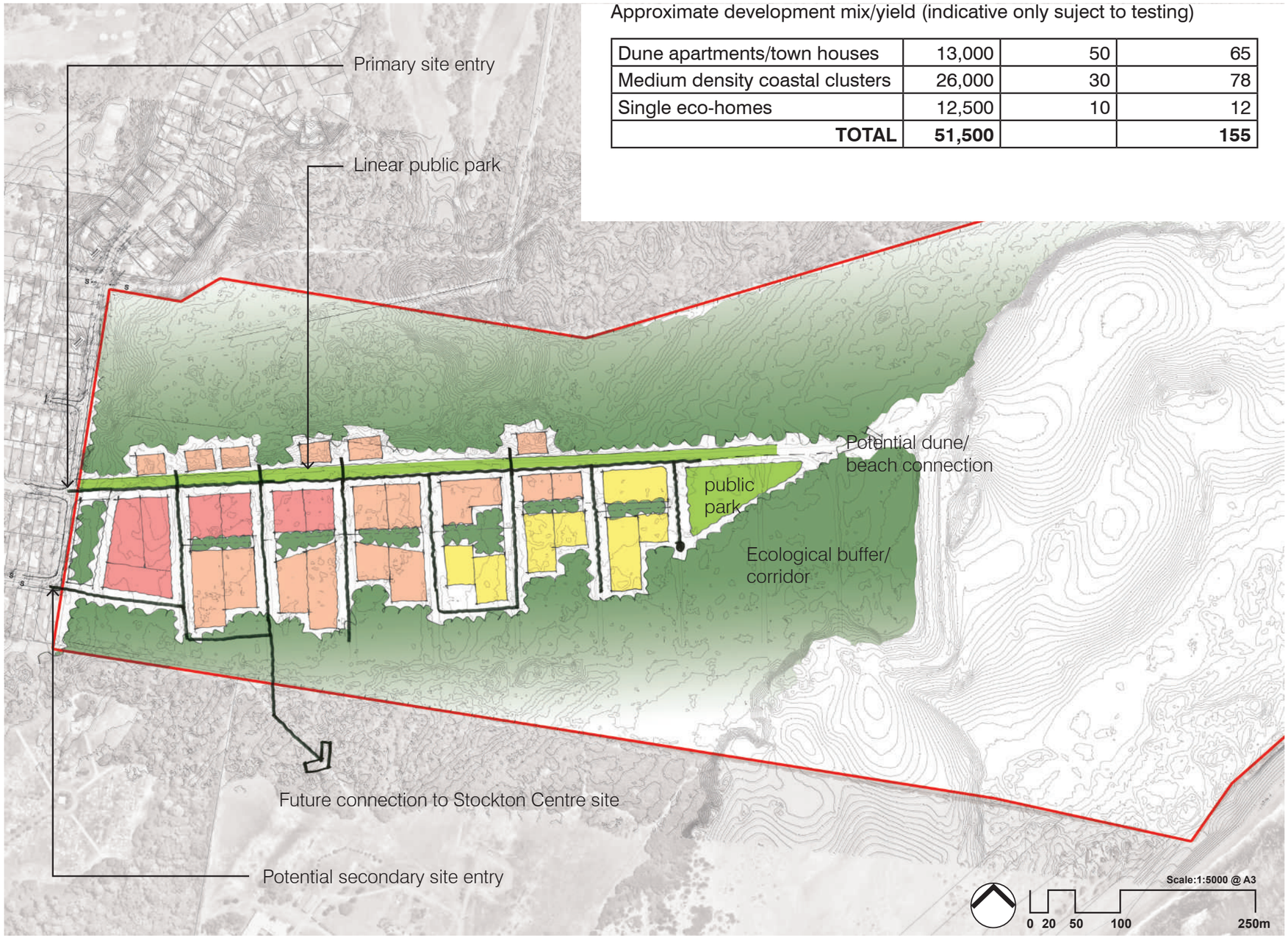
Option three - ‘Staggered range set-out’

Utilising the existing set-out of the rifle range firing mounds and staggering development parcels to allow for bushland encroachment. Streets would be very informal and may include dead ends to reinforce sense of bush environment.

Whilst development is main restricted to previusly disturded areas there is some proposed senstivly located ‘Eco Town Houses’ to the immediate north of the old range area.

Approximate development mix/yield (indicative only suject to testing)

Dune apartments/town houses	13,000	50	65
Medium density coastal clusters	26,000	30	78
Single eco-homes	12,500	10	12
TOTAL	**51,500**		**155**



Legend

- Dune apartments/town houses
- Medium density coastal clusters
- Single eco-homes
- Public Open Space
- Native bush/vegetation

Appendix B
Precedent studies

Precedent studies

The Sea Ranch, California, USA

The Sea Ranch Coastal Landscape

Source: https://noordinaryresort.com/2015/02/27/the-sea-ranch-ca/

Environment

The Pacific Ocean coastline north of San Francisco features a windswept and rugged landscape. The Sea Ranch covers a section of this coastline approximately 16km in length, straddling Highway One as it winds along the hillside. This landscape is characterised by open meadows between hedgerows of cypress trees planted perpendicular to the coast as buffers to the wind. The vision was for a community of people to sensitively inhabit this place while preserving the quality and character of this environment.

The Sea Ranch Condominium One by Moore Lyndon Turnbull and Whitaker

Source: The Sea Ranch: Qaulified Vernacular. Donlyn Lyndon, University of California Berkeley.

Dwellings

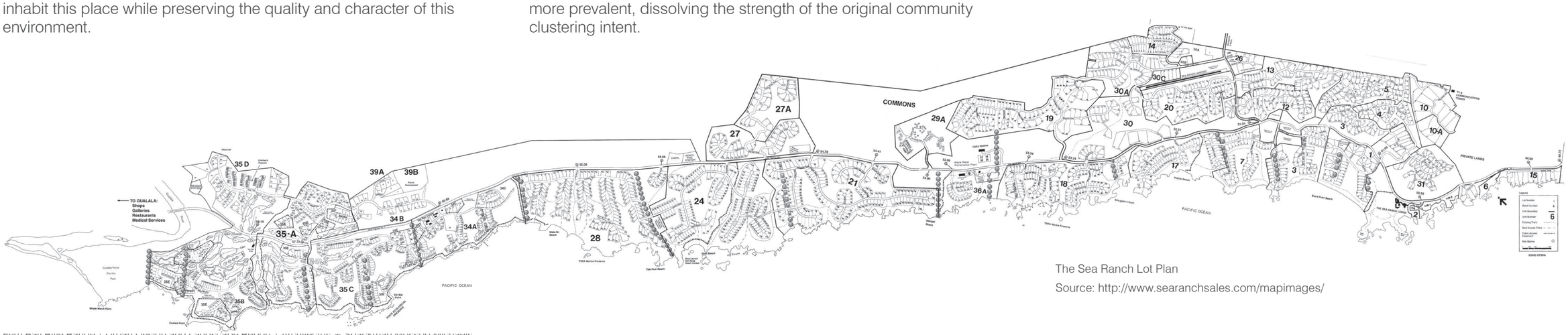
This property was purchased in 1964 by Oceanic Properties for the development of a new town. Landscape architect Lawrence Halprin was hired to plan the site based on ecological considerations. Guidelines were established to promote design continuity in developments, beginning with the prototype Condominium One by Moore Lyndon Turnbull and Whitaker. Over time, houses with more suburban formats have become more prevalent, dissolving the strength of the original community clustering intent.

The Sea Ranch Condominium 1 by Moore Lyndon Turnbull Whitaker

Source: http://ideasgn.com/architecture/condominium-1-sea-ranch-mltw/

Lessons Learned

Architect and developer Al Boeke has stated that his idea was that “we would respect the land. We would build architecture... that seemed natural to this place.” This concept has been largely upheld by attracting environmentally inspired residents to build within site-specific controls; including a covenant, design principles, and design review process.



The Sea Ranch Lot Plan

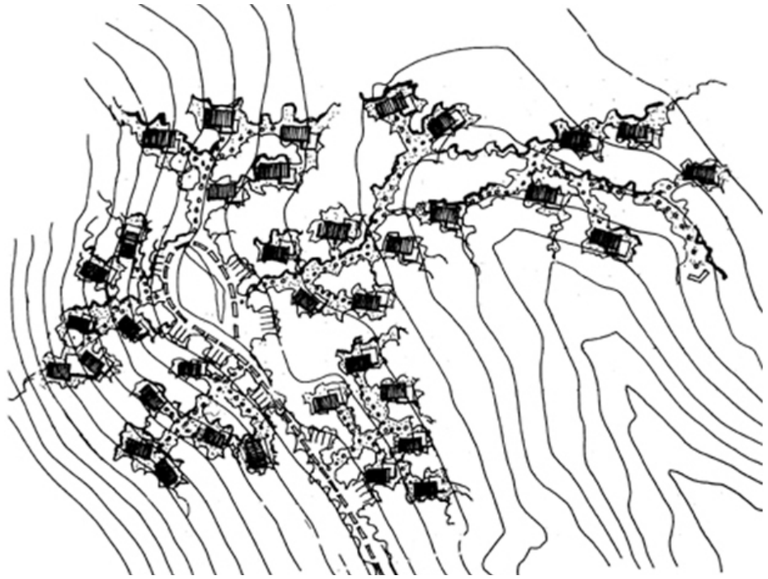
Source: http://www.searanchsales.com/mapimages/

Murray's Beach, NSW

Murray's Beach is located on the Wallarah Peninsula, facing onto Lake Macquarie
Source: Nearmap

Environment

The Wallarah Peninsula is a largely forested area of land between Lake Macquarie to the west and the Pacific Ocean to the east. The North Wallarah Peninsula Master Plan guides development of a series of small suburbs, including the lakeside village of Murray's Beach. This low density housing development features a environment and community oriented character that integrates it with the coastal landscape.



The houses at Murray's Beach are arranged as clusters in the landscape.
Source: Architectus

Dwellings

Streets and housing lots are designed to be woven into the landscape, with lots sold individuallly and developed in accordance with a set of design guidelines. A *Design Essentials* document encourages the sensitive siting, scale, expression, and environmental performance of individual houses in harmony with the bush context. For example, houses should be sited along contours to minimise ground works for cut and fill, and placed within designated development envelopes away from existing trees.

The coastal forest landscape predominates throughout the Murray's Beach development.
Source: Architectus

Lessons Learned

The houses at Murray's Beach are successful in expressing a continuity of landscape. The positioning and openings of houses is generally well staggered, allowing space in between for trees. Construction is mostly lightweight, with a harmonious material and colour palette. Private divisions such as solid fences are discouraged, creating a sense of openness throughout the bushland setting.

Generally, earlier constructions in Murray's Beach display a higher level of contextual harmony than more recent projects. Design regulations appear to have been relaxed, with increases in hard surface areas and more solid fencing materials. A system that relies upon design guidelines for quality control is dependent on the rigourousness of the application of development standards.

Little Bay, NSW

The Prince Henry Hospital Pathology Ward 1.
Source: http://www.princehenrycommunity.com.au/assets/Uploads/images-and-pdfs/nursing-and-medical-museum/nursing-and-medical-museum/ward1pathology.jpg

Environment

Little Bay, to the south-east of Sydney, has been home to the Prince Henry Hospital since 1881. The 1998 consolidation of the Prince Henry and Prince of Wales Hospitals made the Little Bay site available for redevelopment, with master planning by Landcom beginning in 2000. Several large precincts were developed separately, with design guidelines and design review processes to manage design outcomes, heritage conservation and adaptive reuse, housing diversity, and affordable housing provisions.

The Little Bay Master Plan features a wide diversity of housing type.
Source: Randwick DCP 2013

Dwellings

Little Bay has a high diversity of dwelling types; with apartments, terraces, townhouses, and houses. 1% of total dwellings are affordable housing. This variety facilitates community diversity in life stage and family type. There is also a Surf Life Saving Australia office, an Aboriginal Health College, community centres, and a retail precinct, providing local employment, education, and shopping. A variety of high quality public open spaces reinforce the coastal quality of the place and offer recreation opportunities in daily life.

Little Bay displays a successful blend of hertiage, new development, and landscape.
Source: Architectus

Lessons Learned

Little Bay is a highly livable example of new development integrated with the existing place and context. Separate but coherent developments of a range of scales create an attractive aesthetic, while offering opportunities for a range of people to live, work, and play. This has been achieved while conserving the local heritage features and natural coastal character and amenity.

Little Bay apartments, terraces, houses, heritage buildings, and beach.
Source: *Nearmap*

architectus™

BETTER TRANSPORT FUTURES
MARK WAUGH

Proposed Stockton Rifle Range Site Planning Proposal

Defence Housing Australia

Transport Study Report
October 2018

Mark Waugh Pty Ltd

ABN 67 106 169 180

Document History and Status

Issue	Rev.	Issued To	Qty	Date	Approved for Release
Draft	Rev01	DHA	1	30 Jul 16	M Waugh
FINAL DRAFT	Rev02	DHA, NPC	1	30 Sep 16	M Waugh
FINAL	Rev03	DHA, NPC	1	31 Oct 16	M Waugh
FINAL	Rev04	DHA, NPC	1	25 Nov 16	M Waugh
FINAL	Rev05	DHA, NPC	1	05 May 17	M Waugh
FINAL DRAFT	Rev06	DHA, NPC	1	30 July 18	M Waugh
FINAL	Rev07	DHA, NPC	1	30 Oct 18	M Waugh

Printed:	30 October 2018
Last Saved:	30 October 2018
File Name:	C:\Users\Mark.Waugh\Documents\WORK\ACTIVE\#093 DHA Stockton\VARY D MASTERPLAN REVIEW\REPORT\BTF2016093 DHA Stockton RR Transport Report Rev07.Docx
Author:	Mark Waugh
Name of Organisation:	Defence Housing Australia
Name of Project:	Defence Housing Australia Stockton Transport Studies
Name of Document:	RIFLE RANGE TRANSPORT REPORT
Document Version:	FINAL Rev07
Project Number:	BTF2016093RR

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1 Executive Summary

1.1 Background

DHA has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. DHA has recently purchased two surplus Defence sites at Stockton with the objective of obtaining the necessary planning approvals and developing them for a mix of housing for ADF personnel and the private market. These two sites (Fort Wallace and the Stockton Rifle Range) are located just a few kilometres north of the Newcastle CBD across the Hunter River on the Stockton Peninsula. As such the sites are comparatively close to Williamtown RAAF Base (approx. 11 to 12 km by road).

This report updates transport investigations based on a revised Masterplan for the Rifle Range site in support of the rezoning proposal.

Site details are:

	Rifle Range
Title	Lot 5 DP233358
Area	111.35ha
Council	Port Stephens (subject to amalgamation)
Existing Land use Zoning	E2 – Environmental Conservation

A number of earlier assessments of the site have been prepared over a number of years. As part of this work, notional development yields were prepared indicating some 249 development lots may be achievable on the Rifle Range site. This current update has reviewed this yield to a revised total of 318 dwellings. The dwellings are proposed to be a mix of apartments, townhouses, courtyard and cluster homes, with a small number of single 'Eco' homes.

1.2 Summary

The following observations have been made in relation to the assessment of the transport system in the vicinity of the Rifle Range sites at Fern Bay:

a. **Location** – Stockton is a suburb of Newcastle located on the north side of the Hunter River, and adjacent to the Pacific Ocean. It is a narrow peninsula with road access available from the north. Fern Bay is a small village at the northern end of the Stockton peninsula, between the Hunter River north arm, and the Pacific Ocean.

b. **Transport Network –**

   a. **Road Network** – Access to Fern Bay is provided by road from the north and south, via Nelson Bay Road (B63 Route). The Fern Bay road network is a series of local streets on the eastern side of Nelson Bay Road. Access to the wider Newcastle area is provided via the Stockton Bridge to Kooragang Island and on to Tourle Street and Industrial Drive. Access north to Williamtown Airport is via the B63 Nelson Bay Road.

   b. **Ferry Service** – The Newcastle to Stockton Ferry connects Stockton at its southern end, on the Hunter River, to Queens Wharf in the Newcastle CDB

   c. **Bus Services** – Newcastle Buses Bus operates Route 118 serving Fern Bay and Stockton, although the route is quite circuitous. Buses to Williamtown are also available, operated by Port Stephens Coaches.

   d. **Cycle ways** – The Stockton Cycle way was opened in 2013, connecting the peninsula from Stockton Bridge in the north to the Stockton Ferry terminal in the south.

c. Road Network performance

   a. **Peak Periods** – Traffic Movement surveys were conducted previously on 8 June 2016 and 27 October 2016 at the following locations:

i. Nelson Bay Road and Fullerton Street roundabout (8 June 2016)

ii. Nelson Bay Road and Taylor Road (priority control) (8 June 2016)

iii. Nelson Bay Road and Vardon Road (priority control) (27 October 2016)

b. AADT flow data is also available for traffic crossing the Stockton Bridge.

c. Observed flows were well within the technical mid-block capacity of the various roads under review.

d. The offset roundabout at the junction of Nelson Bay Road and Fullerton Street has been tested as operating at a very good level of service.

e. The priority junctions of Nelson Bay Road with Taylor Road and Vardon Road operate with minimal levels of delay on the main road, but with some delay for particularly right turn movements out of the side roads.

d. **Land Use Proposals** – The revised draft indicative Master Plan (Architectus Revision H 10th May 2018) allows for a development yield of 318 dwellings on the Rifle Range site. This has been used in this updated assessment of traffic generation levels form the subject site.

e. **Other Known Development** – Port Stephens Council and The City of Newcastle has recently completed the Fern Bay and North Stockton Traffic & Transport Study (Seca Solution for Port Stephens Council and The City of Newcastle, 28 June 2018) This study has considered traffic impacts of known development proposals in the Fern Bay and North Stockton localities which are of direct relevance to the road network supporting the Rifle Range site. This work has been used with permission of Port Stephens Council and The City of Newcastle to update the traffic assessment of the Rifle Range site along with its revised Master Plan.

f. **Traffic Generation** – Forecast traffic flows would be in the order of 156 trips AM and 172 trips PM for the Rifle range site. The external road network is more than capable of absorbing these levels of additional trips, while remaining at a very good operational level of service.

g. **Initial Site Access Considerations** –

a. **Rifle Range** – The existing flow levels on Nelson Bay Road, coupled with the existing channelised right turn facilities at Taylor Road have been assessed as able to provide a good intersection level of service.

b. **Right turn movements** – Existing right turn movements while very small, show a poor level of service. Additional flows are not expected to be high, and would be able to be dispersed between Taylor Road and Vardon Road.

With the subject site earmarked for active defence force personnel it is expected that local traffic from the site will show a bias in trips to the north more so than a site that is not aligned with defence activity. As such the flows are expected to be split fairly evenly between northbound trips toward RAAF Williamtown and southbound trips, rather than being heavily biased toward the Stockton Bridge and the south.

Performance of right turn movements under existing access arrangements would be poor and it is recommended that one intersection (either Taylor Road or Vardon Road) be provided with improvements to facilitate safe right run movements. This could be in the form of either seagull priority control, or traffic signal control.

Input from NSW RMS is required in this regard. Whilst some informal communication has been made, to date RMS have not been willing (or) able to meet with the study team.

h. **Road Capacity** – Existing traffic flow levels suggest the mid-block two lane two way capacity of the surrounding road network is very satisfactory and has ample spare capacity to cater for the subject development proposals.

i. **Access Strategy** – Two site entrances on Popplewell Road to Council residential street standards. Leading to one upgraded intersection treatments at either of Vardon Rd (traffic to and from the north) and / or Taylor Road (traffic to and from the south)

j. **Other Considerations** –

k. Internal road design – to meet Council road design standards. Carriageways at Local Street, Access Street, Access Place standard.

l. North extension of Stockton cycleway, or possible cycle connection between the two sites lining to the exiting cycleway.

1.3 Conclusion and Next Steps

This report presents the findings of the latest traffic and transport investigations for the updated Draft indicative Master Plan for use of the Rifle Range development site as additional housing in the Newcastle area to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards.

The investigations have found that subject to road and intersection improvements as outlined in these investigations the site is able to be accommodated on the surrounding transport (road) network. The potential works of significance are:

1. Upgrade of one intersection with Nelson Bay Road. Vardon Road has been recommended previously to provide safe right turn facilities and this has been reinforced by the independent work conducted by Port Stephens Council and the City of Newcastle.
2. Upgrade of the local road network to current Council standards from the entrance to the subject site along Popplewell Road to both Taylor Road and Vardon Road (to cater for movements north and south generated by the subject site.)

The overall conclusion is that given the potential level of future development proposed for the Rifle Range site at Fern Bay, along with the Councils' investigations into development in the Fern Bay and North Stockton areas, an access strategy focussing on the Vardon Road intersection with Nelson Bay Road, provided with improved right turn facilities, combined with upgrading of the one local road network to Council standards to support this access arrangement, will present an effective access solution for the subject site. Further liaison is required with the road authorities to confirm their requirements in line with the current strategy being developed by Roads and Maritime Services for the Nelson Bay Road Corridor.

The conclusion here is that subject to the recommended upgrades to road access the planning proposal for the Rifle Range site is supported from a traffic and transport perspective.

The next steps recommended are to seek more detailed engineering advice from The City of Newcastle, Port Stephens Council and NSW Roads and Maritime Services on the form of road and intersection improvements that would best serve the subject site and local Fern Bay community, and best align with the road network development strategy being developed by NSW RMS for the Fern Bay area for Nelson Bay Road.

2 Introduction and Background

2.1 Background

DHA has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. DHA has recently purchased two surplus Defence sites at Stockton with the objective of obtaining the necessary planning approvals and developing them for a mix of housing for ADF personnel and the private market. The subject site (Stockton Rifle Range) is located just a few kilometres north of the Newcastle CBD across the Hunter River on the Stockton Peninsula. These sites are comparatively close to Williamtown RAAF Base (approx. 11 to 12 Km by road).

The details of the two sites are:

	Rifle Range
Title	Lot 5 DP233358
Area	111.35ha
Council	Port Stephens
Existing Land use Zoning	E2 – Environmental Conservation

A number of earlier assessments of the site have been prepared over a number of years. As part of this work, notional development yields were prepared indicating some 249 development lots may be achievable on the Rifle Range site. This current update has reviewed this yield to a revised total of 318 dwellings. The dwellings are proposed to be a mix of apartments, townhouses, courtyard and cluster homes, with a small number of single 'Eco' homes.

2.2 Site Context

The subject site under consideration by DHA for housing for Newcastle based Defence members and their families is located at Fern Bay just north of Newcastle. The close proximity to the RAAF Williamtown base which is about 12 kms to the north of the sites, and the closeness to the regional centre of Newcastle make these sites attractively located for the purposes of housing defence families.

The sites are shown in **Figure 1 – Regional Context** below.

Figure 1 – Regional Context
Source: architectus™ 2016

The local context of the site is shown in **Figure 2 – Local Context** below.

Figure 2 – Local Context
Source: architectus™ 2016

2.3 Objectives of Traffic Investigation

The Traffic/Transport investigations have assessed the constraints and opportunities of the subject site, as a contribution to the design development of the preferred scheme for inclusion in the sites Planning Proposal. Specific work tasks have included:

- Site visits the two sites,
- Review existing information on the sites and surrounding transport network,
- Review any Council Plans, Policies or Strategies relevant to the sites and local area,
- Undertake assessments (traffic, transport, pedestrian, cycleways) to develop a sufficient understanding of the sites and their constraints and opportunities to inform the subsequent Planning Proposal and Development Application(s),
- Liaise with the urban design team on matters relating to the traffic/transport constraints and opportunities of the two sites,
- Contribute to the options development for the two sites,
- Prepare the following reports covering the traffic/transport constraints, opportunities and proposals to support the development and planning proposals:

  1. Initial review of the development options (Summary Working Report),
  2. Supporting summary report for the preferred development option,
  3. Supporting report for the Planning Proposal,
  4. Supporting report for the Development Application,

  This report forms the supporting report for the Planning Proposal.

It should be noted that a comparable report has been prepared for the second site under consideration, and that both pieces of work have taken into account the traffic generation and impacts of the other proposal.

3 Existing Conditions

3.1 Road Network

External Roads

The site is accessed from Popplewell Road in Fern Bay, and is connected back to the B63 Nelson Bay Road via a series of local streets:

1. Vardon Road to the north, with full access to Nelson Bay Road
2. Rankin Road, with left in left out access only at Nelson Bay Road, and
3. Taylor Road also with full access to Nelson Bay Road

Nelson Bay Road (B63)

Nelson Bay Road (B63) is the main road connection from Newcastle via Kooragang Island to the Port Stephens area, including the nearby airport and Defence base at RAAF Williamtown. It is built to a 4 lane dual carriageway arterial standard with sealed shoulders in the vicinity if the subject sites. At its southern end it connects to Fullerton Street via an offset roundabout junction. The western leg of this roundabout connects Nelson Bay Road to Kooragang Island via the Stockton Bridge.

Nelson Bay Road is used as a bus route for regular and for school services. (A copy of the Newcastle Buses bus network map is included in **Appendix B** for reference). Buses serve Stockton and Fern Bay, and complete a loop via Vardon Road Popplewell Road and Rankin Rod to access Nelson Bay Road for the return journey to Newcastle.

Photo Plate 1 – Nelson Bay Road (B63) looking south from near Vardon Road (on the left of photo)

Photo Plate 2 – Nelson Bay Road (B63) looking north from Taylor Road

Photo Plate 3 – Nelson Bay Road (B63) looking south from Taylor Road (on the left of photo)

Photo Plate 4 – Nelson Bay Road (B63) / Fullerton Street roundabout

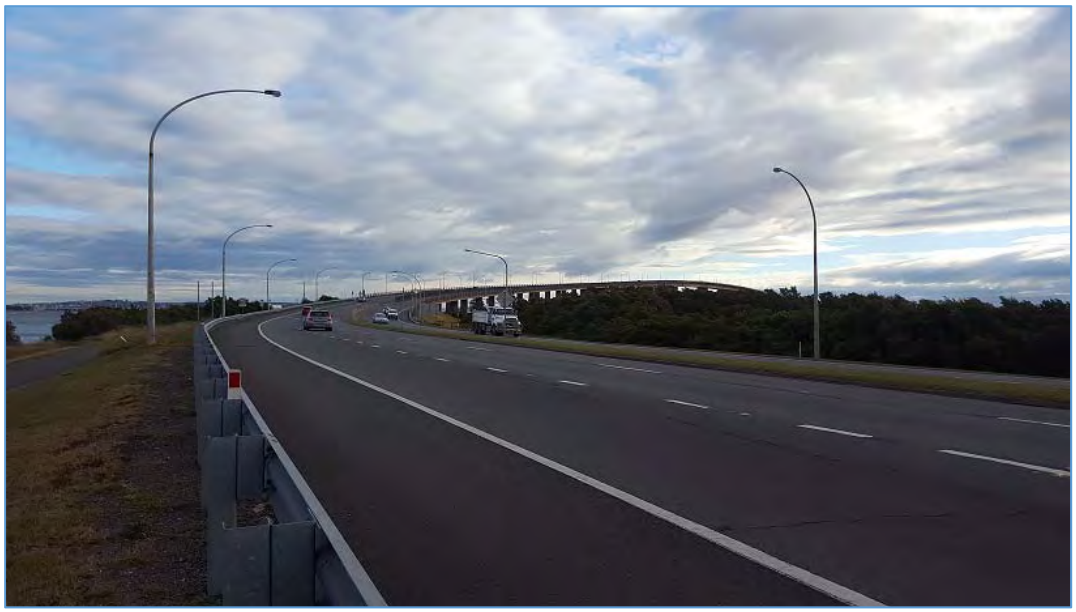


Photo Plate 5 – Nelson Bay Road (B63) looking south and west toward Stockton Bridge

Local Roads serving Rifle Range site

The Rifle Range site is accessed from Popplewell Road in Fern Bay, and connecting back to the Nelson Bay Road (B63) via a series of local streets.

Popplewell Road

Popplewell Road is a local street of approximately 6 metres sealed width. It operates as a two-way single carriageway and performs as part of the local us route to allow scheduled services to return from Fern Bay to Stockton and Newcastle. It does not meet current residential street standards as set down by Council.

Photo Plate 6 – Popplewell Road looking south from Vardon Road

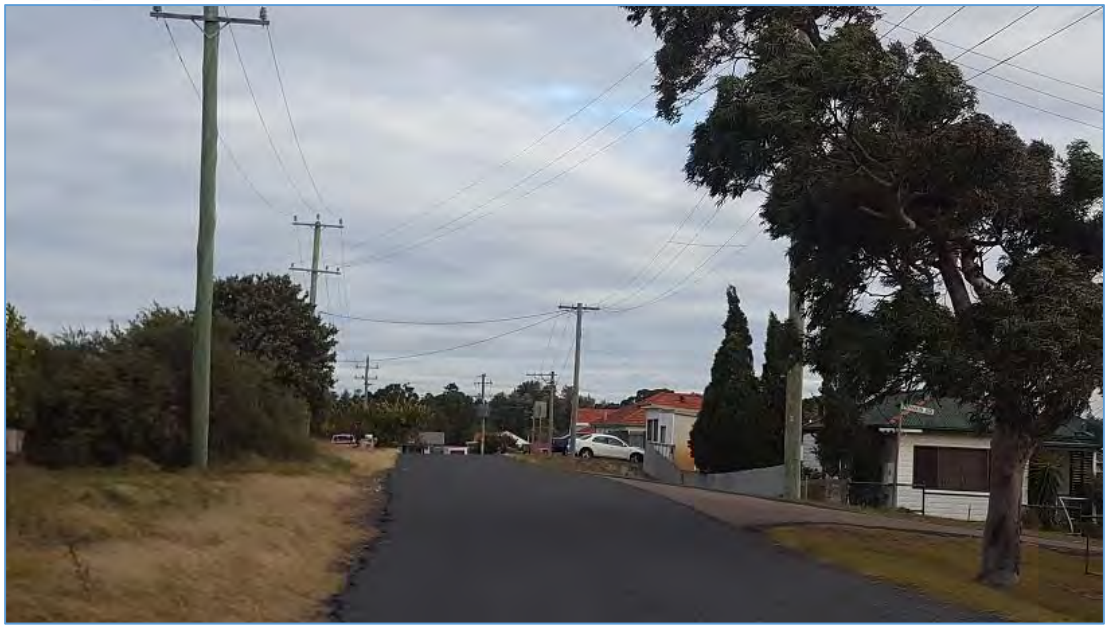


Photo Plate 7 – Popplewell Road looking south near Rankin Road

Vardon Road

To the north of the Rifle Range site, Vardon Road is a local street operating as a two way two lane residential street. It serves a mixture of property including the local public school, community hall, residential property and also the Newcastle Golf Club. It is built to a higher standard than Popplewell Road, with kerb and gutter installed on its northern side. There is a School Speed zone installed along part of its length.

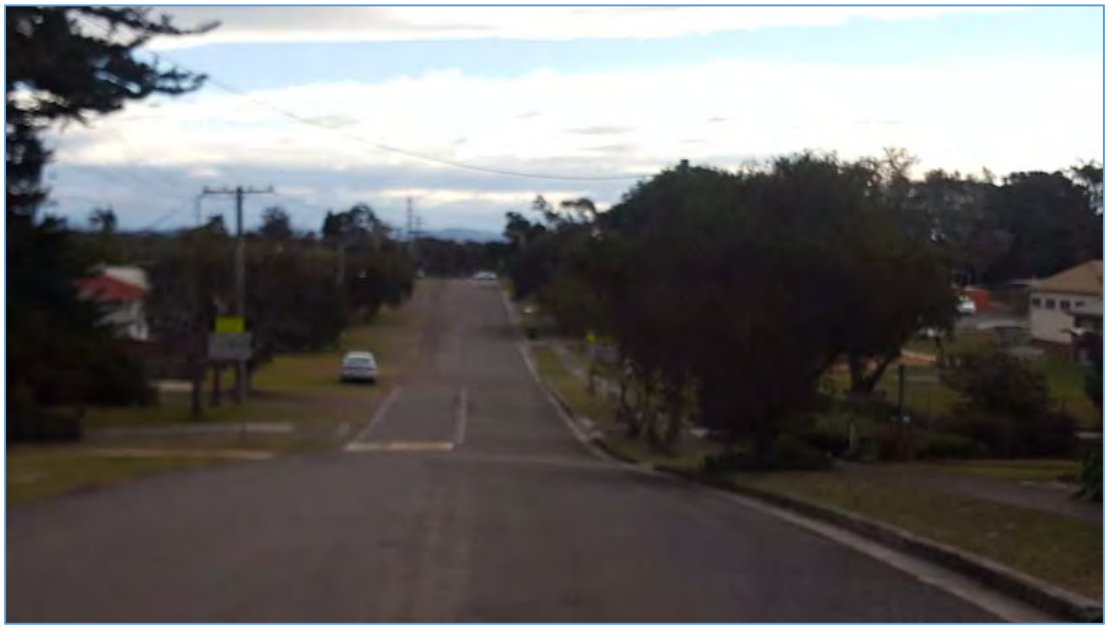


Photo Plate 8 – Vardon Road looking west toward Nelson Bay Road

Rankin Road

Rankin road is another local street of similar construction standard to Popplewell Road and Taylor Road. A two way single lane carriageway, in average condition. It is also part of the local bus route loop to allow services to return from Fern Bay via Stockton, to Newcastle.

Photo Plate 9 – Rankin Road looking east from Nelson Bay Road toward Popplewell Road

Taylor Road

Taylor Road is currently a similar standard to Rankin Road and Popplewell road, but the pavement condition is probably best described as fair to poor, with numerous repairs along its length. Its intersection with Nelson Bay Road provides for full access, allowing for all turning movements.

Photo Plate 10 – Taylor Road looking west toward Nelson Bay Road from Popplewell Road

Photo Plate 11 – Taylor Road looking east from Nelson Bay Road toward Popplewell Road

3.2 Traffic Surveys and Site Observations

2016 Traffic Surveys

In considering the appropriate times for analysis of the impacts of future site activities it is important to ensure all periods of significant on road activity are captured.

Monitoring of traffic movements was conducted over an AM and PM peak for a typical weekday. The traffic surveys were conducted on Wednesday 8 June 2016 and Thursday 27th October 2016. Traffic Survey data was collected at three locations on Nelson Bay Road, at Fullerton Street, Taylor Road and Vardon Road.
The survey data is included in **Appendix C – Traffic Survey Data**.

2017 Traffic Surveys

As part of the Councils' Fern Bay and North Stockton Traffic and Transport Study traffic movement surveys were conducted at various locations in the study area. These included the intersections of Vardon Road and Taylor Road with Nelson Bay Road, the two potential access points for the Rifle Range site.

The following observations of note are made about the 2017 surveys when compared to the BTF surveys conducted 2016:

- Through traffic movements on Nelson Bay Road are comparable, and in fact were observed at higher levels in 2016
- Local road flows were also comparable, and within what would be considered normal daily and seasonal fluctuations in traffic flows.
- The surveys conducted for the Councils were interrupted by a traffic accident on 7th February 2017 which makes the results unreliable.

Our conclusion from considering the traffic flow data available at the time of this review is that reliance on the 2016 survey results is still applicable to develop the baseline data for considering the revisions to the Rifle Range site's Master Plan.

General Site Observations

The most significant observations from a traffic movement efficiency and road safety perspective that were observed from the data monitoring and site observations Wednesday 8th June 2016 were:

1. Traffic flows along Nelson Bay Road are well within technical capacity of a 4 lane dual carriageway road.
2. Parking on the main road is low, but observed on local Fern Bay roads, particularly outside business hours.
3. Bus movements along the local street network were observed, on Vardon Road and Rankin Road.
4. Left turn movements (in and out) from the local road network all operate at satisfactory Service levels
5. The right turns out of Taylor Road and Vardon Road onto Nelson Bay Road northbound, while only small in volume, do not perform well at peak times, operating at a modelled Level of Service 'F'.
6. Right turns at Vardon Road operate at similar levels to Taylor Road, with slightly higher flows because of the location of the local public School and the entrance to Newcastle Golf Club.
7. Consideration of the alternative of allowing the turning movements to occur at Vardon Road onto Nelson Bay Road is a viable alternative to using Taylor Road. This has some merit in that it would allow all the north bound flows from the local area to be accommodated at this location and separate to the southbound flows (accommodated via Taylor Road). The right turn out of Vardon Road northbound has subsequently been monitored in October 2016. While also quite low in volume, it is a larger volume than at Taylor Road. The performance when tested with the SIDRA intersection modelling tool was also at LoS 'F', with slightly higher levels of delay than at Taylor Road.

The above observations have been taken into account when considering the development proposals.

3.3 Cycling Facilities

The road network in the vicinity of the subject site includes generous sealed shoulders along Nelson Bay Road, and Fullerton Street. These are available for use by cyclists.

The Stockton Cycle way, which runs parallel to Fullerton Street from near the Stockton Bridge, was opened by Council in 2013, connecting the peninsula from Stockton Bridge in the north to the Stockton Ferry terminal in the south. It is constructed as high standard concrete pavement dual use path.

The City of Newcastle Council has actively promoted cycling as a mode of transport as well as a recreational activity for many years. This is not without its challenges, including some topography challenges, but with much of the local Stockton area quite flat, it lends itself to the promotion of cycling in the local area.

Appendix B - Newcastle Cycling Map illustrates the existing and planned network of cycleways being development by Council.

3.4 Public Transport Services

The locality is well service by bus public transport, and is also linked to the Newcastle CBD by the Newcastle to Stockton Ferry Service. Scheduled bus and ferry services are operated By Newcastle Buses and Ferries, a State Government owned corporation. Bus services operated by Port Stephens Coaches also serve to area, linking to locations in the north such as Newcastle Airport at Williamtown. The networks, bus and ferry, are illustrated in **Appendix C.**

3.5 Road Authority Liaison

Liaison has been undertaken with officers of both the City of Newcastle and NSW Roads and Maritime. No specific issues were raised from a traffic and transport perspective by either authority although it is noted here that NSW RMS are currently conducting a route development strategy for Nelson Bay Road. It is understood that RMS has a requirement to deliver 20 year strategies on all roads under its jurisdiction. Date of completion was not known at the time of publishing this report.

3.6 Crash History

Data was original sourced for review from the NSW RMS Crash Database. Summary information is provided in **Appendix D** to this report.

The data covered the period from 1st July 2010 to 30th June 2015, and is focussed on the Stockton Bridge, Nelson Bay Road, and Fullerton Street Fern Bay location. Over the period of review there were 20 recorded crashes with 9 casualties. No fatalities were recorded in this vicinity. Of the casualties 4 incidents involved serious injuries. 75% of the incidents occurred on non-intersection locations, with a third involving hitting objects when leaving the (straight) carriageway. 45% of recorded incidents involved single vehicles. Contributing factors were noted as speed (15% and fatigue (10%)

Further to the north and approaching the Newcastle (Williamtown) Airport precinct there were 10 recorded incidents with 13 casualties, in the vicinity of Cabbage Tree Road and Williamtown Drive. In this area speed was noted as a significant contributing factor (40%) and fatigue also but to a lesser extent (20%).

At the key intersections on approaches to the subject site, there have been 2 incidents, one involving a moderate injury in 2011, at the Nelson Bay Road / Fullerton Street intersection. The roundabout control at this junction was upgrade some years ago, with the northbound lanes able to bypass the offset roundabout layout that controls southbound movements and the Fullerton Street approach to the junction. It is understood these changes have had a positive impact on the number type and severity of incidents since that time.

Of note from the crash data is that there were no recorded incidents involving traffic pulling out of local roads onto Nelson Bay Road. This information has been taken into consideration in developing the access strategy for the subject site.

The Councils' work considered the 5 year period from 2012 to 2017, and noted 33 recorded accidents over that 5 year period. Noting also a cluster of incidents within the vicinity of the roundabout controlled intersection of Nelson Bay Road / Fullerton Cover Road / Seaside Boulevard. Also of concern were 2 recorded accidents involving pedestrians near Vardon Road and the Fern Bay Store.

4 Development Proposals

A number of earlier assessments of the subject site have been prepared over several years. As part of this work, a notional development yield was prepared indicating some 249 development lots may be achievable on the Rifle Range site. This yield is being tested as part of the current investigations and are noted here for the purpose of forming a notional understanding of what the impacts may be and what development levels may be possible. The Stockton Rifle Range Indicative Master Plan is illustrated in Appendix A to their report. Key access features include road connections to both Vardon Road and Taylor Road.

4.1 Rifle Range

The details of the site are:

Table 4-2 Rifle Range Site Description

	Rifle Range
Title	Lot 5 DP233358
Area	111.35ha
Council	Port Stephens (subject to amalgamation)
Existing Land use Zoning	E2 – Environmental Conservation
Potential Residential Dwellings	318 dwellings: - 66 Dune Apartments - 68 Townhouses - 48 Courtyard Homes - 120 Cluster Homes - 16 Eco Houses
Proposed Site Access	Via Popplewell Road to Nelson Bay Road

It should be noted that a comparable report has been prepared for the second site under consideration, and that both pieces of work have taken into account the traffic generation and impacts of the other proposal.

4.2 Other Known Developments

The work of Port Stephens Council and The City of Newcastle has identified approximately 1400 (1417) additional dwellings within the North Stockton and Fern Bay localities that could be developed in the forward planning horizon to 2016. This includes:

- For Wallace (100 dwellings)
- Rifle Range (Noted as 300 dwellings)
- The Councils' preferred site for a mixed use centre (750 dwellings and 5000 m^2 retail centre)
- Newcastle Golf Course (80 dwellings)
- Fullerton Cove Caravan Park (145 dwellings)
- Fern Bay Infill development (42 dwellings)

The Councils' work has also taken into account an estimated 300 dwellings yet to be constructed and occupied within the existing Seaside Estate at the northern end of the Fullerton Cove locality.

4.3 Access, Trip Distribution and Assignment Assumptions

It is proposed to access the Rifle Range site via one access point to Popplewell Road, and then via a possible combination of Vardon Road and Taylor Road to Nelson Bay Road. This would allow traffic heading north to travel via Vardon Road, and traffic heading to and from the south via Taylor Road, although technically it would be possible to direct all traffic to either one of these junctions on capacity grounds alone.

If the pattern of trips were to be dispersed this would mean that the right turn movements out of the Fern Bay Precinct heading north can be assumed to travel via Vardon Road. And similarly traffic heading south would be expected to travel via Taylor Road. Irrespective of whether the right turn assignment of trips is made at Taylor Road or Vardon Road there is a need to understand the performance level of this movement as it is one of the most critical for satisfactory and safe intersection performance.

The fundamental assignment and distribution of trips irrespective of the local road assignments has been assumed as follows:

Rifle Range
Assignment of Trips

a. AM – 10% IN, 90% OUT
b. PM – 90% IN, 10% OUT

Directional Distribution

a. 50% northbound via Vardon Road
b. 50% southbound via Taylor Road

The Councils' assessment work applied an overall distribution of 70% south (55% toward Newcastle, 15% toward Stockton) and 35% north toward Williamtown. This was based on the existing directional split of flows at the intersections of Fullerton Street and Seaside Boulevard from surveys conducted in 2017. However, given the specific nature of the Defence Housing Australia development proposals to support housing for personnel from the nearby Williamtown RAAF base, it is still considered appropriate to use the 50% north, 50% south distribution of traffic as applied in earlier assessments for the Rifle Range development proposal.

4.4 Traffic Generation

Standard residential trips rates have been applied in past assessment work, and it is proposed to continue this practice. This is also consistent with the approach applied in the Councils' recent Fern Bay and North Stockton Traffic and Transport Study. This is conservative, in that the proposed mix of townhouses, apartments, courtyard and cluster homes would have a lower traffic generation than that of the single residential dwellings that has been applied here.

Table 4-3 – Applied Traffic Generation Rates presents the revised traffic generation characteristics of the Rifle Range site base on the updated total of 318 dwellings.

Table 4-3 – Future Traffic Generation Assumptions

Masterplan Component	AM Peak Generation Rate (vph)	AM Peak Trips (vph)	PM Peak Generation Rate (vph)	PM Peak Trips (vph)	Comments
Rifle Range	0.71	23 IN 203 OUT	0.78	223 IN 25 OUT	

Notes: All peak trip rates are expressed in vehicles per hour (vph)

These updated traffic generation forecasts represent an increase in the order of 25% over previous allowances for the Rifle Range site. They are however comparable to estimates used in the Councils' recent Traffic and Transport Study.

5 Existing Network Performance

5.1 Road Network

Traffic volume data for the project was collected during a 1 day survey of intersection traffic volumes as outlined in Section 3.2 of this report. These surveys were completed on a typical weekday. The surveys were completed using video monitoring and data capture techniques, and allow post survey viewing of video footage for review of characteristics such as queuing, driver behaviour and so on. Data reduction has been completed that focusses on the typical peak periods for commuters (and school based activity) at the start and end of the business day, i.e. 7.00 AM to 9.30 AM, and 2.00PM to 4.30PM. The results of this monitoring are provided in **Appendix E** of this report.

AM Operations

The results from the 2016 traffic survey indicated that during the surveyed morning AM peak commute period (7.00 to 8.00 AM) the two-way traffic flow along Nelson Bay Road south of Taylor Road was in the order of 1900 vph (864 NB +1060 SB). These flows are well within the technical capacity of a dual carriageway 4 lane urban arterial road at Level of Service (LoS) 'A' northbound, and 'B' southbound.

PM Operations

The corresponding results from the PM survey at Nelson Bay Road and Taylor Road between 3.30 PM and 4.30 PM (peak PM activity) show flows of a similar magnitude to the AM peak period. The PM data set indicates that during the surveyed afternoon peak period the two-way traffic flow along Nelson Bay Road was in the order of 2000 vph (1284 NB +720 SB), slightly more than the morning peak observed. These flows are again well within the technical capacity of urban traffic lanes at LoS 'B' northbound and LoS 'B' southbound.

A summary of the 8th June and 27th October 2016 traffic data is presented in **Table 5.1 – Base Traffic Volumes** below.

Table 5.1 – Base Traffic Volumes

Road	Location	Peak Period	Peak flow(1)	Mid-Block Road Capacity	Level of Service
Nelson Bay Road	North of Taylor Road	AM peak	861 N/B 1055 S/B	900 (one-way) (3) 1400 (one-way) (4)	A B
		PM peak	1260 N/B 714 S/B	900 (one-way) (4) 1400 (one-way) (4)	B A
Nelson Bay Road	South of Taylor Road	AM peak	864 N/B 1060 S/B	900 (one-way) (4) 1400 (one-way) (4)	B A
		PM peak	1284 N/B 720S/B	1400 (one-way) (4) 900 (one-way) (4)	B A
Taylor Road	East of Nelson Bay Rd	AM peak	4 eastbound 15 westbound	200 (one-way) (2)	A A
		PM peak	31 eastbound 18 westbound	200 (one-way) (2)	A A
Vardon Road	East of Nelson Bay Rd	AM peak	46 eastbound 23 westbound	200 (one-way) (2)	A
		PM peak	23 eastbound 27 westbound	200 (one-way) (2)	A

Notes: 1. Traffic flows from 8th June 2016 (Taylor Rd & Fullerton St) & 27th October 2016 (Vardon Road) traffic survey results by Mark Waugh Pty Ltd
2. RTA 2002, Urban Road Conditions, One Lane, Level of Service (Refer Table 5.2 below)
3. RTA 2002, Urban Road Conditions, Two Lanes, Level of Service (Refer Table 5.2 below)

Table 5.1 demonstrates that the roads serving as the main access routes for the subject site will continue to operate well within their technical and functional lane capacity levels as described by Austroads and NSW RMS guidelines.

The results above are drawn from the urban flow conditions Levels of Service definitions as presented in the Guide to Traffic Generating Developments ((NSW ART October 2002) Theses are reproduced here as Table 2.2 - Urban Road peak hour flows per direction, overleaf. It can be seen that the ultimate capacity for Taylor Road and Vardon Road for example in this location is 900 vph at the limit of acceptable flow conditions under urban conditions Level of Service 'D', and possibly up to 1400 vehicles per hour in one direction for LoS 'E'. For the current observed traffic flows along Taylor Road and Vardon Road it can be seen that the level of service for road users is very good at either 'A' and for Nelson Bay Road 'A' or 'B'.

Table 5.2 - Urban Road peak hour flows per direction

Level of service	One Lane (vph)	Two Lanes (vph)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: RTA Guide to Traffic Generating Developments, version 2.2 dated October 2002.

The conclusion drawn from this data is that the technical lane capacity of the road system adjacent to the subject sites is high and the performance is very good.

5.2 Intersection Performance

Local Intersections

As discussed above, there are a number of intersections and local access streets serving the subject site. Intersections of and with the local streets are priority controlled, with the Nelson Bay Road intersections with Taylor Road and Vardon Road currently operating under priority control. All local street intersections to the east of Nelson Bay Road also operate under priority control. This reflects the local function of these roads.

For the assessment of intersection performance it is useful to firstly consider the Austroads threshold levels for intersection capacity under uninterrupted flow conditions. Table 5.3 Intersection Capacity – Uninterrupted Flow Conditions below presents these thresholds. Where traffic flows fall within these limits intersection performance is essentially operating with little or no delay for approaching drivers other than to obey the requisite road rules.

Table 5.3 Intersection Capacity – Uninterrupted Flow Conditions

Road Type	Light Crossing or turning volumes Maximum Design Hour Volumes, Two-way (vph)		
Two Lane through Roadway	400	500	650
Cross Road	250	200	100
Four Lane through roadway	1000	1500	2000
Cross road	100	50	25

Source: Austroads Guide to Traffic Engineering Practice - Part 5, 1988

For both the morning and afternoon peak periods, the survey results indicate that these limits are not met on all the local street priority junctions involving local streets only. Essentially, traffic is required to slow down to negotiate turns with little if any delay for the through traffic movements. This is consistent with the site observations.

Operation of Nelson Bay Road intersections

The higher order interactions that are part of the road network providing access to the subject site are the Nelson Bay Road intersections operating under priority control at Taylor Road and Vardon Road. (While Rankin Road also connects Popplewell Road to Nelson Bay Road it operates under priority control and allows only left in left out turning movements. Given the full access available at both Taylor Road and Vardon Road Rankin Road has not been considered further in these investigations.)

A review of the mid-block capacities on Nelson Bay Road has shown there is significant spare capacity on this route.

For the above intersections, SIDRA[7] Intersection modelling has indicated a good Level of Service (LoS) of "A". The only exception to this is the right turn movements from Vardon Road and Taylor Road which were modelled at a LoS 'F'. This is despite the very low traffic volumes performing these movements. These results are a reflection of the quite high peak traffic flows along Nelson Bay Road. As such investigation of higher order traffic controls is warranted.

What is clear from the intersection analysis is that one of either the intersection of Taylor Road or Vardon Road with Nelson Bay Road is capable of accommodating all of the traffic movements forecast from the subject site.

That is, only one intersection upgrade is required.

Given the existing form of both the Taylor Road and Vardon Road intersections with Nelson Bay Road, the existing lane configurations are acceptable and could be used as the basis for intersection layouts with signalised control.

An alternative form of control that has been considered in past analysis is seagull style priority control that allows the staged movement of right turning vehicles across the main road flows. This was considered an attractive option possibly because of the very low side road flows, and the imposition of additional delay on through flows along Nelson Bay road if traffic signals were to be introduced.

However having reviewed the Councils' work for the Fern Bay and North Stockton Traffic and Transport Study which has considered the continued development within the immediate vicinity of the Rifle Range site, it is considered that the most appropriate form of upgraded intersection control to provide for safer right turn movements onto Nelson Bay road would be traffic signals installed at Vardon Road. This will also allow for the provision of upgraded pedestrian crossings which will go towards alleviating the concern caused by recent incidents involving pedestrian injuries in the locality.

Continued liaison with the road authorities is recommended to allow further development and confirmation of an acceptable overall access strategy along Nelson Bay Road for the Fern Bay community.

Further details of the intersection analyses are provided in **Appendix F** to this report.

Background Traffic Growth

The NSW RMS has for some time considered it necessary to make allowance for 'background growth' along its road corridors. This is to take into account additional traffic flows from unknown sources that add to the base traffic flows. In earlier assessment work for both the Fort Wallace and Rifle Range development proposals background traffic growth was not applied. This is because the growth factor in the area was considered to be the development proposals themselves, and so no growth factor was applied to avoid double dipping.

In the more recent work conducted for the Councils, a background growth factor of 2% per annum applied for 10 years was adopted. , but it is considered that because of the substantial spare capacity in the road network in the vicinity of the subject site, the only issue requiring consideration is the form and performance of the intersections with the local road network.

Traffic from Fort Wallace Planning Proposal

It should be noted that a comparable report has been prepared for the second site under consideration, and that both pieces of work have taken into account the traffic generation and impacts of the other proposal.

6 Future Network Performance

6.1 Road Network

The forecast traffic generation form the subject site presented in Table 4-3 have been added to the existing flows to arrive at the 'with development' scenario.

A summary of the changes in peak traffic flows, assuming 50% of the forecast additional site movements the development are assigned along both Taylor Road and Vardon Road (which is extremely conservative) is presented below.

Table 6.1 – Forecast Mid-Block Traffic Volumes

Road	Location	Peak Period	Peak flow(1)	Mid-Block Road Capacity	Level of Service
Nelson Bay Road	North of Taylor Road	AM peak	951 N/B[4] 1062 S/B[4]	900 (one-way) (3) 1400 (one-way) (3)	B B
		PM peak	1276 N/B[4] 811 S/B[4]	900 (one-way) (3) 1400 (one-way) (3)	B A
Nelson Bay Road	South of Taylor Road	AM peak	875 N/B[4] 1174 S/B[4]	900 (one-way) (3) 1400 (one-way) (3)	A B
		PM peak	1406 N/B[4] 732 S/B[4]	1800 (one-way) (3) 900 (one-way) (3)	C A
Taylor Road	East of Nelson Bay Rd	AM peak	22 eastbound[4] 178 westbound[4]	200 (one-way) (2)	A A
		PM peak	310 eastbound[4] 39 westbound[4]	380 (one-way) (2) 200 (one-way) (2)	B A
Vardon Road	East of Nelson Bay Rd	AM peak	65 eastbound 206 westbound	200 (one-way) (2) 380 (one-way) (2)	A B
		PM peak	203 eastbound 196 westbound	380 (one-way) (2) 200 (one-way) (2)	B A

Notes: 1. Peak flow from 8th June 2016 traffic survey results by Mark Waugh Pty Ltd
2. RTA 2002, Urban Road Conditions, One Lane, Level of Service (Refer Table 5.2 below)
3. RTA 2002, Urban Road Conditions, Two Lanes, Level of Service (Refer Table 5.2 below)
4. 100% of site future traffic assigned to Taylor Road
4. 100% of site future traffic assigned to Vardon Road
5. Traffic Volumes are based on Revision 5 Development yield of 249 lots for Rifle Range

Table 6.1 demonstrates that the roads surrounding the subject site will continue to operate well within their technical and functional lane capacity levels as described by Austroads and NSW RMS guidelines. This includes a review of the updated Indicative Masterplan for the Rifle Range site, with all mid-block capacities still forecast to be within the acceptable Level of Service range of 'A' to 'C' for peak urban traffic flow conditions.

6.2 Potential Intersection Layouts

Two forms of intersection upgrade were considered in past investigations, and were considered to be applicable to either of the Vardon Road or Taylor Road junctions depending on road authority requirements.

Following review of the Councils' recent Fern Bay and North Stockton Traffic and Transport Study the form of intersection upgrade considered most appropriate to support the Rifle Range site and adjacent development is a potential traffic signal upgrade to the Nelson Bay Road / Vardon Road intersection.

Photo Plate 13– Nelson Bay Road (B63) at Vardon Road. U-turn lane in foreground could also be used in a seagull junction.

This form of intersection control can essentially fit within the existing junction configuration. An example of this type of signalised T junction layout is illustrated below.

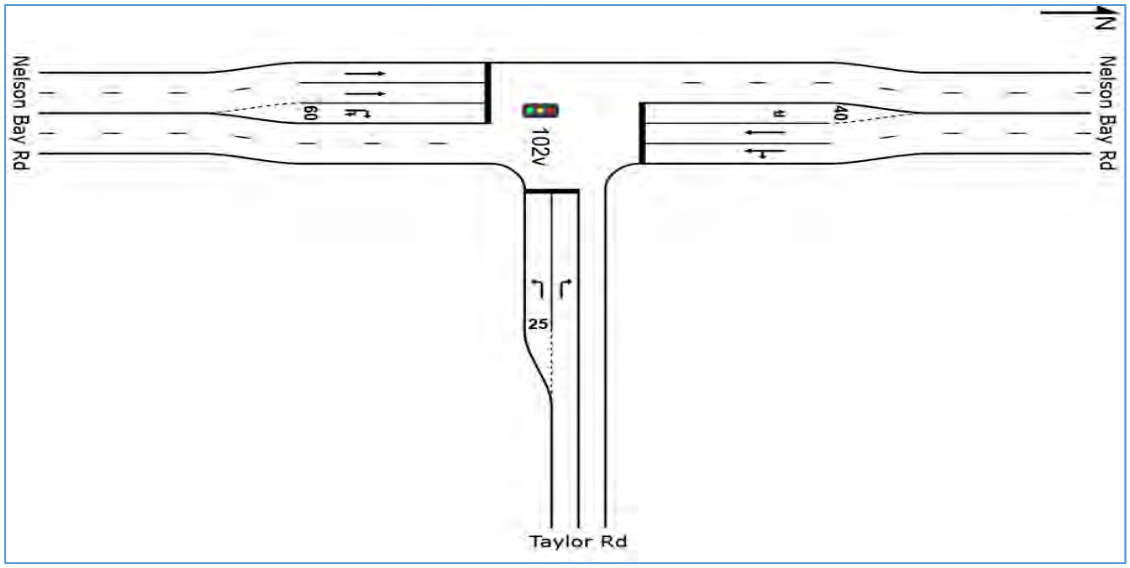


Figure 4 -Schematic layout of signalised intersection treatment.

6.3 Modelled Intersection Performance

Intersection performance have been re-tested here as part of the future site access considerations. The operations of Nelson Bay Road / Taylor Road and/or Vardon Road have been tested to demonstrate the potential future intersection performance. The results of the SIDRA analysis indicate the following potential operating issues:

a. Priority controlled access to local streets can function at very high and satisfactory service levels.

b. Upgrade of the Nelson Bay Road / Vardon Road intersection only is required to accommodate safe right turns out onto Nelson Bay Road.

The intersection analysis performed with SIDRA modelling has been reviewed to a level to confirm the validity of the potential upgraded access option at Vardon Road to support the Rifle Range rezoning proposal. The

SIDRA results are now based on the Revision H dwelling yield of 318 dwellings. The updated modelling results indicate that the critical AM right turn out of Vardon Road under current priority control is forecast to operate at a level of Service LoS 'F' with the updated Rifle Range traffic flows. Consequently signalisation of the intersection will be required to cope with the forecast increase in right turn volumes.

Level of Service Summaries for the junction analyses are included in **Appendix F** to this report.

6.4 Recommended Access Strategy

(Traffic Management Principles from Austroads Guide to Traffic Management Part 4: Network Management)

The functional class of a road determines the balance that needs to be struck between the traffic function and the access function of the abutting land.

The local access requirements of the subject site connecting to Popplewell Road will be satisfied by priority junction control, and road cross sections consistent with the engineering standards of the City of Newcastle for local street design.

Nelson Bay Road is an arterial road, and so its important function is primarily to favour traffic movement over access considerations. Direct access is generally discouraged and in this instance can be avoided by using local road connections.

TRAFFIC ENGINEERING RECOMMENDATIONS:

Having regard for the recent Fern Bay and North Stockton Traffic and Transport Study completed by Port Stephens Council and the City of Newcastle, and also considering the revised and updated Indicative Masterplan for the Rifle Range site.

It is recommended that the forecast level of development activity from the subject site be accommodated on the road network by way of the following road improvements:

a) Upgrade to RMS requirements for traffic signal control of the Vardon Road / Nelson Bay Road
b) Upgrade to Council road design standards of the local roads , Taylor Road and Vardon Road to Nelson Bay Road

Subsequent detailed investigations and design (at Development Application stage and beyond) in conjunction with the road authorities are recommended to confirm acceptable access arrangements for the site.

7 Summary and Conclusions

7.1 Summary

The Defence Housing Australia proposes to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. DHA has recently purchased two surplus Defence sites at Stockton with the objective of obtaining the necessary planning approvals and developing them for a mix of housing for ADF personnel and the private market. This updated traffic study has investigated the existing conditions and potential development of Defence Housing Australia housing facilities on the Rifle Range site at Fern Bay near Newcastle NSW, arriving at the following outcomes:

Existing Conditions

a. Existing flow conditions on Nelson Bay Road are well within technical capacity limits of its function and standard of construction.
b. Local roads in Fern Bay are quite old, but serviceable for the existing low levels of local traffic. Pavement conditions are generally fair to poor.
c. Intersections have been assessed as operating at satisfactory service levels, with the exception of existing right turns out of Taylor and Vardon roads onto Nelson Bay Road.
d. Cycling facilities are provided along the Hunter River foreshore, from near Stockton Bridge to the Stockton Ferry terminal.
e. The Newcastle to Stockton ferry service links Stockton to the Newcastle CBD with regular scheduled services.
f. Existing bus services connect Fern Bay and Stockton to Newcastle, and also north to Newcastle Airport.

Proposed Development

g. Additional traffic generation associated with the Rifle Range site has been updated to reflect the 318 dwellings of the Indicative Master plan (Architectus Revision H 10th May 2018)

h. The Fern Bay and North Stockton Traffic and Transport Study completed recently by Port Stephens Council and the City of Newcastle has also been considered in the review and updates to this traffic assessment.

i. Access is still planned via Popplewell Road to Taylor Road and Vardon Road, connecting to Nelson Bay Road.

Future Performance

j. Future flow conditions on Nelson Bay Road are forecast to remain well within technical capacity limits for the function and standard of construction of the road under urban flow conditions.
k. Intersections have been assessed under future flow conditions as operating at satisfactory service levels, with the exception of northbound right turns out of either Taylor or Vardon Roads onto Nelson Bay Road.

ACCESS RECOMMENDATIONS:

In view of the conditions of the local roads and performance of intersections on Nelson Bay Road the following recommendations are made for improvements to support the development proposal:

a. Upgrade of the intersection of Nelson Bay Road with Vardon Road to provide safe right turn access for the existing Fern Bay community and future development, including the proposal for the Rifle Range site.
b. Confirm design requirements and upgrades to Taylor Road and Vardon Road to Council local street standards, with both roads performing a local access function connecting to Nelson Bay Road.

7.2 Conclusion

Access focussing on the Vardon Road intersection with Nelson Bay Road, provided with improved right turn facilities, combined with upgrading of the local road connections to the main road network, to Council design standards, will present a very effective access solution. The improvements will also greatly benefit the existing Fern Bay community. Further liaison is required with the road authorities but on the basis of this revised traffic assessment the updated Indicative Masterplan for the Rifle Range sites is considered satisfactory from a traffic and transport perspective.

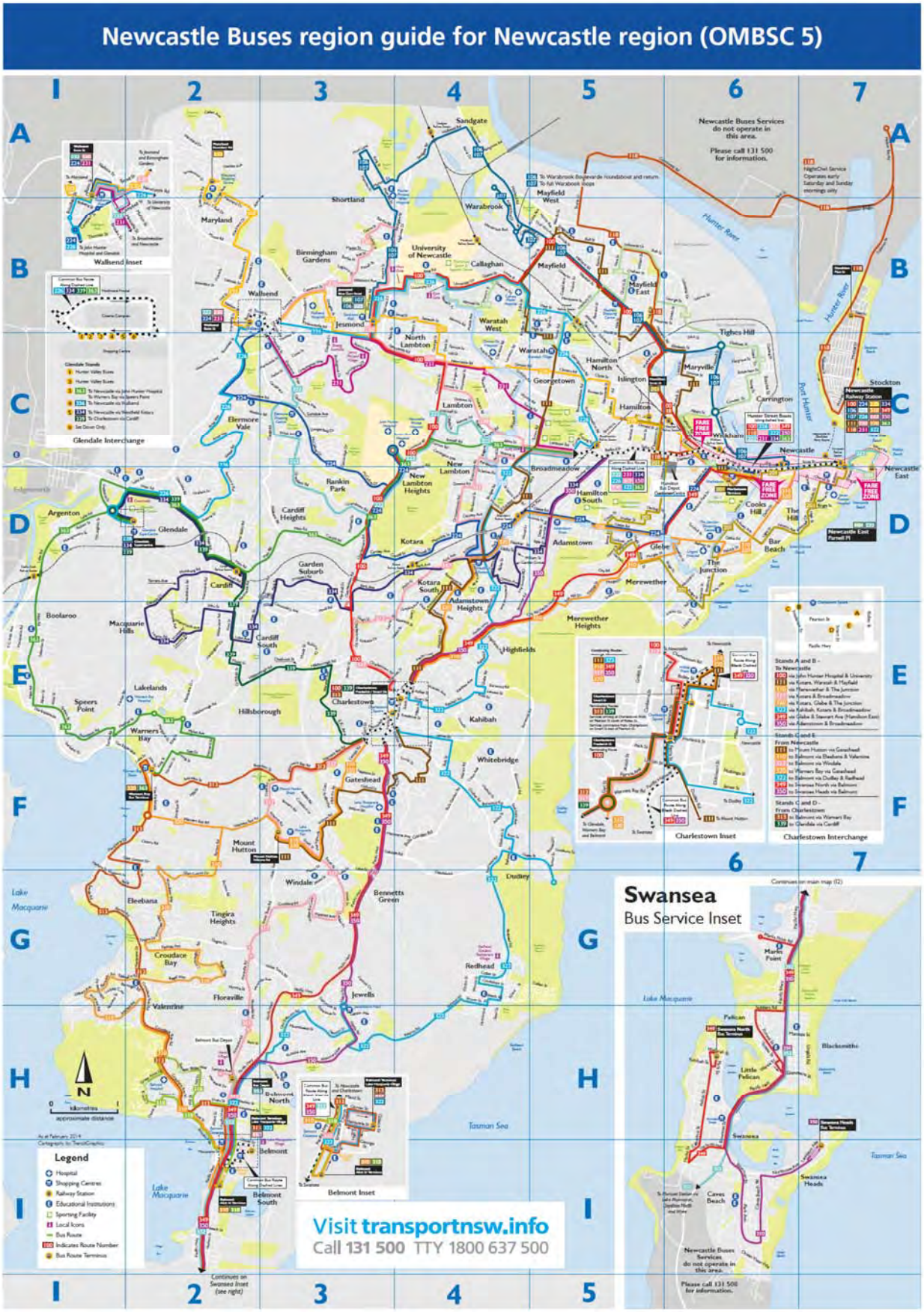
The overall conclusion is that given the potential level of future development now proposed for the Rifle Range site at Fern Bay, the access strategy put forward here to support the planning proposal is supported.

Appendix A. Rifle Range Draft Indicative Master Plan (Revision H 10/05/18)

Source: Architectus 2018

Appendix B. Newcastle Cycling Map

Appendix C. Public Transport Maps



BETTER TRANSPORT FUTURES

Route 130

Section Point Number
Location:

00 **Fingal Bay Shops** Marine Drive
01 Rocky Point Road
02 Marine Drive
03 Shoal Bay Road
04 Shoal Bay Road
05 **Nelson Bay** Coles, Donald Street
06 Government Road
07 Sandy Point Road
08 **Salamander Shopping Centre**
09 Salamander Way
10 Nelson Bay Road
11 Frost Road
12 Frost Road
13 **Boat Harbour** Kingsley Drive
14 **Anna Bay Shops** Gan Gan Road
15 Nelson Bay Road
16 Nelson Bay Road
17 Nelson Bay Road
18 Nelson Bay Road
19 Nelson Bay Road OR Marsh Road
20 Nelson Bay Road OR Marsh Road
21 Nelson Bay Road OR Marsh Road
22 Nelson Bay Road OR Marsh Road
23 Nelson Bay Road
24 **Salt Ash School**
25 Nelson Bay Road
26 Nelson Bay Road
27 Nelson Bay Road
28 Nelson Bay Road
29 **Newcastle Airport**
30 Nelson Bay Road
31 Nelson Bay Road
32 Nelson Bay Road
33 Nelson Bay Road
34 **Fern Bay** Bay Way Caravan Park
35 Nelson Bay Road
36 Nelson Bay Road
37 Teal Street
38 Cormorant Road
39 Cormorant Road
40 **Mayfield** Woolworths, Maitland Road
41 Maitland Road
42 **Newcastle Station** Coach Terminal

Bus route map

130, 131, 132, 133, 134, 135

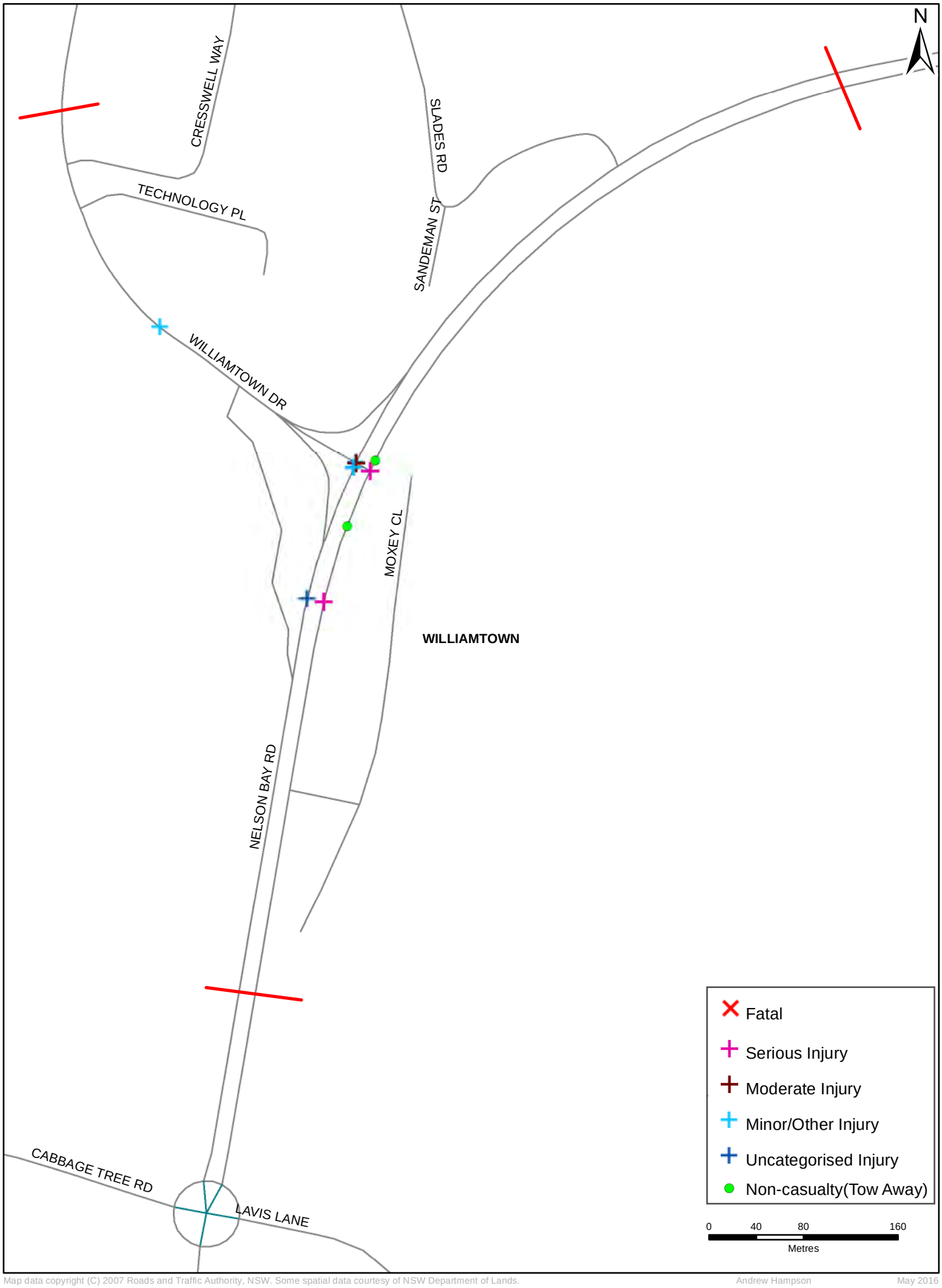
Timing Points

A Fingal Bay Shops Marine Drive
B Shoal Bay Resort Shoal Bay Road
C Little Beach Dixon Drive
D Tomaree Hospital & Seabreeze Shops
E Nelson Bay Coles, Donald Street
F Corlette Vantage Estate
G Galoola Drive & Bagnall Beach Road
H Corlette Post Office
I Salamander Shopping Centre
J Boat Harbour Kingsley Drive
K Birubi Point Fitzroy Street
L Anna Bay Shops Gan Gan Road
M Taylors Beach Roundabout
N Soldiers Point Ridgeway Avenue
O Bobs Farm School Marsh Road
P Salt Ash School
Q Newcastle Airport
R Fern Bay Bay Way Caravan Park
S Mayfield Woolworths, Maitland Road
T Newcastle Station Coach Terminal
U Raymond Terrace Sturgeon Street

Appendix D. Crash History

Nelson Bay Road and Williamtown Drive, Williamtown

Crash period 01/07/2010 to 30/06/2015



Map data copyright (C) 2007 Roads and Traffic Authority, NSW. Some spatial data courtesy of NSW Department of Lands.

Andrew Hampson

May 2016

Detailed Crash Report - sorted

Transport for NSW
Centre for Road Safety

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Nelson Bay Rd**						
737195 P	28/10/2010	Thu	09:00	10 m N	WILLIAMTOWN DR	TJN	CRV	Overcast	Dry	80	2	WAG	U U	S in NELSON BAY RD	Unk	Proceeding in lane	N	0	0	
E42597045					Daylight	RUM: 30	Rear end					CAR	M59	S in NELSON BAY RD	0	Stationary				
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Nelson Bay Rd**						
754112 P	19/05/2011	Thu	15:38	5 m S	WILLIAMTOWN DR	TJN	STR	Fine	Dry	80	2	CAR	F53	N in NELSON BAY RD	80	Proceeding in lane	I	0	3	
E45001643					Daylight	RUM: 30	Rear end					CAR	F82	N in NELSON BAY RD	0	Stationary				
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Nelson Bay Rd**						
761747 P	21/07/2011	Thu	18:20	at	WILLIAMTOWN DR	TJN	CRV	Raining	Wet	70	1	CAR	M26	S in NELSON BAY RD	70	Proceeding in lane	I	0	2	S
E45228464					Darkness	RUM: 87	Off lft/lft bnd=>obj					Utility pole								
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Nelson Bay Rd**						
761799 P	22/07/2011	Fri	14:30	at	WILLIAMTOWN DR	TJN	CRV	Raining	Wet	80	2	CAR	F26	N in NELSON BAY RD	70	Proceeding in lane	I	0	1	
E156032296					Daylight	RUM: 30	Rear end					TRK	M40	N in NELSON BAY RD	70	Proceeding in lane				
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Nelson Bay Rd**						
787583 P	07/03/2012	Wed	11:00	50 m W	WILLIAMTOWN DR	DIV	CRV	Raining	Wet	70	1	CAR	M26	S in NELSON BAY RD	60	Proceeding in lane	N	0	0	S
E48579555					Daylight	RUM: 87	Off lft/lft bnd=>obj					Drain/culvert								
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Nelson Bay Rd**						
806499 P	06/08/2012	Mon	14:30	at	WILLIAMTOWN DR	TJN	CRV	Fine	Dry	80	1	UTE	M48	N in NELSON BAY RD	80	Proceeding in lane	I	0	1	F
E47846860					Daylight	RUM: 81	Off left/rt bnd=>obj					Signal pole								
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Nelson Bay Rd**						
812166 P	28/09/2012	Fri	15:44	500 m N	CABBAGE TREE RD	DIV	STR	Fine	Dry	100	2	M/C	F44	N in NELSON BAY RD	70	Proceeding in lane	I	0	1	
E49410766					Daylight	RUM: 30	Rear end					TRK	M29	N in NELSON BAY RD	0	Stationary				
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Williamtown Dr**						
1007282 P	09/10/2013	Wed	13:15	200 m W	NELSON BAY RD	2WY	CRV	Fine	Dry	60	1	WAG	M61	W in WILLIAMTOWN DR	50	Proceeding in lane	I	0	1	S F
E55232283					Daylight	RUM: 81	Off left/rt bnd=>obj					Signpost								
Hunter Region					**Port Stephens LGA**				**Williamtown**					**Nelson Bay Rd**						
1034425 P	09/07/2014	Wed	15:40	500 m N	CABBAGE TREE RD	DIV	STR	Fine	Dry	80	2	CAR	M29	N in NELSON BAY RD	30	Proceeding in lane	I	0	1	
E56102416					Daylight	RUM: 30	Rear end					CAR	M39	N in NELSON BAY RD	0	Stationary				

Detailed Crash Report - sorted

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region		**Port Stephens LGA**			**Williamtown**									**Nelson Bay Rd**						
1040656 P	17/07/2014	Thu	16:30	5 m S	WILLIAMTOWN DR	TJN	CRV	Fine	Dry	60	4	TRK	M30	N in NELSON BAY RD	90	Proceeding in lane	I	0	3	S
E54998152			Daylight			RUM:	30	Rear end				TRK	M21	N in NELSON BAY RD	0	Stationary				
												CAR	M49	E in WILLIAMTOWN DR	20	Turning right				
												CAR	M20	S in NELSON BAY RD	0	Stationary				

Report Totals: Total Crashes: 10 Fatal Crashes: 0 Injury Crashes: 8 Killed: 0 Injured: 13

Crashid dataset Nelson Bay Road and Williamtown Drive, Williamtown - crash data from 01/07/2010 to 30/06/2015

Note: *Ordered by: Crash Date,Crash Time,Crash No.*

Crash self reporting, including self reported injuries began in Oct 2014. Trends from 2014 are expected to vary from previous years. More unknowns are expected in self reported data. For further information refer to Data Manual or report provider.

Summary Crash Report

# Crash Type		
Car Crash	9	90.0%
Light Truck Crash	3	30.0%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	*(0)*	*(0.0%)*
Bus Crash	0	0.0%
"Heavy Vehicle Crash	*(0)*	*(0.0%)*
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	1	10.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	6	60.0%
Non intersection	4	40.0%

* Up to 10 metres from an intersection

Collision Type		
Single Vehicle	4	40.0%
Multi Vehicle	6	60.0%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	9	90.0%
Unclassified Road	1	10.0%

Contributing Factors		
Speeding	4	40.0%
Fatigue	2	20.0%

Weather		
Fine	6	60.0%
Rain	3	30.0%
Overcast	1	10.0%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	3	30.0%
Dry	7	70.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	0	0.0%
Daylight	9	90.0%
Dusk	0	0.0%
Darkness	1	10.0%

Crash Movement		
Intersection, adjacent approaches	0	0.0%
Head-on (not overtaking)	0	0.0%
Opposing vehicles; turning	0	0.0%
U-turn	0	0.0%
Rear-end	6	60.0%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	0	0.0%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	4	40.0%
Out of control on curve	0	0.0%
Other crash type	0	0.0%

Speed Limit					
40 km/h or less	0	0.0%	80 km/h zone	5	50.0%
50 km/h zone	0	0.0%	90 km/h zone	0	0.0%
60 km/h zone	2	20.0%	100 km/h zone	1	10.0%
70 km/h zone	2	20.0%	110 km/h zone	0	0.0%

~ 07:30-09:30 or 14:30-17:00 on school days	~ 40km/h or less	0	0.0%	~ School Travel Time Involvement	5	50.0%

Day of the Week												
Monday	1	10.0%	Wednesday	3	30.0%	Friday	2	20.0%	Sunday	0	0.0%	WEEKEND	0	0.0%
Tuesday	0	0.0%	Thursday	4	40.0%	Saturday	0	0.0%	WEEKDAY	10	**********			

CRASHES	10	
Fatal	0	0.0%
Serious inj.	2	20.0%
Moderate inj.	1	10.0%
Minor/Other inj.	3	30.0%
Uncategorised inj.	2	20.0%
Non-casualty	2	20.0%

Self Reported Crash	0	0%

Time Group		% of Day	
00:01 - 02:59	0	0.0%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	0	0.0%	4.2%
08:00 - 08:59	0	0.0%	4.2%
09:00 - 09:59	1	10.0%	4.2%
10:00 - 10:59	0	0.0%	4.2%
11:00 - 11:59	1	10.0%	4.2%
12:00 - 12:59	0	0.0%	4.2%
13:00 - 13:59	1	10.0%	4.2%
14:00 - 14:59	2	20.0%	4.2%
15:00 - 15:59	3	30.0%	4.2%
16:00 - 16:59	1	10.0%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	1	10.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	0	0.0%	8.3%
22:00 - 24:00	0	0.0%	8.3%

Street Lighting Off/Nil		% of Dark
0	of 1	in Dark 0.0%

CASUALTIES	13	
Killed	0	0.0%
Seriously inj.	2	15.4%
Moderately inj.	2	15.4%
Minor/Other inj.	5	38.5%
Uncategorised inj.	4	30.8%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes		Casualties
2	2014	4
1	2013	1
3	2012	2
3	2011	6
1	2010	0

McLean Periods		%	% Week
A	0	0.0%	17.9%
B	0	0.0%	7.1%
C	5	50.0%	17.9%
D	0	0.0%	3.5%
E	0	0.0%	3.6%
F	1	10.0%	10.7%
G	4	40.0%	7.1%
H	0	0.0%	7.1%
I	0	0.0%	12.5%
J	0	0.0%	10.7%

#Holiday Periods												
New Year	0	0.0%	Easter	0	0.0%	Queen's BD	0	0.0%	Christmas	0	0.0%	Easter SH	0	0.0%	Sept./Oct. SH	1	10.0%
Aust. Day	0	0.0%	Anzac Day	0	0.0%	Labour Day	1	10.0%	January SH	0	0.0%	June/July SH	1	10.0%	December SH	0	0.0%

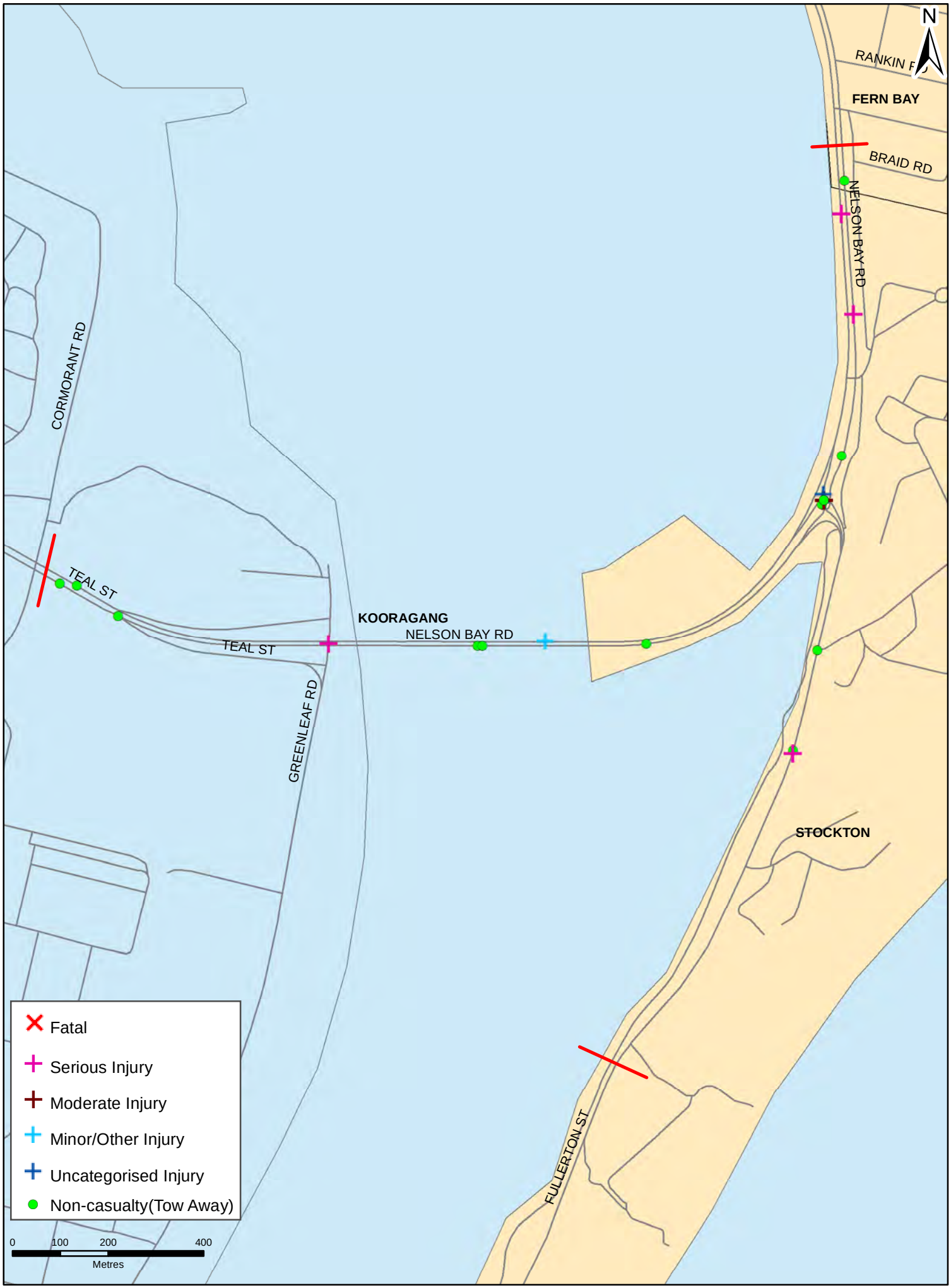
Crashid dataset Nelson Bay Road and Williamtown Drive, Williamtown - crash data from 01/07/2010 to 30/06/2015

Note: Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data. Reporting yrs 1996-2004 and 2014 onwards contain uncategorised inj crashes.

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Stockton Bridge, Nelson Bay Road and Fullerton Street, Fern Bay

Crash period 01/07/2010 to 30/06/2015



Map data copyright (C) 2007 Roads and Traffic Authority, NSW. Some spatial data courtesy of NSW Department of Lands.

Andrew Hampson

May 2016

Detailed Crash Report - sorted

Transport for NSW
Centre for Road Safety

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
717007 P	03/07/2010	Sat	14:25	at	FULLERTON ST	RDB	CRV	Fine	Dry	80	2	CAR	F81	W in FULLERTON ST	10 Proceeding in lane		N	0	0	
E41773328					Daylight	RUM: 10	Cross traffic					TRK	M28	S in NELSON BAY RD	50 Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
717500 P	12/07/2010	Mon	12:20	10 m	S FULLERTON ST	RDB	CRV	Fine	Dry	80	2	LOR	M67	S in NELSON BAY RD	40 Proceeding in lane		N	0	0	
E41570045					Daylight	RUM: 30	Rear end					CAR	F65	S in NELSON BAY RD	40 Proceeding in lane					
Hunter Region				**Port Stephens LGA**			**Fern Bay**							**Nelson Bay Rd**						
723113 P	12/08/2010	Thu	07:50	100 m	N FULLERTON COVE RD	DIV	STR	Fine	Dry	100	2	CAR	M21	S in NELSON BAY RD	Unk Proceeding in lane		N	0	0	
E41907766					Daylight	RUM: 30	Rear end					WAG	F47	S in NELSON BAY RD	Unk Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Stockton**							**Fullerton St**						
740774 P	01/02/2011	Tue	08:50	555 m	S NELSON BAY RD	2WY	CRV	Fine	Dry	70	1	WAG	M40	S in FULLERTON ST	55 Proceeding in lane		N	0	0	F
E376143391					Daylight	RUM: 81	Off left/rt bnd=>obj					Utility pole								
Hunter Region				**Newcastle LGA**			**Kooragang**							**Teal St**						
750199 P	10/04/2011	Sun	01:14	600 m	N SANDPIPER CL	DIV	STR	Fine	Dry	80	1	WAG	M53	W in TEAL ST	80 Proceeding in lane		N	0	0	
E44524077					Darkness	RUM: 66	Object on road					Other non fixed object								
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
757281 P	05/05/2011	Thu	14:55	at	FULLERTON ST	RDB	STR	Fine	Dry	70	2	CAR	M17	N in NELSON BAY RD	20 Turning right		I	0	2	
E44540221					Daylight	RUM: 21	Right through					CAR	F71	S in NELSON BAY RD	20 Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
765006 P	04/08/2011	Thu	12:45	600 m	N FULLERTON ST	DIV	STR	Fine	Dry	80	1	CAR	M59	N in NELSON BAY RD	75 Proceeding in lane		I	0	1	
E654664490					Daylight	RUM: 71	Off rd left => obj					Utility pole								
Hunter Region				**Newcastle LGA**			**Stockton**							**Fullerton St**						
770833 P	04/10/2011	Tue	12:00	560 m	S NELSON BAY RD	2WY	CRV	Fine	Dry	70	1	M/C	F43	N in FULLERTON ST	70 Pull out opposite		I	0	1	S
E46401051					Daylight	RUM: 51	Out of control otake													
Hunter Region				**Newcastle LGA**			**Kooragang Isla**							**Greenleaf Rd**						
781088 P	20/10/2011	Thu	21:45	at	STOCKTON BDGE	2WY	STR	Fine	Dry	60	4	CAR	M22	N in GREENLEAF RD	Unk Proceeding in lane		I	0	2	
E46808741					Darkness	RUM: 71	Off rd left => obj					CAR		N in GREENLEAF RD	0 Parked					
												PED	F18	GREENLEAF RD	Lie/sit on carriageway					
												PED	M19	GREENLEAF RD	Lie/sit on carriageway					

Detailed Crash Report - sorted

Transport for NSW
Centre for Road Safety

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
789179 P	02/03/2012	Fri	04:50	700 m W	FULLERTON ST	DIV	STR	Raining	Wet	60	1	CAR	F57	E in NELSON BAY RD	60 Proceeding in lane		I	0	1	
E91173101					Darkness	RUM: 73	Off rd rght => obj					Fence (prior to 2014)								
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
787317 P	14/03/2012	Wed	05:30	400 m N	FULLERTON ST	DIV	STR	Fine	Dry	70	1	WAG	M57	S in NELSON BAY RD	60 Proceeding in lane		I	0	1	
E47407445					Darkness	RUM: 71	Off rd left => obj					Utility pole								
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
811301 P	11/09/2012	Tue	05:33	at	STOCKTON BDGE	DIV	CRV	Fine	Dry	80	4	4WD	M24	W in NELSON BAY RD	50 Proceeding in lane		N	0	0	
E50837287					Dawn	RUM: 30	Rear end					VAN	M38	W in NELSON BAY RD	50 Proceeding in lane					
												4WD	M34	W in NELSON BAY RD	50 Proceeding in lane					
												CAR	F61	W in NELSON BAY RD	50 Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
836620 P	15/05/2013	Wed	10:00	at	FULLERTON ST	RDB	CRV	Fine	Dry	70	2	CAR	M62	W in FULLERTON ST	30 Proceeding in lane		N	0	0	
E51252036					Daylight	RUM: 10	Cross traffic					CAR	F19	S in NELSON BAY RD	50 Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Kooragang**							**Teal St**						
857191 P	29/10/2013	Tue	16:45	100 m E	CORMORANT ROAD OP	DIV	STR	Overcast	Wet	80	1	CAR	F38	E in TEAL ST	90 Proceeding in lane		N	0	0	S
E53018456					Daylight	RUM: 71	Off rd left => obj					Fence (prior to 2014)								
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
1009025 P	24/01/2014	Fri	20:10	at	FULLERTON ST	TJN	CRV	Overcast	Wet	70	1	CAR	M64	N in NELSON BAY RD	80 Proceeding in lane		I	0	1	S
E460723191					Darkness	RUM: 87	Off lft/lft bnd=>obj					Utility pole								
Hunter Region				**Newcastle LGA**			**Kooragang**							**Nelson Bay Rd**						
1010672 P	04/02/2014	Tue	07:40	at	STOCKTON BDGE	DIV	STR	Fine	Dry	80	1	CAR	M U	W in NELSON BAY RD	65 Proceeding in lane		N	0	0	
E53628132					Daylight	RUM: 71	Off rd left => obj					Bridge								
Hunter Region				**Newcastle LGA**			**Kooragang**							**Nelson Bay Rd**						
1014048 P	09/03/2014	Sun	18:50	500 m S	FULLERTON ST	DIV	STR	Fine	Dry	80	2	CAR	M31	W in NELSON BAY RD	40 Proceeding in lane		N	0	0	
E188434897					Daylight	RUM: 30	Rear end					CAR	M57	W in NELSON BAY RD	0 Stationary					
Hunter Region				**Newcastle LGA**			**Stockton**							**Fullerton St**						
1022452 P	17/04/2014	Thu	14:45	at	STOCKTON CENTRE ENT	2WY	STR	Fine	Dry	70	2	CAR	M52	W in FULLERTON ST	10 Forward from drive		N	0	0	
E54257614					Daylight	RUM: 47	Emerging from drive					4WD	M68	S in FULLERTON ST	55 Proceeding in lane					

Detailed Crash Report - sorted

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region				**Newcastle LGA**					**Kooragang**					**Teal St**						
1038161 P	28/08/2014	Thu	21:00	at	GREENLEAF ROAD TO	DIV	STR	Overcast	Wet	80	3	CAR	M19	W in TEAL ST	40	Proceeding in lane	N	0	0	
E55550975					Darkness	RUM:	30	Rear end				CAR	F29	W in TEAL ST	0	Stationary				
												CAR	F17	W in TEAL ST	0	Stationary				
Hunter Region				**Port Stephens LGA**					**Fern Bay**					**Nelson Bay Rd**						
1041839 P	07/09/2014	Sun	04:30	150 m	S TAYLOR RD	DIV	STR	Raining	Wet	70	2	UTE	U U	S in NELSON BAY RD	70	Proceeding in lane	N	0	0	F
E56227779					Darkness	RUM:	71	Off rd left => obj				CAR		S in NELSON BAY RD	0	Parked footpath				

Report Totals: Total Crashes: 20 Fatal Crashes: 0 Injury Crashes: 7 Killed: 0 Injured: 9

Crashid dataset Stockton Bridge, Nelson Bay Road and Fullerton Street, Fern Bay - crash data from 01/07/2010 to 30/06/2015

Note: *Ordered by: Crash Date,Crash Time,Crash No.*

Crash self reporting, including self reported injuries began in Oct 2014. Trends from 2014 are expected to vary from previous years. More unknowns are expected in self reported data. For further information refer to Data Manual or report provider.

Summary Crash Report

# Crash Type		
Car Crash	19	95.0%
Light Truck Crash	1	5.0%
Rigid Truck Crash	1	5.0%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	*(1)*	*(5.0%)*
Bus Crash	0	0.0%
"Heavy Vehicle Crash	*(1)*	*(5.0%)*
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	1	5.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	1	5.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	5	25.0%
Non intersection	15	75.0%

* Up to 10 metres from an intersection

Collision Type		
Single Vehicle	9	45.0%
Multi Vehicle	11	55.0%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	16	80.0%
Unclassified Road	4	20.0%

Contributing Factors		
Speeding	3	15.0%
Fatigue	2	10.0%

Weather		
Fine	15	75.0%
Rain	2	10.0%
Overcast	3	15.0%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	5	25.0%
Dry	15	75.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	1	5.0%
Daylight	12	60.0%
Dusk	0	0.0%
Darkness	7	35.0%

Crash Movement		
Intersection, adjacent approaches	2	10.0%
Head-on (not overtaking)	0	0.0%
Opposing vehicles; turning	1	5.0%
U-turn	0	0.0%
Rear-end	5	25.0%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	1	5.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	7	35.0%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	2	10.0%
Out of control on curve	0	0.0%
Other crash type	2	10.0%

Speed Limit					
40 km/h or less	0	0.0%	80 km/h zone	9	45.0%
50 km/h zone	0	0.0%	90 km/h zone	0	0.0%
60 km/h zone	2	10.0%	100 km/h zone	1	5.0%
70 km/h zone	8	40.0%	110 km/h zone	0	0.0%

~ 07:30-09:30 or 14:30-17:00 on school days	~ 40km/h or less			~ School Travel Time Involvement		
	0	0.0%		5	25.0%	

Day of the Week												
Monday	1	5.0%	Wednesday	2	10.0%	Friday	2	10.0%	Sunday	3	15.0%	WEEKEND	4	20.0%
Tuesday	5	25.0%	Thursday	6	30.0%	Saturday	1	5.0%	WEEKDAY	16	80.0%			

CRASHES	20	
Fatal	0	0.0%
Serious inj.	4	20.0%
Moderate inj.	1	5.0%
Minor/Other inj.	1	5.0%
Uncategorised inj.	1	5.0%
Non-casualty	13	65.0%

CASUALTIES	9	
Killed	0	0.0%
Seriously inj.	4	44.4%
Moderately inj.	3	33.3%
Minor/Other inj.	1	11.1%
Uncategorised inj.	1	11.1%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Self Reported Crash	0	0%

Time Group		% of Day	
00:01 - 02:59	1	5.0%	12.5%
03:00 - 04:59	2	10.0%	8.3%
05:00 - 05:59	2	10.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	2	10.0%	4.2%
08:00 - 08:59	1	5.0%	4.2%
09:00 - 09:59	0	0.0%	4.2%
10:00 - 10:59	1	5.0%	4.2%
11:00 - 11:59	0	0.0%	4.2%
12:00 - 12:59	3	15.0%	4.2%
13:00 - 13:59	0	0.0%	4.2%
14:00 - 14:59	3	15.0%	4.2%
15:00 - 15:59	0	0.0%	4.2%
16:00 - 16:59	1	5.0%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	1	5.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	3	15.0%	8.3%
22:00 - 24:00	0	0.0%	8.3%

Street Lighting Off/Nil		% of Dark
0	of 7	in Dark 0.0%

Crashes		Casualties
6	2014	1
2	2013	0
3	2012	2
6	2011	6
3	2010	0

McLean Periods		% Week	
A	6	30.0%	17.9%
B	1	5.0%	7.1%
C	6	30.0%	17.9%
D	1	5.0%	3.5%
E	0	0.0%	3.6%
F	1	5.0%	10.7%
G	1	5.0%	7.1%
H	1	5.0%	7.1%
I	0	0.0%	12.5%
J	3	15.0%	10.7%

#Holiday Periods																		
New Year	0	0.0%	Easter	1	5.0%	Queen's BD	0	0.0%	Christmas	0	0.0%	Easter SH	2	10.0%	Sept./Oct. SH	1	5.0%	
Aust. Day	1	5.0%	Anzac Day	0	0.0%	Labour Day	0	0.0%	January SH	1	5.0%	June/July SH	2	10.0%	December SH	0	0.0%	

Crashid dataset Stockton Bridge, Nelson Bay Road and Fullerton Street, Fern Bay - crash data from 01/07/2010 to 30/06/2015 plus provisional data to date

Note: Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data. Reporting yrs 1996-2004 and 2014 onwards contain uncategorised inj crashes.

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Appendix E. Traffic Movement Survey Results

Notes on Vardon Road Survey Data:

1. Surveys completed using IPad App TurnCount
2. Standard setup is 4 leg (12 movement) junction
3. Eastern leg used to monitor Nelson Bay Road NB and SB U-turn movements

TURNING MOVEMENT SURVEY

Nelson Bay Rd and Fullerton St, Nelson Bay
Wednesday, June 8, 2016

Weather:	Overcast
Suburban:	Nelson Bay
Customer:	Better Transport

Survey Start	
AM:	7:00
PM:	14:00

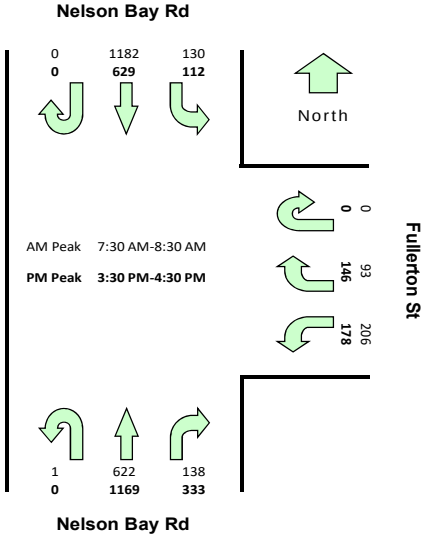
Peakhour	
AM:	7:30 AM-8:30 AM
PM:	3:30 PM-4:30 PM

All Vehicles

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
7:00	7:15	0	171	14	0	20	64	0	25	245	2286	
7:15	7:30	0	226	23	0	12	53	1	20	188	2350	
7:30	7:45	0	270	29	0	24	65	0	34	189	2372	Peak
7:45	8:00	0	298	22	0	22	55	1	32	183	2272	
8:00	8:15	0	333	41	0	26	40	0	36	127	2116	
8:15	8:30	0	281	38	0	21	46	0	36	123	1942	
8:30	8:45	0	216	57	0	22	44	0	42	130	1846	
8:45	9:00	0	168	47	0	37	59	0	47	99	1799	
9:00	9:15	0	185	24	0	30	48	0	29	113	1780	
9:15	9:30	0	197	35	0	30	54	0	31	102		
9:30	9:45	0	180	36	0	17	55	0	57	119		
9:45	10:00	0	168	39	0	23	48	0	45	115		
14:00	14:15	0	210	30	0	40	60	0	46	169	2326	
14:15	14:30	0	207	25	0	44	56	0	73	188	2404	
14:30	14:45	0	182	45	0	44	56	0	75	178	2389	
14:45	15:00	2	159	39	0	35	49	0	86	228	2495	
15:00	15:15	0	173	15	0	58	64	0	72	251	2526	
15:15	15:30	0	166	28	0	43	47	0	75	219	2512	
15:30	15:45	0	164	41	0	46	50	0	76	309	2567	Peak
15:45	16:00	0	145	29	0	31	38	0	98	288	2461	
16:00	16:15	0	153	21	0	34	53	0	77	281	2411	
16:15	16:30	0	167	21	0	35	37	0	82	291		
16:30	16:45	0	116	30	0	39	45	0	73	277		
16:45	17:00	0	149	29	0	26	45	0	87	243		

Peak Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd			Peak
Period Start	Period End	U	T	L	U	R	L	U	R	T	total
7:30	8:30	0	1182	130	0	93	206	1	138	622	2372
15:30	16:30	0	629	112	0	146	178	0	333	1169	2567

Graphic



Light Vehicles

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	166	13	0	20	62	0	25	234
7:15	7:30	0	215	22	0	10	49	0	18	177
7:30	7:45	0	259	29	0	22	65	0	32	176
7:45	8:00	0	292	21	0	21	54	1	32	169
8:00	8:15	0	315	39	0	24	40	0	32	116
8:15	8:30	0	276	38	0	20	44	0	34	114
8:30	8:45	0	199	57	0	21	42	0	42	116
8:45	9:00	0	156	44	0	34	56	0	46	87
9:00	9:15	0	175	24	0	30	48	0	28	103
9:15	9:30	0	189	33	0	28	53	0	29	88
9:30	9:45	0	174	35	0	16	53	0	54	115
9:45	10:00	0	161	38	0	23	45	0	44	104
14:00	14:15	0	201	28	0	39	58	0	44	156
14:15	14:30	0	203	25	0	44	52	0	71	182
14:30	14:45	0	174	43	0	43	55	0	75	165
14:45	15:00	2	149	38	0	35	46	0	83	218
15:00	15:15	0	166	15	0	58	64	0	72	248
15:15	15:30	0	150	27	0	43	45	0	75	213
15:30	15:45	0	161	41	0	46	50	0	76	299
15:45	16:00	0	132	29	0	31	38	0	97	282
16:00	16:15	0	151	21	0	34	52	0	76	275
16:15	16:30	0	160	20	0	35	37	0	80	281
16:30	16:45	0	110	30	0	39	44	0	73	265
16:45	17:00	0	145	28	0	26	45	0	87	239

Heavy Vehicles

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	5	1	0	0	2	0	0	11
7:15	7:30	0	11	1	0	2	4	1	2	11
7:30	7:45	0	11	0	0	2	0	0	2	13
7:45	8:00	0	6	1	0	1	1	0	0	14
8:00	8:15	0	18	2	0	2	0	0	4	11
8:15	8:30	0	5	0	0	1	2	0	2	9
8:30	8:45	0	17	0	0	1	2	0	0	14
8:45	9:00	0	12	3	0	3	3	0	1	12
9:00	9:15	0	10	0	0	0	0	0	1	10
9:15	9:30	0	8	2	0	2	1	0	2	14
9:30	9:45	0	6	1	0	1	2	0	3	4
9:45	10:00	0	7	1	0	0	3	0	1	11
14:00	14:15	0	9	2	0	1	2	0	2	13
14:15	14:30	0	4	0	0	0	4	0	2	6
14:30	14:45	0	8	2	0	1	1	0	0	13
14:45	15:00	0	10	1	0	0	3	0	3	10
15:00	15:15	0	7	0	0	0	0	0	0	3
15:15	15:30	0	16	1	0	0	2	0	0	6
15:30	15:45	0	3	0	0	0	0	0	0	10
15:45	16:00	0	13	0	0	0	0	0	1	6
16:00	16:15	0	2	0	0	0	1	0	1	6

16:15	16:30	0	7	1	0	0	0	0	2	10
16:30	16:45	0	6	0	0	0	1	0	0	12
16:45	17:00	0	4	1	0	0	0	0	0	4

Bus

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	1	1	0	1	0	0	0	1
7:15	7:30	0	2	0	0	0	0	0	0	0
7:30	7:45	0	2	2	0	1	0	0	0	1
7:45	8:00	0	7	2	0	0	0	0	0	1
8:00	8:15	0	7	0	0	1	1	0	0	0
8:15	8:30	0	2	2	0	0	0	0	0	0
8:30	8:45	0	0	0	0	2	0	0	1	1
8:45	9:00	0	0	1	0	1	0	0	0	1
9:00	9:15	0	2	0	0	2	0	0	0	2
9:15	9:30	0	1	1	0	1	0	0	0	0
9:30	9:45	0	1	1	0	1	0	0	0	0
9:45	10:00	0	1	0	0	0	0	0	0	1
14:00	14:15	0	0	1	0	1	0	0	0	0
14:15	14:30	0	1	1	0	0	1	0	0	0
14:30	14:45	0	1	0	0	0	0	0	0	1
14:45	15:00	0	2	1	0	0	0	0	1	3
15:00	15:15	0	1	0	0	1	0	0	1	4
15:15	15:30	0	1	1	0	1	0	0	0	8
15:30	15:45	0	2	1	0	1	0	0	1	8
15:45	16:00	0	0	1	0	1	0	0	1	5
16:00	16:15	0	1	2	0	1	0	0	1	1
16:15	16:30	0	1	0	0	1	0	0	1	2
16:30	16:45	0	2	0	0	0	0	0	0	0
16:45	17:00	0	1	1	0	0	0	0	0	2

Cyclists

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	0	0	1	0	2	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	1	0	0	0	0	0	0
8:30	8:45	0	0	0	1	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	1	0	0	0
9:30	9:45	0	0	0	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0	0	0	0
14:00	14:15	0	0	0	0	0	0	0	0	0
14:15	14:30	0	0	0	0	0	0	0	0	0
14:30	14:45	0	0	0	0	0	0	0	0	0
14:45	15:00	0	0	0	0	0	0	0	0	0
15:00	15:15	0	0	0	0	0	1	0	0	0
15:15	15:30	0	0	0	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	0	0	0	0

15:45	16:00	0	0	0	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	1	0	0	0
16:30	16:45	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0

Pedestrians Crossing

Time		Approach Nelson B		t Approach Fullerton		Approach Nelson B	
Period Start	Period End	Westbound	Eastbound	orthboun	outhboun	Westbound	Eastbound
7:00	7:15	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0
14:00	14:15	0	0	0	0	0	0
14:15	14:30	0	0	0	0	0	0
14:30	14:45	0	0	0	0	0	0
14:45	15:00	0	0	0	0	0	0
15:00	15:15	0	0	0	0	0	0
15:15	15:30	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	0
15:45	16:00	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0

TURNING MOVEMENT SURVEY

Nelson Bay Rd and Taylor Rd, Nelson Bay
Wednesday, June 8, 2016

Weather:	Overcast
Suburban:	Nelson Bay
Customer:	Better Transport

Survey Start	
AM:	7:00
PM:	14:00

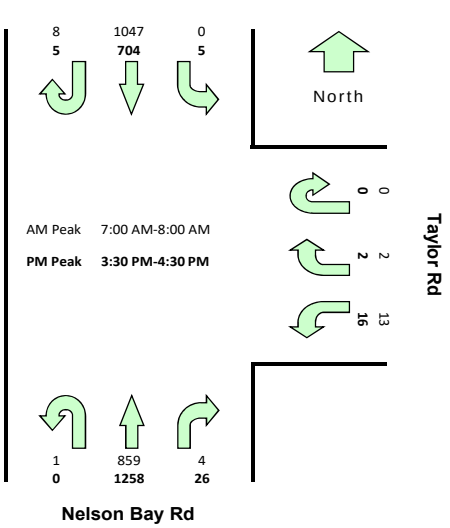
Peakhour	
AM:	7:00 AM-8:00 AM
PM:	3:30 PM-4:30 PM

All Vehicles

Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
7:00	7:15	1	196	0	0	1	2	1	1	263	1934	Peak
7:15	7:30	4	251	0	0	0	1	0	0	195	1888	
7:30	7:45	1	296	0	0	1	4	0	2	207	1886	
7:45	8:00	2	304	0	0	0	6	0	1	194	1785	
8:00	8:15	1	283	0	0	0	4	0	2	129	1629	
8:15	8:30	2	298	1	0	0	5	0	5	138	1575	
8:30	8:45	0	252	0	0	0	8	0	2	148	1494	
8:45	9:00	1	207	0	0	1	5	0	5	132	1433	
9:00	9:15	1	217	0	0	1	4	0	6	136	1406	
9:15	9:30	2	221	0	0	0	9	0	4	132		
9:30	9:45	1	210	0	0	0	4	0	1	133		
9:45	10:00	1	189	0	0	1	4	0	3	126		
14:00	14:15	2	222	0	0	1	6	0	4	196	1812	
14:15	14:30	3	231	0	0	0	3	0	1	238	1885	
14:30	14:45	0	231	1	0	2	4	0	4	225	1862	
14:45	15:00	1	184	0	0	0	3	0	3	247	1935	
15:00	15:15	4	191	2	0	0	3	1	9	294	1971	
15:15	15:30	2	190	0	0	0	2	0	6	253	1963	
15:30	15:45	0	194	2	0	1	3	0	5	335	2016	Peak
15:45	16:00	1	169	2	0	0	5	0	4	293	1935	
16:00	16:15	0	177	1	0	0	1	0	8	309	1927	
16:15	16:30	4	164	0	0	1	7	0	9	321		
16:30	16:45	0	139	0	0	0	4	0	9	307		
16:45	17:00	1	175	1	0	1	2	0	8	278		

Peak Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd			Peak
Period Start	Period End	U	T	L	U	R	L	U	R	T	total
7:00	8:00	8	1047	0	0	2	13	1	4	859	1934
15:30	16:30	5	704	5	0	2	16	0	26	1258	2016

Graphic



Light Vehicles

Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	1	190	0	0	1	2	1	1	250
7:15	7:30	4	242	0	0	0	1	0	0	186
7:30	7:45	1	289	0	0	1	4	0	2	193
7:45	8:00	2	298	0	0	0	6	0	1	182
8:00	8:15	1	270	0	0	0	4	0	2	120
8:15	8:30	2	293	1	0	0	5	0	5	130
8:30	8:45	0	244	0	0	0	8	0	2	135
8:45	9:00	1	196	0	0	1	5	0	5	117
9:00	9:15	1	209	0	0	1	4	0	6	126
9:15	9:30	2	213	0	0	0	9	0	4	117
9:30	9:45	1	205	0	0	0	4	0	1	129
9:45	10:00	1	183	0	0	1	4	0	3	117
14:00	14:15	2	213	0	0	1	6	0	4	185
14:15	14:30	3	229	0	0	0	3	0	1	232
14:30	14:45	0	224	1	0	2	4	0	4	214
14:45	15:00	1	177	0	0	0	3	0	3	238
15:00	15:15	4	188	2	0	0	3	1	9	290
15:15	15:30	2	178	0	0	0	2	0	6	250
15:30	15:45	0	192	2	0	1	3	0	5	328
15:45	16:00	1	157	2	0	0	5	0	4	289
16:00	16:15	0	173	1	0	0	1	0	8	304
16:15	16:30	4	160	0	0	1	7	0	9	321
16:30	16:45	0	134	0	0	0	4	0	9	301
16:45	17:00	1	172	1	0	1	2	0	8	273

Heavy Vehicles

Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	6	0	0	0	0	0	0	13
7:15	7:30	0	9	0	0	0	0	0	0	9
7:30	7:45	0	7	0	0	0	0	0	0	14
7:45	8:00	0	6	0	0	0	0	0	0	12
8:00	8:15	0	13	0	0	0	0	0	0	9
8:15	8:30	0	5	0	0	0	0	0	0	8
8:30	8:45	0	8	0	0	0	0	0	0	13
8:45	9:00	0	11	0	0	0	0	0	0	15
9:00	9:15	0	8	0	0	0	0	0	0	10
9:15	9:30	0	8	0	0	0	0	0	0	15
9:30	9:45	0	5	0	0	0	0	0	0	4
9:45	10:00	0	6	0	0	0	0	0	0	9
14:00	14:15	0	9	0	0	0	0	0	0	11
14:15	14:30	0	2	0	0	0	0	0	0	6
14:30	14:45	0	7	0	0	0	0	0	0	11
14:45	15:00	0	7	0	0	0	0	0	0	9
15:00	15:15	0	3	0	0	0	0	0	0	4
15:15	15:30	0	12	0	0	0	0	0	0	3
15:30	15:45	0	2	0	0	0	0	0	0	7
15:45	16:00	0	12	0	0	0	0	0	0	4
16:00	16:15	0	4	0	0	0	0	0	0	5
16:15	16:30	0	4	0	0	0	0	0	0	0
16:30	16:45	0	5	0	0	0	0	0	0	6
16:45	17:00	0	3	0	0	0	0	0	0	5

Bus

Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	2	0	0	0	0	0	0	2
7:15	7:30	0	2	0	0	0	0	0	0	0
7:30	7:45	0	4	0	0	0	1	0	0	2
7:45	8:00	0	12	0	0	0	0	0	0	1
8:00	8:15	0	3	0	0	0	0	0	0	1
8:15	8:30	0	4	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	2
8:45	9:00	0	1	0	0	0	1	0	0	0
9:00	9:15	0	2	0	0	1	0	0	0	4
9:15	9:30	0	2	0	0	0	0	0	0	1
9:30	9:45	0	1	0	0	0	0	0	0	0
9:45	10:00	0	1	0	0	0	0	0	0	1
14:00	14:15	0	1	0	0	0	0	0	0	1
14:15	14:30	0	1	0	0	0	0	0	0	0
14:30	14:45	0	2	0	0	0	0	0	0	1
14:45	15:00	0	1	0	0	0	0	0	0	3
15:00	15:15	0	2	0	0	0	0	0	0	5
15:15	15:30	0	1	0	0	0	0	0	2	7
15:30	15:45	0	1	0	0	0	0	0	1	7
15:45	16:00	0	1	0	0	0	0	0	0	7
16:00	16:15	0	1	0	0	0	1	0	0	2
16:15	16:30	0	2	0	0	0	0	0	0	1
16:30	16:45	0	1	0	0	0	0	0	0	0
16:45	17:00	0	2	0	0	0	0	0	0	2

Cyclists

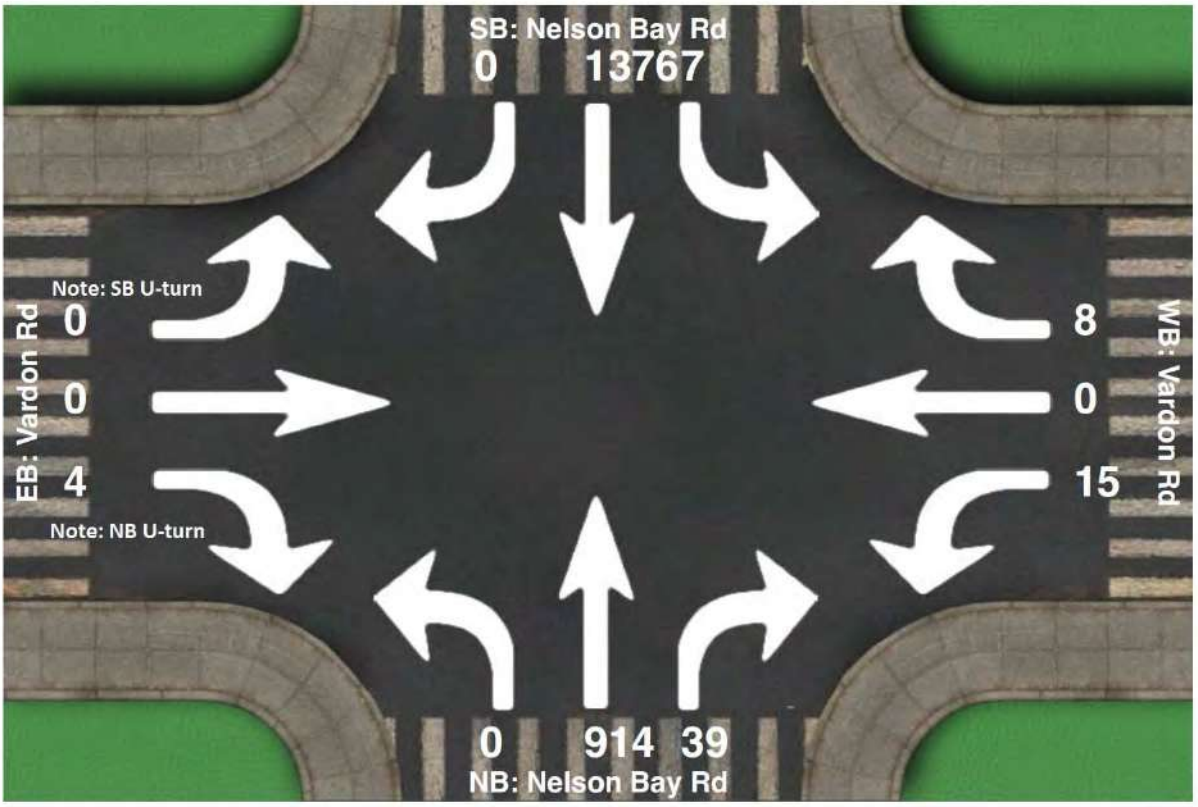
Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	1	0	0	0	0	0	0	2
7:15	7:30	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	1
7:45	8:00	0	0	0	0	0	0	0	0	2
8:00	8:15	0	1	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	9	0	0	1
9:00	9:15	0	0	0	0	0	0	0	0	1
9:15	9:30	0	0	0	0	0	0	0	0	1
9:30	9:45	0	0	0	0	0	0	0	0	1
9:45	10:00	0	1	0	0	0	0	0	0	0
14:00	14:15	0	0	0	0	0	0	0	0	0
14:15	14:30	0	2	0	0	0	0	0	0	1
14:30	14:45	0	0	0	0	0	0	0	0	1
14:45	15:00	0	0	0	0	0	0	0	0	0
15:00	15:15	0	1	0	0	0	0	0	0	0
15:15	15:30	0	1	0	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	0	0	0	0
15:45	16:00	0	1	0	0	0	0	0	0	0
16:00	16:15	0	1	0	0	0	0	0	0	2
16:15	16:30	0	0	0	0	0	0	0	0	0
16:30	16:45	0	1	0	0	0	0	0	0	1
16:45	17:00	0	1	0	0	0	0	0	0	1

Pedestrians Crossing

Time		Approach Nelson B		st Approach Taylor		Approach Nelson B	
Period Start	Period End	Westbound	Eastbound	orthboun	outhboun	Westbound	Eastbound
7:00	7:15	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0
7:45	8:00	0	0	3	2	0	0
8:00	8:15	0	2	0	0	0	0
8:15	8:30	0	0	1	0	0	0
8:30	8:45	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0
9:45	10:00	0	0	0	1	0	0
14:00	14:15	0	0	0	0	0	0
14:15	14:30	0	0	0	0	0	0
14:30	14:45	0	2	0	0	0	0
14:45	15:00	0	0	1	0	0	0
15:00	15:15	0	2	0	0	0	1
15:15	15:30	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	1
15:45	16:00	0	0	0	0	0	0
16:00	16:15	0	0	2	1	0	0
16:15	16:30	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0
16:45	17:00	0	1	0	0	0	0

Intersection Peak Hour

Location: Nelson Bay Rd at Vardon Rd, Fern Bay
GPS Coordinates:
Date: 2016-10-27
Day of week: Thursday
Weather: O'cast
Analyst: JMW



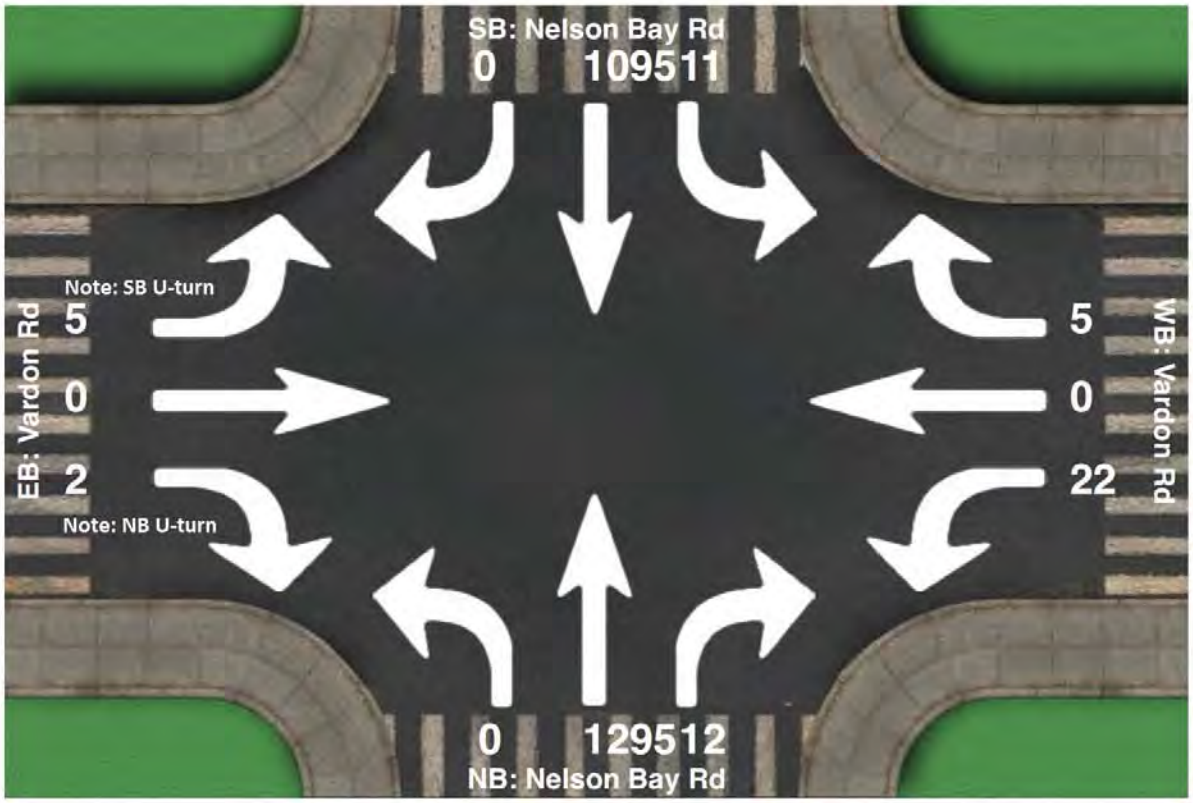
Intersection Peak Hour

07:15 - 08:15

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	7	1376	0	15	0	8	0	914	39	0	0	4	2363
Factor	0.29	0.84	0.00	0.31	0.00	0.22	0.00	0.75	0.54	0.00	0.00	0.17	0.85
Approach Factor	0.85			0.32			0.78			0.17			

Intersection Peak Hour

Location: Nelson Bay Rd at Vardon Rd, Fern Bay
GPS Coordinates:
Date: 2016-10-27
Day of week: Thursday
Weather: O'cast
Analyst: JMW



Intersection Peak Hour

16:10 - 17:10

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	11	1095	0	22	0	5	0	1295	12	5	0	2	2447
Factor	0.23	0.87	0.00	0.37	0.00	0.21	0.00	0.84	0.50	0.42	0.00	0.17	0.86
Approach Factor	0.87			0.32			0.84			0.58			

Appendix F. Traffic Modelling Summaries

Modelling Scenarios Tested

1. Existing junction layouts, Existing Traffic Flows
2. Existing junction layouts, With Development Traffic Flows
3. Alternate (Signal) control, Taylor Road, With Development Traffic Flows

LANE LEVEL OF SERVICE

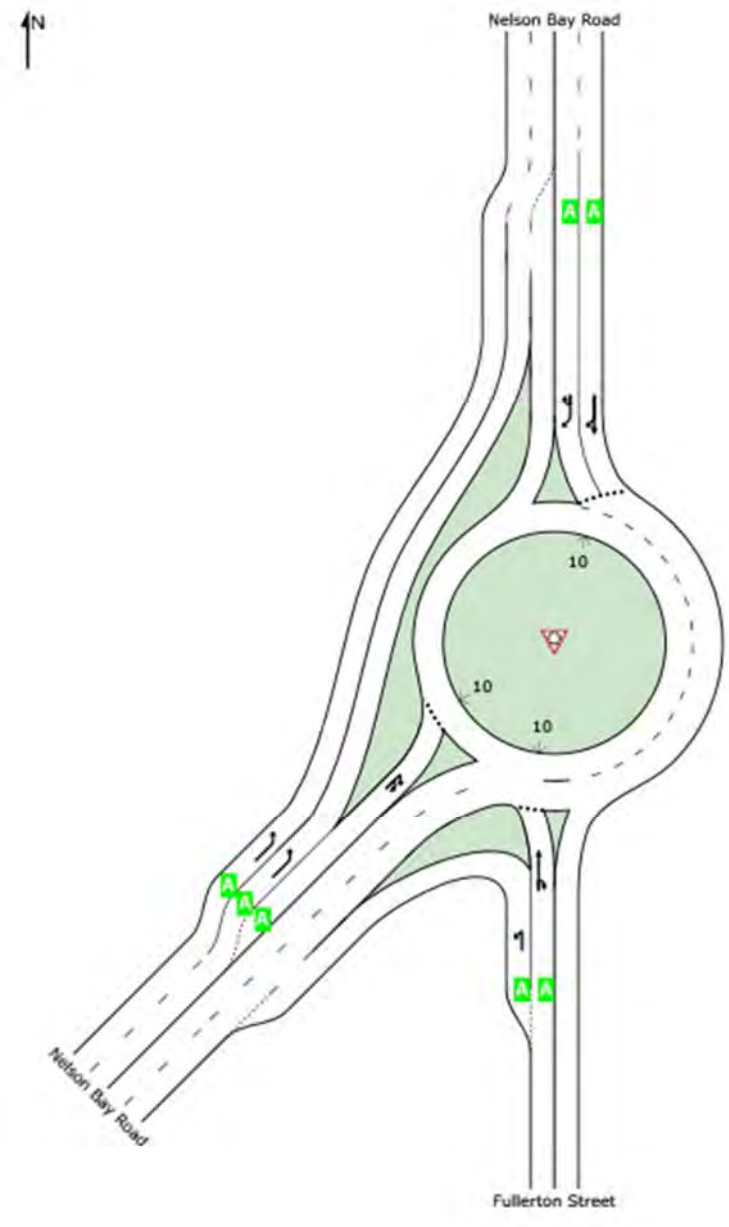
Lane Level of Service

Site: 101 [Nelson Bay Rd & Fullerton St - AM+RR+FW+BG1.5]

DHA Stockton
Roundabout

All Movement Classes

	South	North	Southwest	Intersection
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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LANE LEVEL OF SERVICE

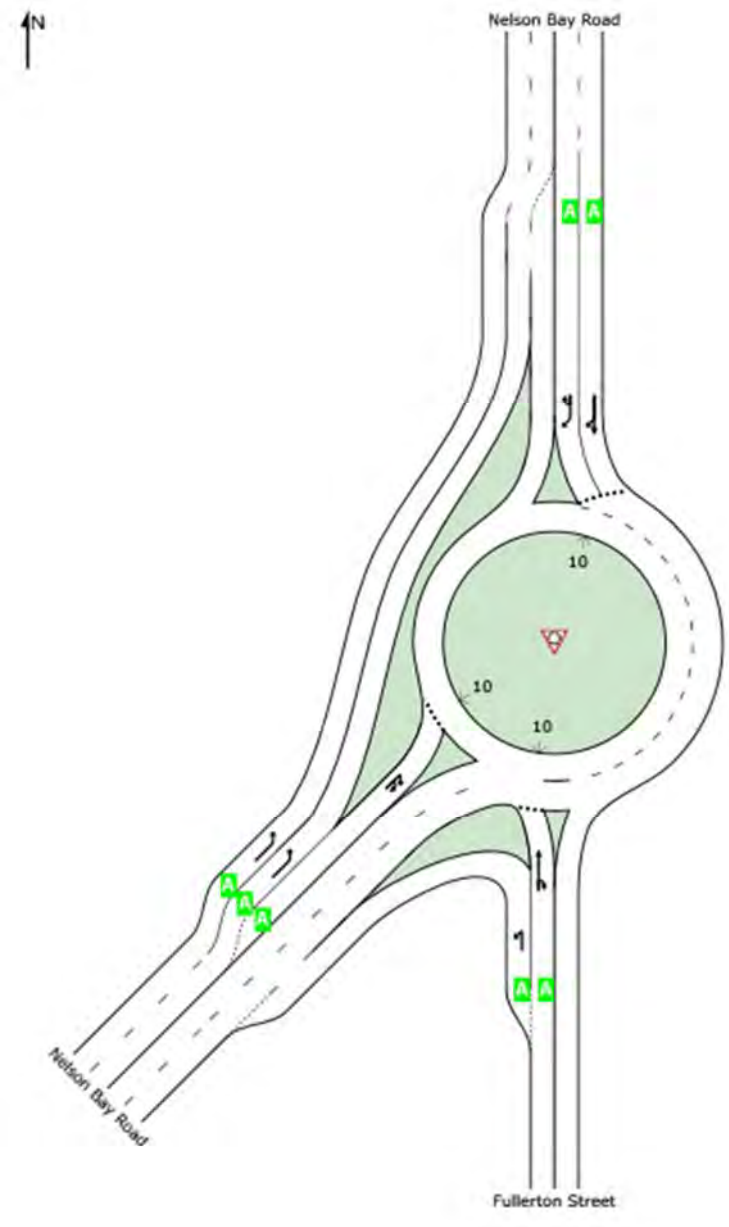
Lane Level of Service

Site: 101 [Nelson Bay Rd & Fullerton St - PM+RR+FW+BG1.5]

DHA Stockton
Roundabout

All Movement Classes

	South	North	Southwest	Intersection
LOS	A	A	A	A



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SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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LANE LEVEL OF SERVICE

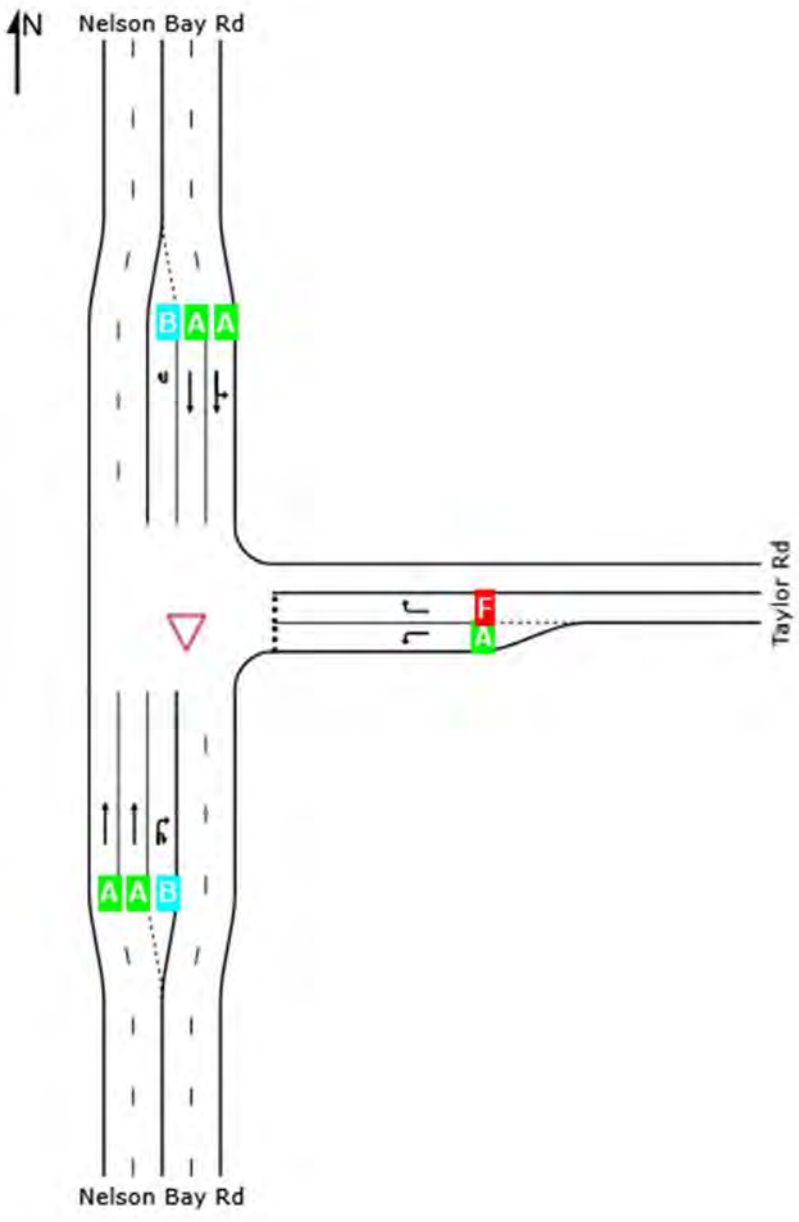
Lane Level of Service

Site: 102 [Nelson Bay Rd & Taylor Rd - AM]

DHA Stockton Taylor
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	North	Intersection
LOS	NA	C	NA	NA



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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LANE LEVEL OF SERVICE

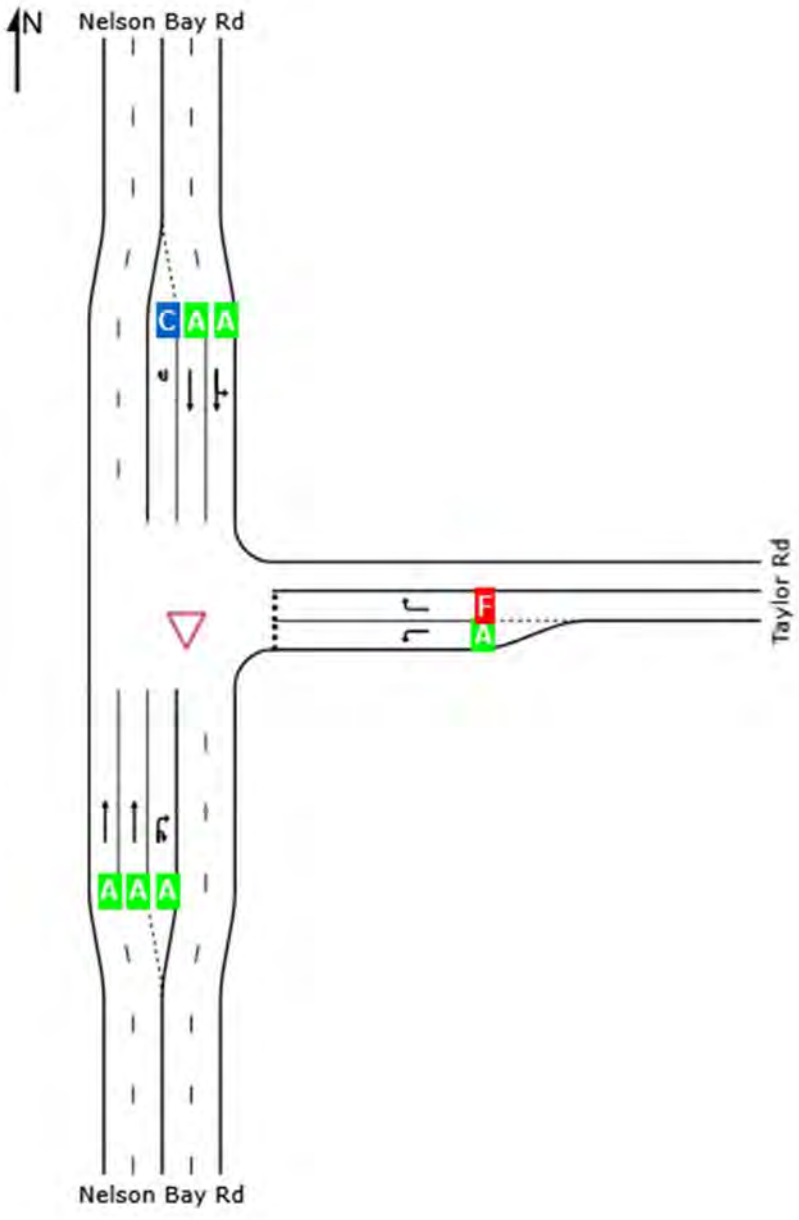
Lane Level of Service

Site: 102 [Nelson Bay Rd & Taylor Rd - PM]

DHA Stockton Taylor
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	North	Intersection
LOS	NA	D	NA	NA



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SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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LANE LEVEL OF SERVICE

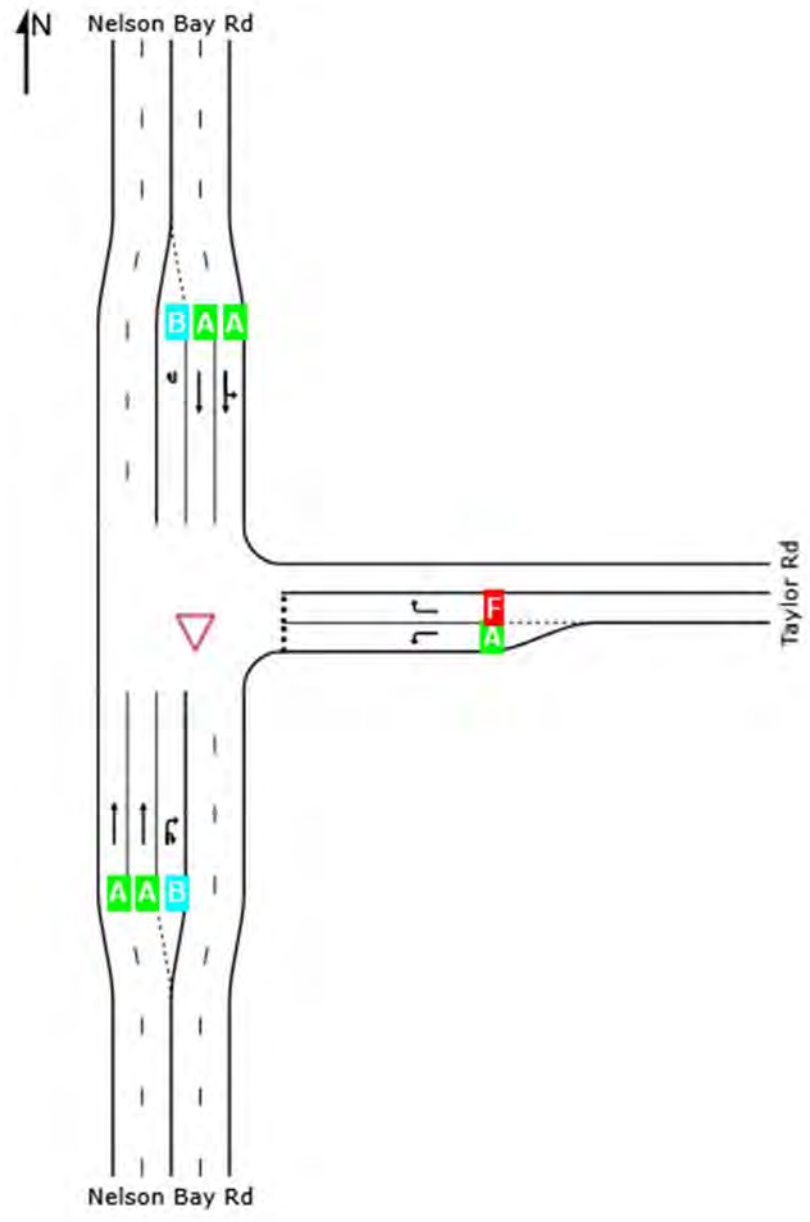
Lane Level of Service

Site: 102 [Nelson Bay Rd & Taylor Rd - AM+RR+FW+BG1.5]

DHA Stockton Taylor
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	North	Intersection
LOS	NA	F	NA	NA



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LANE LEVEL OF SERVICE

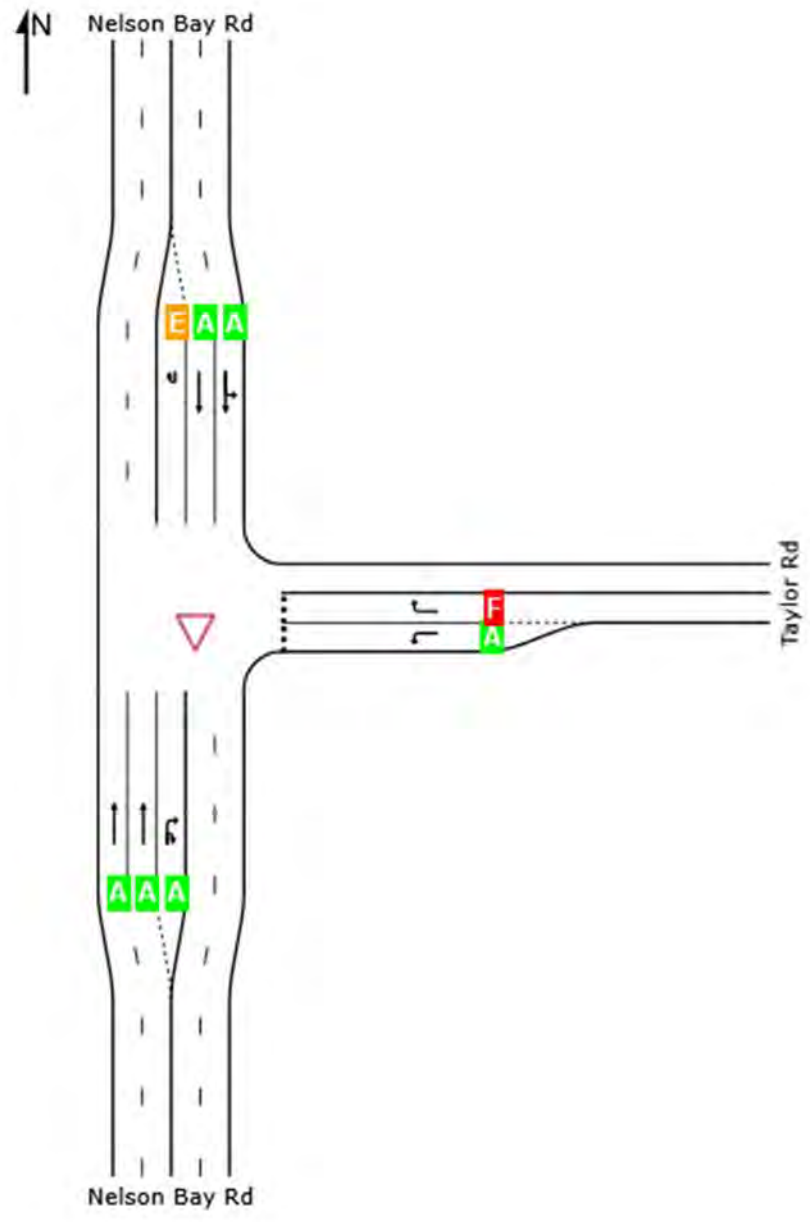
Lane Level of Service

Site: 102 [Nelson Bay Rd & Taylor Rd - PM+RR+FW+BG1.5]

DHA Stockton Taylor
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	North	Intersection
LOS	NA	F	NA	NA



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SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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LANE LEVEL OF SERVICE

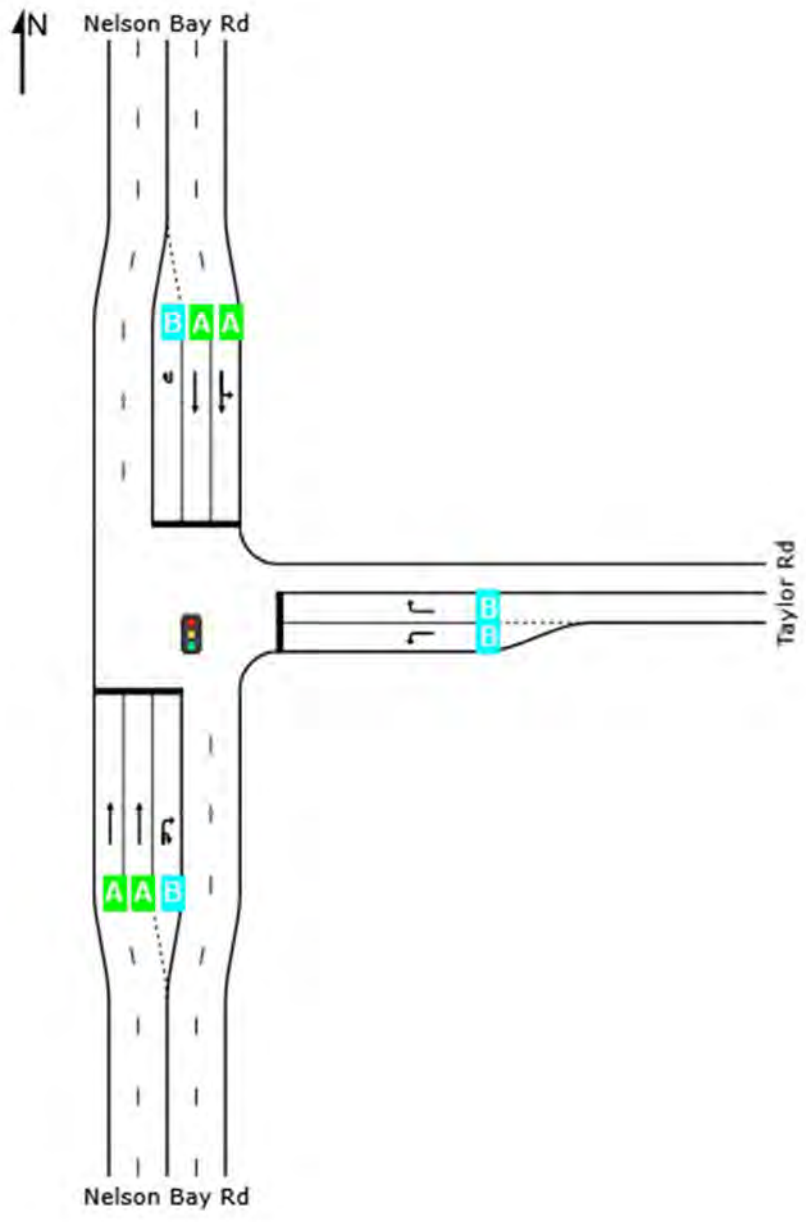
Lane Level of Service

Site: 102v [Nelson Bay Rd & Taylor Rd - AM+RR+FW+BG1.5 - Signals Conversion]

DHA Stockton Taylor
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	Intersection
LOS	A	B	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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LANE LEVEL OF SERVICE

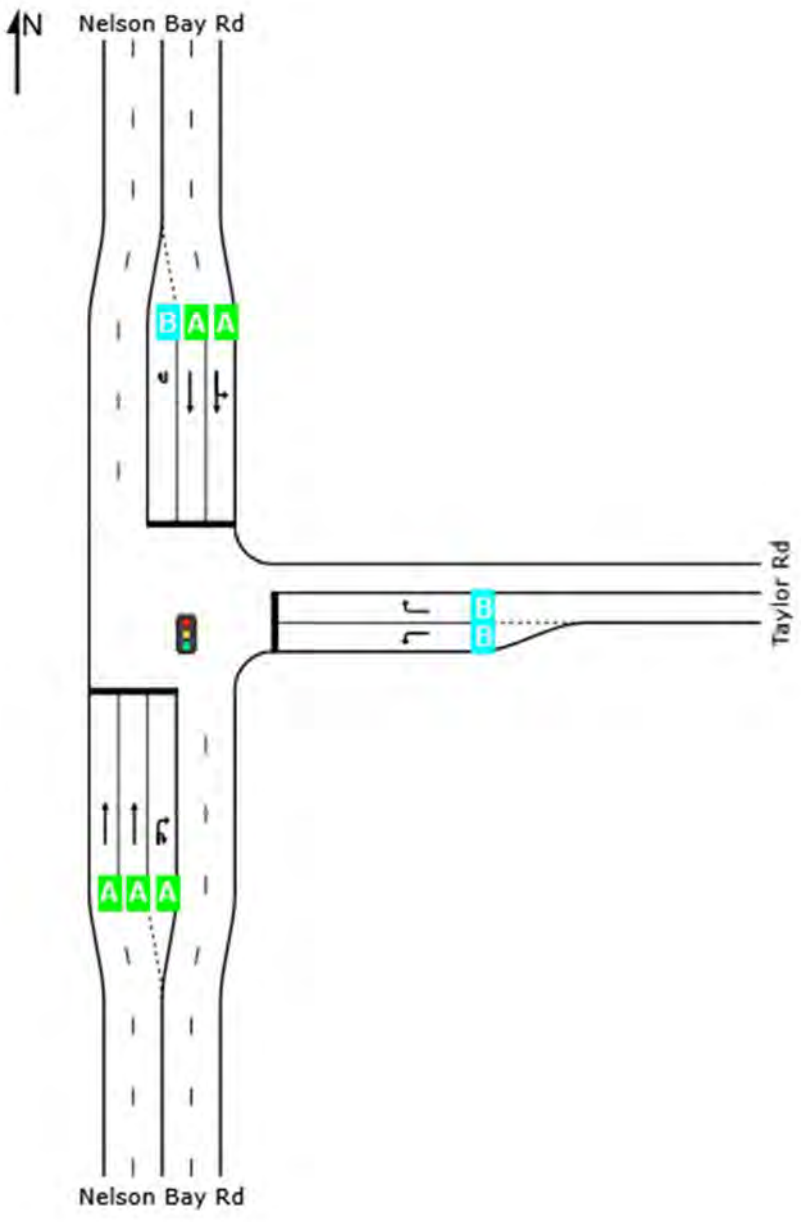
Lane Level of Service

Site: 102v [Nelson Bay Rd & Taylor Rd - PM+RR+FW+BG1.5 - Signals Conversion]

DHA Stockton Taylor
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	Intersection
LOS	A	B	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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To include:

190308_Updated Rifle Range Planning Proposal

Attachment A_Proposed Mapping Amendments_placehold

Attachment B_Urban Design and Landscape Report

Attachment C_Transport Study Report

Attachment D_Bushfire Assessment

Attachment E_Stormwater Report

Attachment F_Coastal Engineering Assessment

Attachment G_Site Audit Statement

Attachment H_Ecological

Attachment I_Heritage Impact Statement

Attachment J_ACHAR

Attachment K_Servicing Report

Attachment L_Consultation Report

Attachment M_Site Environmental Management Plan

Attachment N_Social Impact Assessment

Rifle Range Bushfire Assessment

Popplewell Road, Fern Bay
NSW

Ref: 97963 - 20170283

Document Log: NCA16R39082 V3

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24 May 2018

Prepared for:

Defence Housing Australia
Suite 2, 45D Fitzroy Street
Carrington NSW 2294

Bushfire Threat Assessment

Popplewell Road, Fern Bay NSW

Kleinfelder Job No. NCA16R39082 V3

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This report was prepared for the sole use of the proponents, their agents and any regulatory agencies involved in the development application approval process. It should not be otherwise referenced without permission.

Please note:

This report is prepared in accordance with current accepted practice as described in the NSW Rural Fire Service Guide Planning for Bushfire Protection, 2006 – a Guide for Councils, Planners, Fire Authorities, Developers and Home Owners, AS 3959–2009 Construction of buildings in bushfire-prone areas, and the National Construction Code (NCC).

This report is not an insurance policy. Owing to the unpredictable nature of bushfires and of weather conditions at the time of a bushfire, this report cannot be taken as a warranty that the recommended bushfire mitigation measures will protect the property from damage in every possible bushfire event. Ultimately, the onus is on the land owner to accept the risks associated with development on the site in light of the identified bushfire threat.

Document Control:

Version	Date	Author	Technical Review	Peer Review
2.0	May 2017	Dan Pedersen	Dan Pedersen	
3.0	24 May 2018	Dan Pedersen	Dan Pedersen BPAD Bushfire Planning & Design Accredited Practitioner Level 3	Bradley Deane

Kleinfelder
95 Mitchell Street
Cardiff NSW 2285
PH: 02 4949 5200

ABN: 23 146 082 500

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EXECUTIVE SUMMARY

Report Type	Bushfire Threat Assessment
Applicant's Name	Defence Housing Australia
Applicant Contact Details	
Site Address	Popplewell Road, Fern Bay NSW
Lot No.	Lot 5
Deposited Plan No.	DP 233358
Local Government Area	Port Stephens Council
Zoning under Newcastle City Council LEP	E2 – Environmental Conservation
Fire Danger Index Area Name	Greater Hunter Region, FDI 100
Bushfire Prone Land	Yes
Source methodology/s	NSW Rural Fire Service (2006), Planning for Bushfire Protection guidelines. Australian Standard 3959–2009: Construction of Buildings in Bushfire-Prone Areas.
Site visit date	20 July 2016
Document date	24 May 2018
Document number	NCA16R39082 V3
Site plan/s attached	No
Conclusion	*This bushfire assessment provides the proponent with information regarding the assessment of the classified bushfire prone vegetation within and surrounding the subject site and the minimum performance provisions that must be addressed to comply with Chapter 4 of PBP (2006) for residential subdivisions.* *This bushfire assessment confirmed that the proposed development can achieve BAL 29 providing recommended APZ are managed. Water and access provisions are deemed suitable for the proposed development.*

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1. SCOPE OF ASSESSMENT

Under the *Rural Fires and Environmental Assessment Legislation Amendment Act* 2002 (amends the *Environmental Planning and Assessment Act* 1979) local councils are required to ensure that all developments in bushfire prone lands conform to documented bushfire protection specifications.

DHA are seeking to lodge a planning proposal with Port Stephens Council to rezone the site to allow a diversity of residential uses. A master plan has been developed to demonstrate how the site would develop in accordance with best practice planning and urban design principles.

This report assesses the performance of the illustrated master plan (180510 Stockton Rifle Range Draft indicative Master Plan LR [002]). The design for the property Lot 5 (DP 233358), Popplewell Road, Fern Bay NSW, is assessed against the criteria as detailed in the NSW RFS Planning for Bushfire Protection (PBP).

This report cannot be used for any other design unless authorised and amended by the author of this report. Future detailed Development Applications (DA's) will be supported by detailed bushfire assessment.

1.1 PROJECT DESCRIPTION

The proponent has engaged Kleinfelder to conduct a bushfire threat assessment to inform the planning proposal, which involves the residential uses within an existing Australian Defence Force (ADF) land holding. The subject site was previous used by the ADF as a rifle range and training area.

In May 2017 a draft bushfire assessment was issued. This assessment supersedes the May 2017 draft, as a new layout has been designed. However, the design is within the same footprint as the 2017 design, and adheres to the same performance criteria.

The subject site location and surrounding vegetation and landscape characteristics are shown in **Figure 1**.

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1.2 SITE ASSESSMENT METHODOLOGY

The site assessment methodology used to determine the level of bushfire attack for this development has been sourced from Appendix 2 of the NSW RFS Planning for Bushfire Protection (PBP) (2006). The assessment procedure used to determine the category of bushfire attack level (BAL) is in accordance with AS3959 - 2009.

1.2.1 Integrated Development

Section 4.46 (formerly Section 91) of the EP&A Act defines integrated development – i.e. residential subdivisions. Integrated developments require a formal approval from the NSW Rural Fire Service under s100B of the *Rural Fires Act 1997*.

Section 100B of the *Rural Fires Act 1997* states that the NSW Rural Fire Service can issue a BFSA approval provided the development meets certain requirements and standards. A BFSA authorises development to the extent that it complies with standards regarding setbacks (to mitigate radiant heat), provision of water supply, emergency management and other matters considered by the Commissioner to be necessary to protect persons, property or the environment from danger that may arise from a bushfire. A BFSA requires a bushfire assessment to be prepared in accordance with Clause 44(1) of the *Rural Fires Regulation 2013*, which specifies the information requirements for consideration of a BFSA under section 100B of the RF Act.

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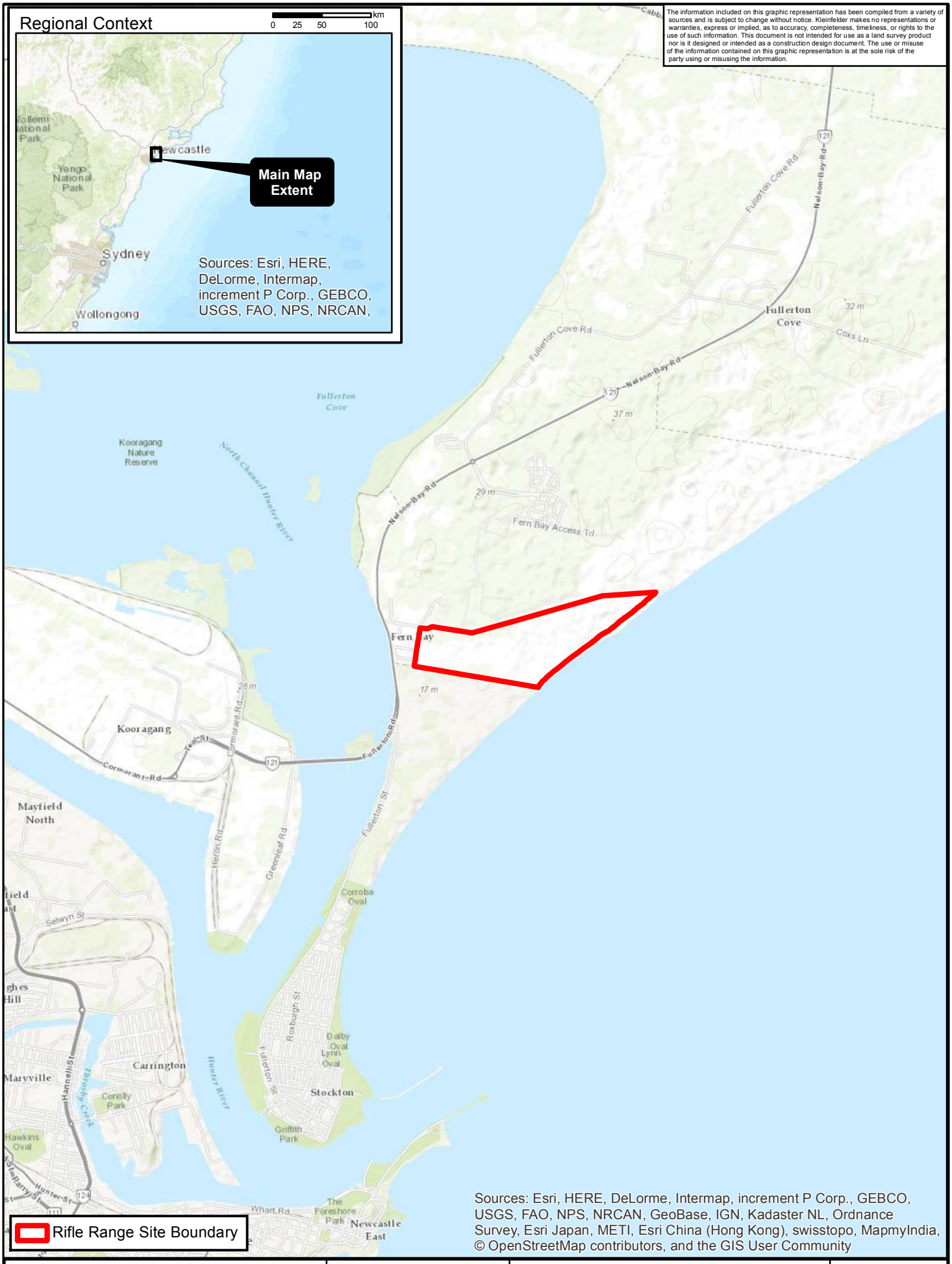

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km

GDA 1994 MGA Zone 56

1:50,000

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PROJECT REFERENCE: 20170283

DATE DRAWN: 04-Jul-17 15:30 Version 1

DRAWN BY: amarshall

DATA SOURCE:
Nearmap - 2017
LPI - 2017

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Locality

Defence Housing Australia
Rifle Range Site
Stockton Peninsula, NSW 2295

FIGURE:

1

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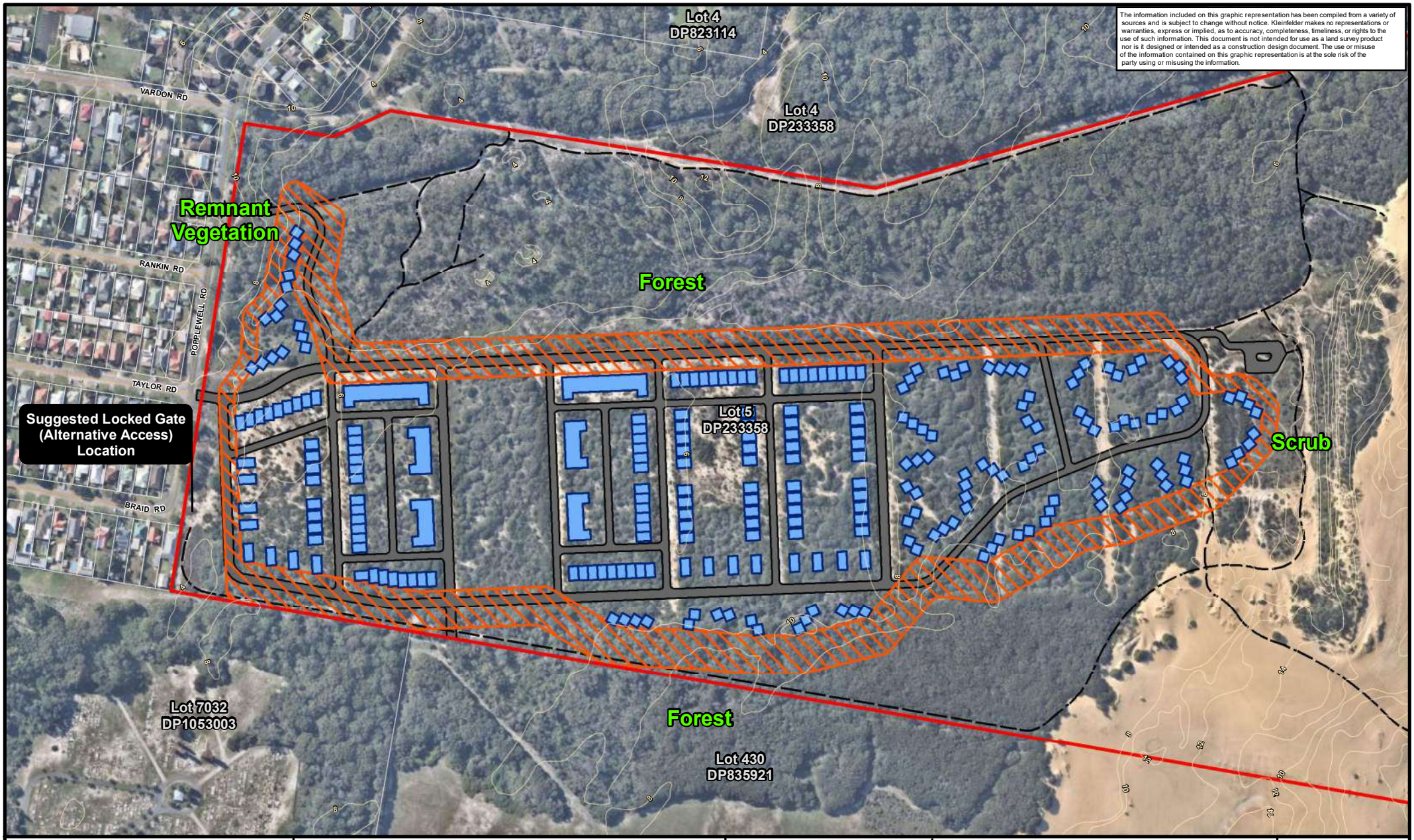

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0 15 30 60
metres

1:4,200

GDA 1994 MGA Zone 56

N

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- Subject Site (Rifle Range)
- Proposed Dwellings and Existing Heritage Buildings
- Proposed Roads
- Asset Protection Zone (13 /25 / 32m Wide)
- Contours (2m)
- Lot Boundaries
- Major Roads
- Local Roads
- Tracks

PROJECT REFERENCE: 20170283

DATE DRAWN: 24/05/2018 11:23 Version 1

DRAWN BY: BDeane

DATA SOURCE:
Architectus - 2018
Nearmap - 2018
DFSI - 2017

Rifle Range
Asset Protection Zone

Defence Housing Australia
Rifle Range Bushfire Assessment
Popplewell Road, Fern Bay NSW

FIGURE:

2

L:\GIS FOLDER\00 CLIENT FILES\97963_DefenceHousingAustralia\20170283_DHA_RifleRange_FortWallace_Bushfire\Mapping\20170283_RR_Fig2_APZ_D20180524.mxd

2. BUSHFIRE THREAT ASSESSMENT

2.1 LOCATION AND SURROUNDING LAND USE

The subject site is positioned between Nelson Bay Road to the west, Stockton Beach to the east and the Worimi Regional Park to the north. The southern perimeter of the subject site delineates the boundary between the Port Stephens Council LGA and the Newcastle City Council LGA.

The subject site is currently zoned under the Port Stephens Council LEP (2013) as E2 – Environmental Conservation, however the proponent intends to submit a rezoning application with Port Stephens Council to rezone a proportion of the subject site as RU2 – Low Density Residential.

The surrounding land is comprised of park land, residential development and the Stockton Centre (Disability Services) to the south.

2.2 FIRE WEATHER

Port Stephens Council LGA is within the Greater Hunter Region and has an FDI value of 100 (Table 2.1, AS3959-2009).

2.3 ENVIRONMENTAL FEATURES

The northern perimeter of the subject site delineates the southern boundary of the Worimi Regional Park. The park was established in 2007 and covers an estimated area of 1567ha of land within the Worimi Conservation Lands that stretches along the coastal dune system from Fern Bay to Anna Bay.

2.4 THREATENED SPECIES

No threatened species constrain the bushfire mitigation actions proposed (Umwelt, 2016).

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2.5 ABORIGINAL ARTEFACTS

No heritage or artefacts would constrain the bushfire mitigation actions proposed (Umwelt, 2016).

2.6 BUSHFIRE ASSESSMENT

2.6.1 Bushfire Hazard (Vegetation Classification)

The vegetation classification is identified in all directions from the development out to a distance of 140 metres.

The area of vegetation within the subject site located to the north and south side of the proposed development site has been mapped by Port Stephens Council in 2004 as Category 1 bushfire prone vegetation as shown on **Plate 1**.

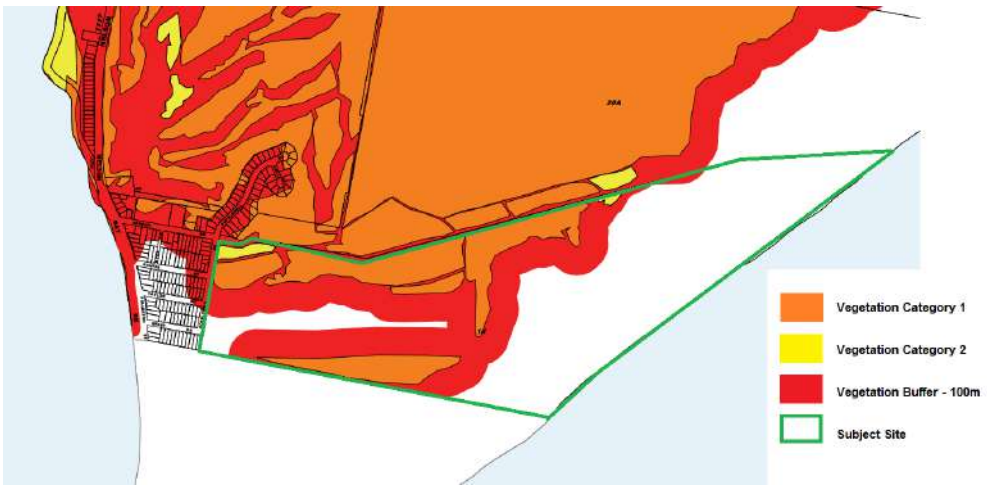

Plate 2: Port Stephens Bushfire Prone Land Map 2004.

The predominant bushfire hazard is located in the north and south section of the subject site, with some residual **scrub** retained to the east.

During the site inspection the bushfire prone vegetation was Coastal Sand Apple Blackbutt Forest and assessed as **forest**.

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Scrub is the predominant vegetation to the east.

The regenerating scrublands situated within the proposed development site will be cleared for development.

Table 1 details the vegetation classification in each direction.

2.6.2 Slope Assessment

The effective slope under the classified vegetation located to the north and south of the subject site has been assessed as flat to upslope.

Slopes do not exceed 5 degrees at this location.

2.6.3 Distance to Classified Vegetation (Asset Protection Zones)

The assessment will determine the required minimum setbacks from dwelling construction to the vegetation hazard type.

The vegetation hazard are either upslope or on flat terrain from the proposed development areas. The minimum setbacks to achieve BAL29, as detailed in AS3959-2009 are:

- Forest on flat/upslope: 25m - 35m
- Forest on 0-5 degree: 32m - 43m
- Scrub: 13m - 19m

For the purpose of this BAL assessment it is assumed that all setbacks (APZ) are manage in perpetuity.

2.6.4 Determine Bushfire Attack Level (Construction Standards)

The bushfire attack level (BAL) is derived using the vegetation classification, setback distance and effective slope. The BAL rating is equivalent to the AS3959-2009 requirements for the construction of various elements of a Class 1, 2 and 3 buildings.

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With a minimum setback of 25 metres to upslope forest vegetation to the north and south and 13 metres to upslope scrub vegetation to the east, BAL 29 is achievable (refer to **Figure 2**).

Table 1 details the vegetation classification for each direction from the proposed development and the calculated BAL rating.

Table 1:

Aspect	Vegetation Classification	Distance (APZ)	Slope	BAL
North	Forest	Min 25m	Flat/Upslope	**BAL 29**
East	Scrub	Min 13	Flat/Upslope	**BAL 29**
South	Forest	25-32m	Flat or 0-5 degrees	**BAL 29**
West	NA (Residential)	NA	NA	NA

2.6.5 Water Supply

The subject site is connected to the town reticulated water supply. This water supply will be extended throughout the proposed subdivision via a ring main system.

The following water supply performance measures can be achieved in later, future designs:

- All above ground water and gas service pipes external to the building will be metal, including and up to any taps.
- All fire hydrant spacing, sizing and pressures will comply with AS 2419.1 – 2005.
- Fire hydrants will not be located within any road carriageway and provisions for parking on public roads will be met.

2.6.6 Access and Egress

2.6.6.1 Public Road & Property Access

Residential development of the site would be accessible via Popplewell Road, which is a sealed two lane public through road, suitable for evacuation and simultaneous emergency management.

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All public roads and property access roads will be designed in a manner that complies with the performance criteria's outlined in Section 4.1.3 of PBP 2006.

Public roads will be a combination of perimeter roads linking with an internal road system. Main thoroughfare roads will be 8m trafficable width kerb to kerb. Internal roads will be 6.5m trafficable width kerb to kerb.

The design allows for alternate access at 2 points onto Popplewell Road. A third emergency access can be provided through a locked gate and managed access along the southern boundary. The design avoids any potential dead ends to residential areas.

All public and property access dimensions and capacity requirement can be achieved.

A fire trail access is recommended at the bushland interface between the cluster homes to the south around to the west, and in the north. These would provide some access for fire management purposes, and APZ maintenance.

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3. COMPLIANCE SUMMARY

Table 2: Planning for Bush Fire Protection (2006) Compliance summary table.

3.1 APZ	
Intent:	**Complies with PBP (2006): YES**
This section is to provide for sufficient space for firefighting and other emergency services personnel, ensuring radiant heat levels permit operations under critical conditions of radiant heat, smoke and embers, while supporting or evacuating occupants.	The proposed development site has adequate space within the subject site, such that all required setbacks (APZ) can be established and maintained in perpetuity on site. The master plan shows that the APZ will provide adequate separation between the residential lots and the upslope forest vegetation to the north and south, and the upslope scrub vegetation to the east. All additional bushfire mitigation strategies will be managed entirely within the subject site.
3.2 Access	
Intent	**Complies with PBP (2006): YES**
This section is to provide for safe operational access for emergency services personnel in suppressing a bush fire, while residents are accessing or egressing an area.	The existing public roads and all proposed public roads will comply the minimum performance requirements of PBP 2006 (Chapter 4.1.3(1) Public Roads). All property access roads will comply the minimum performance requirements of PBP 2006 (Chapter 4.1.3(2) Property Access).
3.3 Services	
Intent	**Complies with PBP (2006): YES**
This section is to provide adequate water services for the protection of buildings during and after the passage of a bushfire, and to locate gas and electricity so as not to contribute to the risk of fire to buildings.	**Water**: Water supply to proposed development will comply with Chapter 4, of PBP (2006). The reticulated water supply will use a ring main system, and all above ground water and gas service pipes external to the building are metal, including and up to any taps. Fire hydrant spacing, sizing and pressure will comply with AS 2419.1 – 2005. Hydrants are not located within any road carriageway, and all provisions of parking on public roads are met.
	Gas: Gas services can conform to Chapter 4 of PBP (2006). Any reticulated or bottled gas must be installed and maintained in accordance with AS 1596 and the requirements of relevant authorities.

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3.1 APZ	
	Electricity: Electrical services can conform to Chapter 4 of PBP (2006). Location of electricity services will not lead to ignition of surrounding grassland or the fabric of buildings or risk life from damaged electrical infrastructure. Where practical, new electrical transmission should be underground.

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4. CONCLUSION

The bushfire assessment indicate that the master plan and associated design principles located at (Lot 5 , DP 233358), Popplewell Road, Fern Bay NSW can comply with all performance criteria's outlined for integrated (residential subdivision) development in Chapter 4 of PBP (2006).

AS 3959-2009 sets out requirements for the construction of various elements of a building in order to reduce the likelihood of ignition of the building when subject to bushfire attack. The proposed development (residential subdivision) can achieve **BAL 29** (minimum construction requirement).

The proposed design provides for suitable access and water provisions for emergency management.

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ADW JOHNSON PTY LIMITED
ABN 62 129 445 398

Sydney
Level 35 One International Towers
100 Barangaroo Avenue
Sydney NSW 2000
02 8046 7411
sydney@adwjohnson.com.au

Central Coast
5 Pioneer Avenue
Tuggerah NSW 2259
02 4305 4300

coast@adwjohnson.com.au

Hunter Region
7/335 Hillsborough Road,
Warners Bay NSW 2282
Ph. 02 4978 5100
Fax. 02 4978 5199
hunter@adwjohnson.com.au

Engineering

Working Beyond Expectations

Stormwater Management Plan

The Rifle Range
Planning Proposal

Property:
Popplewell Street, Fern Bay

Applicant:
Defence Housing Australia

Date:
June 2018

Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Draft	30/09/2016	L Gibbs	A Williams
B	Preliminary Issue	23/01/2017	R Champness	L Gibbs
C	Updated Masterplan	05/05/2017	R Champness	L Gibbs
D	Final	30/05/2017	R Champness	L Gibbs
E	Minor Amendments	21/06/2017	A Van de Mortel	L Gibbs
F	Updated Masterplan	01/06/2018	R Champness	L Gibbs

Limitations Statement

This report has been prepared in accordance with and for the purposes outlined in the scope of services agreed between ADW Johnson Pty Ltd and the Client. It has been prepared based on the information supplied by the Client, as well as investigation undertaken by ADW Johnson and the sub-consultants engaged by the Client for the project.

Unless otherwise specified in this report, information and advice received from external parties during the course of this project was not independently verified. However, any such information was, in our opinion, deemed to be current and relevant prior to its use. Whilst all reasonable skill, diligence and care have been taken to provide accurate information and appropriate recommendations, it is not warranted or guaranteed and no responsibility or liability for any information, opinion or commentary contained herein or for any consequences of its use will be accepted by ADW Johnson or by any person involved in the preparation of this assessment and report.

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The Client should be aware that this report does not guarantee the approval of any application by any Council, Government agency or any other regulatory authority.

Executive Summary

ADW Johnson has been engaged by Defence Housing Australia (DHA) to prepare a Stormwater Management Plan to support the planning proposal for the proposed rezoning of the site known as The Rifle Range from E2 to Part R2 and Part E1.

This Stormwater Management Plan specifically addresses both stormwater quantity and quality. It has addressed the impacts of development of the site on the existing drainage regime, determined the stormwater discharge constraints and identified proposed stormwater device measures to adequately treat the stormwater prior to discharging to receiving waters.

This Stormwater Management Plan is based on a concept master plan developed for the site to inform the Planning Proposal.

Based on review of the existing site topography and geotechnical conditions, it has been identified that any surface runoff will infiltrate into the existing sand substrate within the site limits.

A stormwater routing model was created using the XPRAFTS software to determine the required area to infiltrate the site discharge 1% AEP storm events. The results for 1% AEP storm event have been provided in ***Section 5.***

A MUSIC model was used to simulate pollutant source elements for the proposed development to confirm that the stormwater can be adequately treated within the limits of the development. Further details on water quality modelling can be found in ***Section 6***. The results from this study demonstrate that there is adequate capacity within the site to achieve the required performance objectives of the stormwater management.

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1.0 Introduction

ADW Johnson has been engaged by Defence Housing Australia (DHA) to prepare a Stormwater Management Plan to support the planning proposal for the proposed rezoning of the site known as The Rifle Range from E2 to Part R2 and Part E1.

The land subject to this application is located in Fern Bay adjacent to Popplewell Street to the west, Stockton Bight to the east undeveloped land to the north and Stockton Centre to the south. The location of the site is shown in ***Figure 1***.

Figure 1 - Site Locality (Google earth).

This report covers the following:

- Existing site and proposed development within ***Section 2***;
- Councilõs requirements for a Stormwater Management Plan within ***Section 3***;
- Overview of the proposed development within ***Section 4***;
- Stormwater Discharge detailed in ***Section 5***;
- Stormwater Quality detailed in ***Section 6***; and
- Erosion and Sediment Control during construction outlined in ***Section 7***.

2.0 Site Description

2.1 EXISTING SITE

The subject site is located within Port Stephens Council LGA off Popplewell Street at Fern Bay. The site is located on a sand spit between the Pacific Ocean (Stockton Bight) and the Hunter River South Arm as shown in ***Figure 2***. The site has a gentle fall from east to west with a slight tilt to the north.

Figure 2 - Existing Site.

The existing drainage within the subject site consists of site runoff from the southern portion of the site and drains north towards low lying areas. These low lying areas are located between the dune system to the north east of the site and to the north of the site. The site is underlain by an unconfined aquifer, in which the site recharges through infiltration.

2.2 PROPOSED DEVELOPMENT

The planning proposal proposes to rezone the site with a combination of R2 and E1 zones.

The proposed rezoning will allow the redevelopment of the site with a mixture of varying density residential lots.

The planning proposal plan and masterplan of the site is shown in **Figures 3** and **4**.

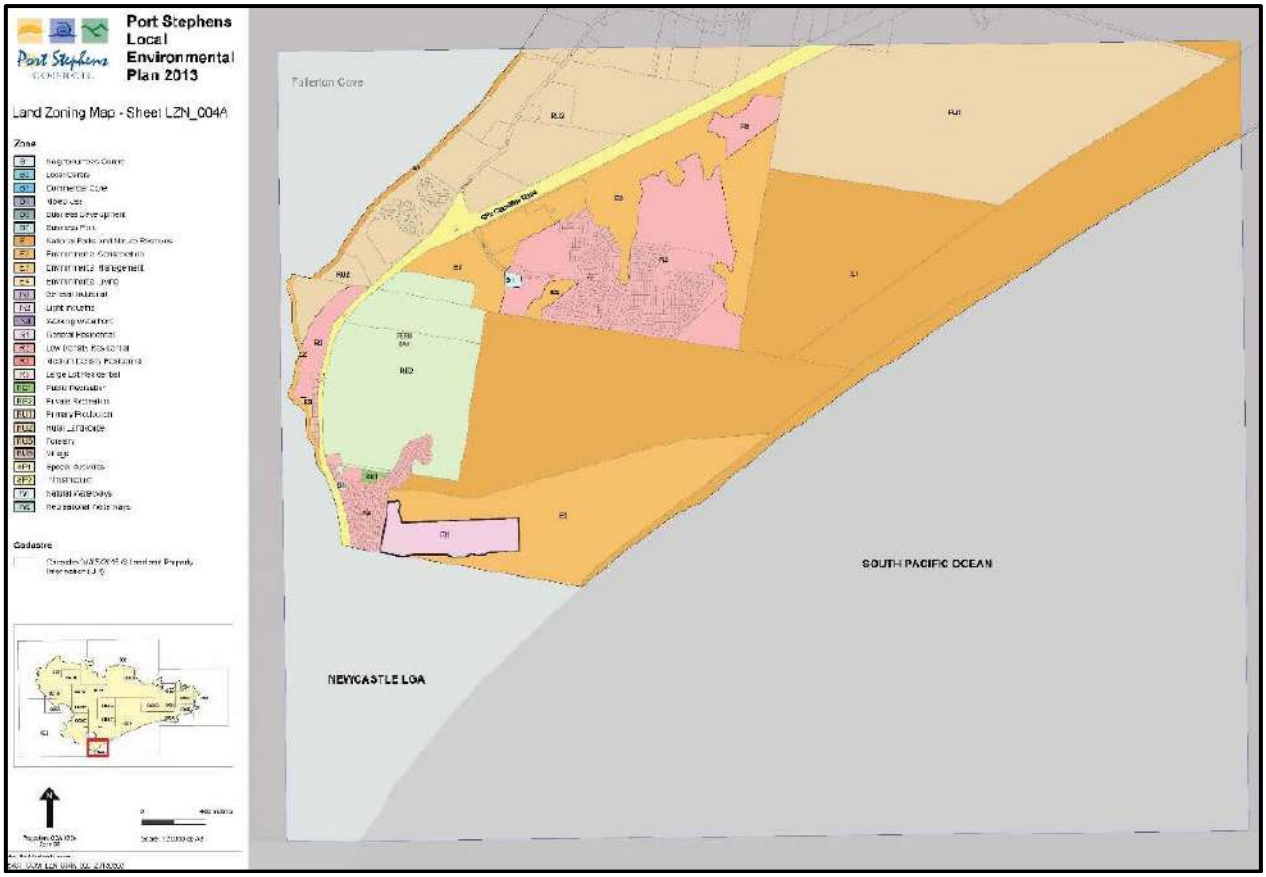

Figure 3 - Proposed Zoning.

Figure 4 - Masterplan.

3.0 Council Requirements

Port Stephens City Council provides objectives and controls for developments within òPort Stephens Development Control Plan 2014ó (DCP). *Part B* òGeneral Controlsó of the DCP outline relevant controls for subdivision development.

Part B4 òDrainage and Water Qualityó of DCP contains compliance requirements for discharge of stormwater from the site.

The objective of B4.A ð Stormwater Drainage Plan are:

- To ensure a stormwater drainage plan is submitted when *development* increases *non-permeable surfaces* and will place significant additional flows into *public drainage;*
- To ensure the stormwater drainage plan details a legal and physical point of discharge to minimise impacts on *water balance*, *surface water* and *groundwater* flow regimes and flooding; and
- To implement sustainable mitigation systems that can be maintained using resources available to the maintainer.

The objective of B4.B ð On Site Detention are:

- To regulate the impacts on the capacity of the public drainage system.

The objective of B4.C ð Water Quality are:

- To ensure development does not impact on water quality through the use of water quality through use of water quality modelling, such as MUSIC Modelling and subsequent WSUD measures;
- To safeguard the environment by improving the quality of stormwater run-off; and
- To ensure water quality is protected and maintained during the construction phase through the conditioning of appropriate measures.

Table 1 - Water Quality Targets (Port Stephens Council DCP, 2014)

Pollutant	Targets
Total Suspended Solids (TSS)	90% of average annual load
Total Phosphorus (TP)	60% of average annual load
Total Nitrogen (TN)	45% of average annual load

Part B5 òFloodingó of DCP containing compliance requirements for flood compliance for a proposed development which is situated within the flood planning area or at or below the flood planning level.

Whilst not located within a flood planning area the subject site due to its drainage regime would be subject to the principles within Part B5.

The objective of B5 ð Flooding are:

- *To reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property.*
- *To recognise flood prone land as a valuable resource that should not be sterilised by unnecessarily precluding its development.*
- *That flood risk is considered as early as possible in the planning and development process, is based on the best available flood information and is a flexible, locally-specific, merit-based approach.*
- *To ensure that the use and development of flood prone land has risk consequences that are acceptable to the community, takes into account the full spectrum of flood risks and recognises the social, economic and environmental values of flood prone land.*
- *To implement the principles of the NSW Government 2005, 'Floodplain Development Manual' into new development and satisfy the provisions of PSLEP2013 Clause 7.3.*

4.0 Overview

The planning proposal and concept masterplan has been planned and designed to achieve water cycle management objectives. This process is known as Water Sensitive Urban Design (WSUD). As part of the WSUD approach for this development, the protection of the waterways and management of stormwater within the landscape were key principles. The objectives outlined in Part B of the Port Stephens DCP were incorporated in to the developmentõs WSUD.

The proposed development incorporates measures to manage stormwater prior to discharging into the natural drainage system. A stormwater treatment train is proposed to provide appropriate treatment of pollutant prior to discharging to the natural environ, this is detailed in ***Section 6.***

Construction activity has potential to impact on the adjacent environment and have a detrimental effect on the natural drainage regime. To maintain this area during construction, erosion and sediment controls will be implemented as outlined in ***Section 7***.

5.0 Stormwater Discharge

The existing drainage within the area of the site proposed to be rezoned to residential discharges north toward low lying areas. These low lying areas are located between the dune system to the north east of the site and to the north of the site. The site is underlain by an unconfined aquifer, in which the site stormwater recharges through infiltration.

In the developed scenario for the site the impervious area is increased which will increase the runoff from the hardstand areas, reducing the infiltration occurring within the developed portion of the site and hence increase the volume of infiltration required elsewhere within the site.

An assessment was undertaken using the hydrological model XP RAFTS to determine the required area to achieve infiltration of the critical 1% AEP storm. The model has adopted the following parameters outlined in ***Section 5.1***.

5.1 MODELLING PARAMETERS

5.1.1 Rainfall Intensity

The Rainfall Intensity Frequency Duration (IFD) data adopted was sourced from the Bureau of Meteorology website (IFD AR&R87 application).

5.1.2 XPRAFTS Parameters

The rainfall losses adopted within XPRAFTS are provided in ***Table 2***.

Table 2 - XPRAFTS Rainfall Losses

Parameter	Pervious Area	Impervious Area
Initial Loss (IL)	125.0mm	1.5mm
Continuing Loss (CL)	20mm/hr	0mm/hr

Roughness values (Manningõs ônõ) were determined based on the terrain and vegetation. For the pervious conditions, the Manningõs ônõ was 0.035 while the impervious adopted was 0.02.

5.2 CATCHMENT

The catchment was delineated by analysis of the digital terrain model using LiDAR available survey data and then confirmed by ground inspection.

In the developed scenario the total catchment adopted was 21.05 ha. This is made up of 19.19ha of rezoned/developed land and 1.86ha of undeveloped land.

5.3 STORMWATER ASSESSMENT

To determine the impact on the subject site the XP RAFTS model was created for storm durations range from the 30 minute storm up to the 4,320 min (72 hours).

The site survey determined that the subject site once developed would generally discharge to the north. Subject to development outcome the area to the north east of the site may not be able to receive stormwater overflow, this assessment has therefore assumed that the entire developed site would discharge to the low lying area towards the north of the development.

An assessment of Geotechnical report indicated that at the time of assessment there was groundwater found in one borehole RL 1.0. The groundwater levels within the low lying area of the site is known to fluctuate during wet and dry seasons, with some evidence that the lower area of the site exfiltrate to the surface. Evidence of ponded water was found with aerial photography taken January 10th 2016 after prolonged period of rain (305mm over 4 days) with the water elevation determined to be approximately 2.1m (or 0.4m above the lowest point within the site).

The management of stormwater discharge from the site is therefore proposed to include the infiltration of stormwater throughout the higher areas of the site post water quality treatment. This is proposed to occur within infiltration basins located amongst the development footprint with basins (linear) located north of the development site, these basins are proposed to vary in elevation between RL 4.0 and 6.0.

XPRAFTS models were prepared adopting an infiltration area ranging from 2,000m^2 to 14,500m^2 to determine an appropriate infiltration area to limit the flood depth to below or equal to 1m.

Geotechnical report prepared by Douglas Partners (Nov 2016) identified the site permeability rates varied across the site from 295mm/hr (7.08m/day) to 1980mm/hr (47.5m/day), with a recommended infiltration rate of 36mm/hr to be adopted for modelling purposes.

5.4 STORMWATER RESULTS

The model results indicate that a total infiltration area of 14,500 m^2 with an adopted peak flood depth of 1 m during the critical 1% AEP storm.

The critical storm event was determined to be the 48 hour (2,880 min). These results indicate that there is sufficient available infiltration zone within the site to cater for the proposed development of the land during the critical 1% AEP Storm event.

5.5 EXTREME EVENTS

An assessment of site flow paths based on a review of topographical maps has determined that the site is confined by surrounding coastal dunes to the east, and north, higher ground to the south and Popplewell Street at its southern end at RL 6.8. As the proposed development site (R2 land) varies in elevation from RL 5.0 to 7.0 there is no overland flow path from the site to Nelson Bay Road. The developed site will discharge north to the low lying area which at its lowest is approximately RL 1.7.

It is known that the groundwater levels within the low lying area can vary during wet climatic conditions and exfiltrate to the surface. This will reduce the holding capacity within surface area. An assessment was undertake to determine the available storage within the low lying area between an adopted peak groundwater elevation (RL 2.4) and an estimated minimum development level of RL 4.7.

It was determined that the available storage is 132 000 m^3. This storage volume can contain approximately double the volume of the 72hr 1% AEP storm event, assuming no infiltration occurs within the development site and all surface water discharges to the low area.

5.6 SEA LEVEL RISE AND CLIMATE CHANGE

The subject site ranges in elevation from RL 2.0 m AHD to approximately 7.0 m AHD within the proposed development zoned land, and to an elevation of 16 m AHD within the dune system to the east of the site.

The subject site is separated from the effect of the Hunter River flooding by elevated levels within existing development to RL 6.0 m AHD to the west, and is separated from the sea by the dune system to the east.

The Lower Hunter River Flood Study (Greens Rocks to Newcastle) 1994 prepared by Lawson and Treloar on behalf of Port Stephens Council and Newcastle City Council was updated in 2008 by DHI Water and Environmental Pty Ltd on behalf of Newcastle City Council due to increased intensification of development within Hexham area and the use of up to date numerical modelling techniques. The DHI report identified that the 1% AEP flood level at Stockton Bridge with the adopted sea level rise is 1.34 m AHD. A sensitivity assessment within the DHI report indicated that with a 20% increase in Hunter River discharge the 1% AEP flood level at Stockton Bridge is 1.51 m AHD, this is considered an appropriate assessment of the Hunter River Flood level including sea level rise and Climate Change.

The subject site is protected from the effects of sea level rise from both the east and west, and is above the predicted Hunter River 1% AEP flood level, therefore it is considered that the proposed rezoning of the development is not constrained due to sea level rise of climate change effects. A Coastal Engineering Assessment has been prepared by BMT WBM Pty Ltd and submitted as part of the planning proposal for the site.

6.0 Stormwater Quality

The Stormwater management strategy for the site focuses on minimising impact of the development on the receiving waters adjacent to the site. The subject site discharges to the low lying areas to the north. At these locations the stormwater from the site infiltrate into the unconfined aquifer below.

To maintain stormwater quality to the prescribed levels in Port Stephens Council DCP a treatment train approach is proposed, where a number of devices are used to cleanse the site discharge prior to discharging to the infiltration zones.

A MUSIC model was prepared to determine the required land take to facilitate appropriate stormwater treatment devices.

A typical 1 ha catchment was setup to represent the proposed residential usage.

6.1 MUSIC MODELLING

The MUSIC model included the following treatment train approach:

- Gross Pollutant Trap; and
- Bio filtration basin.

The use of BASIX compliant rainwater tanks is recommended in future modelling, however for the purpose of determining required land take rainwater tanks have been excluded.

It is noted that the above treatment train devices have been adopted for the purpose of determining the appropriate land take required to facilitate the appropriate treatment of stormwater. Alternate devices such as swales, buffer strips, constructed wetlands could be used.

Pollutant source inputs were obtained from the *'Draft NSW MUSIC Modelling Guidelines'* (BMT WBM, 2010). The parameters adopted for the varying land uses were implemented in accordance with Table 3-2 of the above stated document. The rainfall-runoff parameters were updated where appropriate to meet PSCõs set rainfall-runoff parameters within MUSIC-link.

The residential source node within MUSIC has been adopted, with an impervious percentage of 70%.

The parameters used within the MUSIC model are presented below**.**

Gross Pollutant Traps

GPTs are utilised as conveyance controls, though they can also be used as an end of line control. For the purposes of this model a High Flow Ecosol GPT has been adopted for the 1 Ha catchment. The treatment node was sourced from the Ecosol website. It is required that at detailed design stage, gross pollutant traps be positioned throughout the development to intercept the majority of stormwater discharging from the development while ensuring that the Gross Pollutant Traps are serviceable and remain efficient during smaller duration storm events.

The removal efficiency of the GPT is summarised in ***Table 3***.

Table 3 - GPT Removal Efficiencies (Ecosol)

Pollutant	% Removal Efficiency
Total Suspended Solids	55
Total Phosphorus	40
Total Nitrogen	40
Gross Pollutants(>2000Õm)	99

The high flow bypasses for the modelled GPTs have been set to 100L/s based on a conservatively sized Ecosol model.

Biofiltration Basins

Biofiltration basins are utilised as end of line controls treating the water prior to discharging into the infiltration zone.

Table 4 - Biofiltration Basin Parameters

Parameter	Catchment Urban
Surface Area (m^2)	500
Extended Detention Depth (m)	0.30
Exfiltration Rate (mm/hr)	0
Filter Area (m^2)	400
Filter Depth (m)	0.40
Saturated Hydraulic Conductivity (sandy Loam)	180
Base Lined	no
Vegetated with Nutrient Removal Plants	yes
Underdrain Present	yes
Submerged Zone	no

6.2 WATER QUALITY RESULTS

The average annual pollutant loads from a generic 1Ha catchment are summarised in ***Table 5***.

Table 5 - Treatment Train Effectiveness

Pollutant	Result (%)
TSS (kg/yr)	**97.7**
TP (kg/yr)	**66.8**
TN (kg/yr)	**70.9**
GP (kg/yr)	**100**

From ***Table 5*** it can be seen that the treatment train successfully reduced the pollutant loads.

It is recommended that a whole of site detailed MUSIC model be prepared at future development stages throughout the site to confirm the bio retention basin areas required to treat the catchment based on the ultimate land use.

These results indicate that there is sufficient available land within the site to cater for the proposed development of the land.

7.0 Erosion and Sediment Control

Port Stephens Council requires the use of erosion and sediment controls to manage and contain pollutant runoff, both during construction and as long term permanent treatments thus ensuring the minimisation of impact on the environment. All erosion and sediment controls and practices are to be in accordance with PSCõs DCP and *'Managing Urban Stormwater'* by Landcom/NSW Department of Housing.

Long term permanent treatments are outlined as part of the treatment train within ***Section 6.*** The treatment train specified has been shown to sufficiently manage and control the pollutants leaving the development in accordance with Councilõs pollutant reduction targets.

Treatment devices will be utilised to contain the generated pollutants from the site during construction. These include but are not limited to:

- Sediment Basins;
- Silt Fencing;
- Hay bale and Geotextile Fencing;
- Kerb Inlet Controls;
- Sandbag Kerb Inlet Sediment traps;
- Shaker Ramp; and
- Diversion Drains.

Any clean water entering the site from upstream catchments is to be diverted around the construction site where possible hence remaining clean. Runoff generated from within the site is to be treated and managed using a combination of the above stated treatment devices.

Due to the extents of disturbed areas, the use of sediment basins will be required (Landcom, 2004). During construction, the proposed bio filtration basins will be utilised as temporary sediment basins. Refer to **Appendix A** for a typical Erosion and Sediment Control Plan.

8.0 Conclusion

ADW Johnson were engaged by Defence Housing Australia to prepare a report detailing Stormwater Management to support the rezoning of Lot 5 DP 233358 Popplewell Street Fern Bay from E2 to a combination of E2 to Part R2 and Part E1.

The impact on the existing drainage regime has been assessed in regard to Stormwater discharge, stormwater quality pollutant loads and erosion and sediments controls.

Appropriate erosion and sediment controls implemented to the requirements of Port Stephens Council are required for the construction period to protect downstream receiving waters.

The assessment determined the necessary mitigation measures required to be implemented are able to be readily provided within the subject land. The measures include the construction of stormwater quality devices which are able to adequately reduce pollutant loads to Port Stephens Council requirements, ensuring protection of existing environment and hydrology.

Appendix A ð Erosion and Sediment Control

FIGURE A-1 ð EROSION AND SEDIMENT CONTROL PLAN

239478(30)-ESK-002_A

NEWCASTLE GOLF COURSE

LOT 4 DP823114

EXISTING WWPS

POPPLEWELL RD

NAGLE CL

VARDON RD

HYDE LANE

RANKIN RD

NELSON BAY RD

TAYLOR RD

BRAID RD

TEMP SEDIMENT BASIN

SUBJECT SITE

LOT 5 DP233358

SHAKER RAMP

CONSTRUCTION ACCESS

DIVERSION DRAIN - CLEAN WATER

DIVERSION DRAIN - DIRTY WATER

SILT FENCE

NO GO FENCE

ver.	date	comment	drawn	pm	level information	scale (A3 original size)
A	24.01.17	INITIAL ISSUE	Z.J.	A.W.	DATUM: LIDAR DATA CONTOUR INTERVAL: 0.5m	0 50 100 125m SCALE: 1:2500 (FULL)

drawing title:

APPENDIX A: EROSION & SEDIMENT CONTROL PLAN

location: LOT 5 D.P.233358 POPPLEWELL ROAD, FERN BAY

council: PORT STEPHENS

dwg ref: 239478(30)-ESK-002_A

client: DHA Defence Housing Australia

adw johnson
central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
www.adwjohnson.com.au

Plotted By: Zachary Jarvie Plot Date: 24/01/17 2:58:33PM Cad File: N:\239478\239478(30)E\DRAWINGS\ENGINEERING\CIVIL\239478(30)-ESK-002_A.DWG

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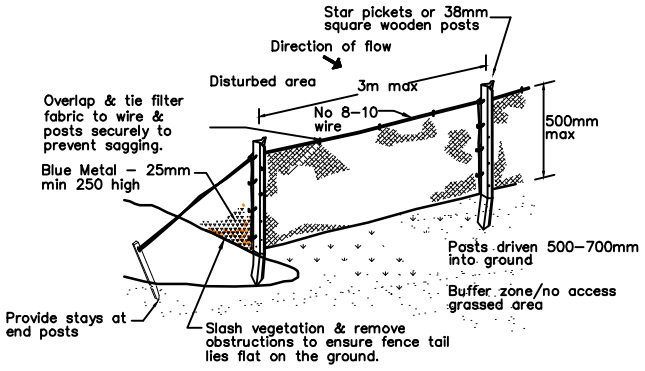
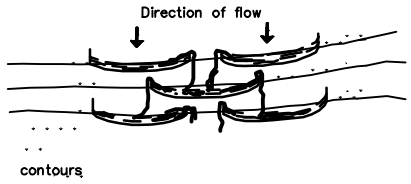
NOTES:

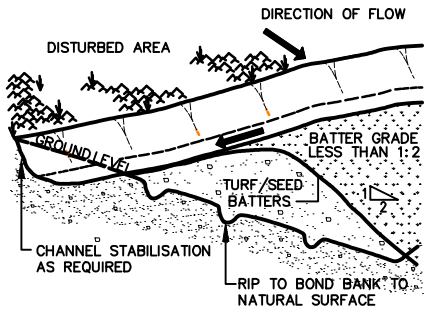
1. ALL TOPSOIL IN SITE REGRADING AREAS AND ROAD RESERVES TO BE STOCKPILED AS DETERMINED ON SITE OR AS SHOWN
2. ALL TOPSOIL TO BE REMOVED BY EITHER EXCAVATOR OR SCRAPER AND MOVED DIRECTLY TO STOCKPILE LOCATION
3. STOCKPILE AREA TO BE FULLY FENCED WITH SILT PROOF FABRIC AT ALL TIMES
4. IMPORTED MATERIAL TO BE PLACED DIRECTLY INTO SITE REGRADING AREAS. IMPORTED MATERIAL IS NOT TO BE STOCKPILED
5. STOCKPILES ARE TO BE REMOVED AS SOON AS PRACTICABLE AND SITES REINSTATED IMMEDIATELY
6. ALL AREAS DISTURBED DURING CONSTRUCTION ARE TO BE RE-INSTATED AND SEEDED IMMEDIATELY
7. ALL SITE REGRADING IS TO BE CARRIED OUT UNDER THE SUPERVISION OF A QUALIFIED GEOTECHNICAL ENGINEER
8. SILT FENCES AND STRAW BALING TO BE PLACED WHERE DIRECTED BY COUNCIL'S ENGINEER AND MAINTAINED AT ALL TIMES
9. WHERE PRACTICAL CATCHDRAINS OR SMALL LEVIES ARE TO BE CONSTRUCTED TO MINIMISE EXTERNAL RUNOFF ENTERING THE SITE
10. DISTURBED AREAS TO BE KEPT TO A MINIMUM.
11. CONTROL CLEAN WATER FROM ABOVE THE SITE, THROUGH THE SITE AND AROUND THE SITE.
12. KEEP CLEAN WATER SEPERATE FROM DIRTY WATER.
13. CONSERVE ALL TOPSOIL, STOCKPILE AND PROTECT FOR REUSE ON SITE.
14. PROTECT ALL DISTURBED AREAS FROM EROSION.
15. MINIMISE SEDIMENTATION.
16. MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES UNTIL COMPLETE REHABILITATION IS ACHIEVED.
17. OBTAIN COUNCIL'S PERMISSION BEFORE CLEARING OF ANY TREES.
18. AN ONSITE MEETING WITH COUNCIL'S SOIL CONSERVATION CONSULTANT PRIOR TO COMMENCEMENT OF WORK WILL BE REQUIRED
19. MAXIMUM HEIGHT OF TOPSOIL STOCKPILE IS TO BE 2.0 METRES.
20. MAXIMUM SIDE SLOPE OF STOCKPILES TO BE 2H:1V



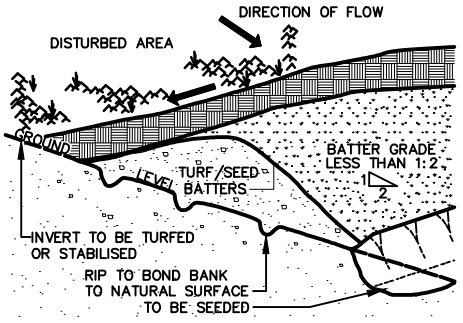
SILT FENCE



SILT FENCE CONFIGURATION



DIVERSION DRAIN



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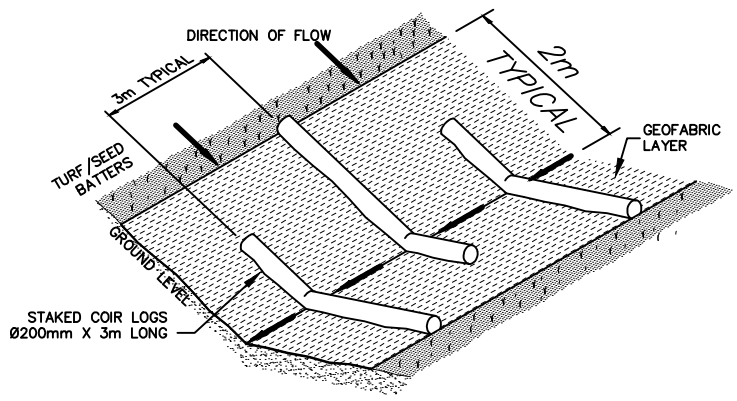

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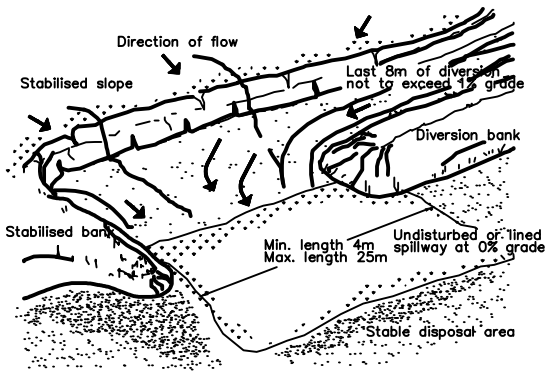

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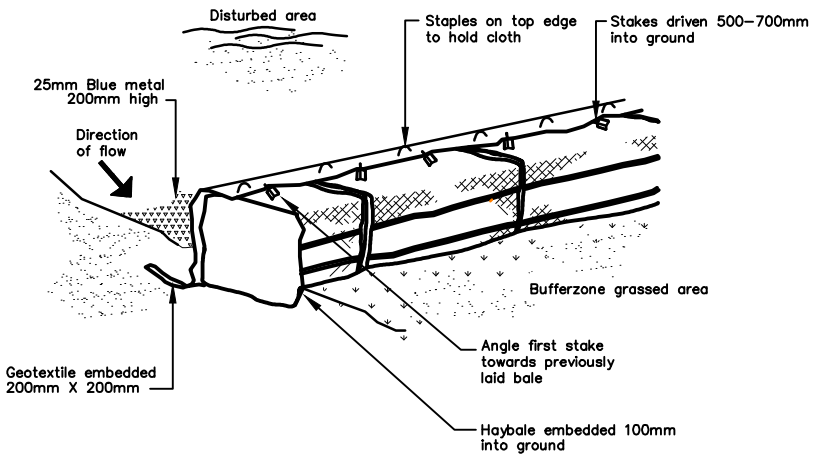

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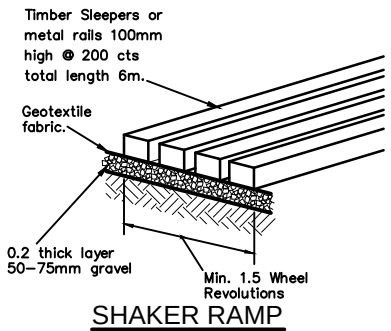

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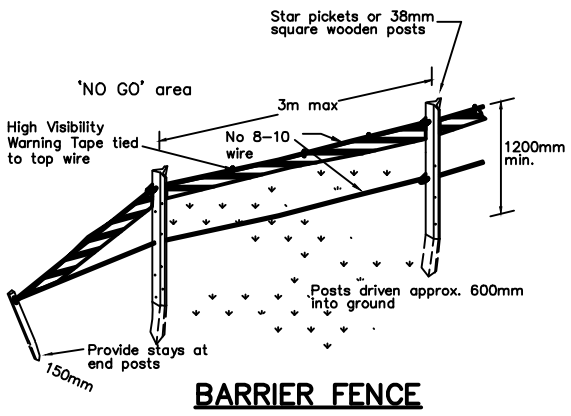

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APPENDIX A: EROSION & SEDIMENT CONTROL DETAILS

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council: PORT STEPHENS

dwg ref: 239478(30)-ESK-002_A

client: DHA Defence Housing Australia

adw johnson
central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
www.adwjohnson.com.au

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"Where will our knowledge take you?"

DHA Stockton Rifle Range Stockton Beach Coastal Engineering Assessment

December 2016

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BMT WBM Pty Ltd
126 Belford Street
Broadmeadow NSW 2292
Australia
PO Box 266
Broadmeadow NSW 2292

Tel: +61 2 4940 8882
Fax: +61 2 4940 8887

ABN 54 010 830 421

www.bmtwbm.com.au

Document:	R.N20693.001.00.RifleRange.docx
Title:	DHA Stockton Rifle Range Stockton Beach Coastal Engineering Assessment
Project Manager:	Verity Rollason
Author:	Verity Rollason
Client:	Department of Housing Australia
Client Contact:	Nigel Macdonald, Gully Coote
Client Reference:	

Synopsis: **This Coastal Hazard Assessment report outlines the potential for coastal erosion, wave overtopping, reduced foundation capacity of dunes, and sand drift to affect the Stockton Rifle Range Planning Proposal by 2100. Measures to mitigate or manage the identified risks by 2100 are also provided.**

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	September 2016	PEH		VPR	
02	December 2016	MF		MF	
03	May 2016	MF		MF	

DISTRIBUTION

Destination	Revision										
	0	1	2	3	4	5	6	7	8	9	10
DHA / NPC	PDF										
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Executive Summary

Defence Housing Australia (DHA) has recently purchased the Stockton Rifle Range site (Lot 5 DP233358) covering 111.35 ha on Stockton Beach within the Port Stephens local government area (LGA), see Figure 1. DHA seeks to rezone this site and develop it for a mix of housing for Australian Defence Force (Defence) personnel and the private market. DHA's planning proposal seeks to rezone the site for low density residential development (R2); and Public Recreation (RE1).

This report provides an assessment of coastal hazards by 2100 that may impact upon the Stockton Rifle Range site, proposed zoning and masterplan prepared by Architectus (refer to Figure 1). Where impacts may occur, this report provides recommended mitigation measures to reduce the risks. Key outcomes of the coastal hazard and mitigation assessment are summarised below.

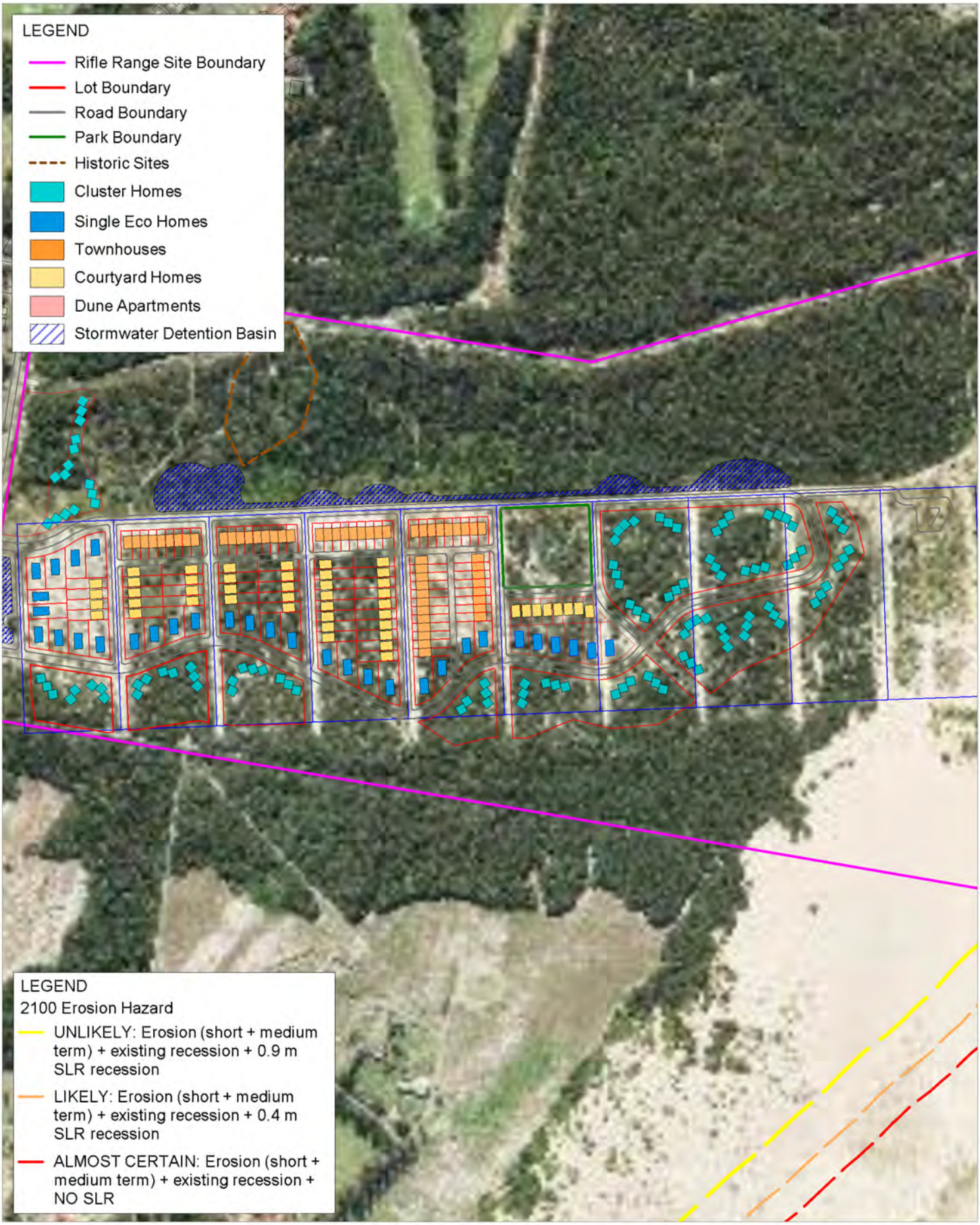
Risks from Erosion by 2100

Three scenarios for erosion by 2100 were investigated:

- an 'almost certain' erosion scenario including short and medium term erosion, ongoing recession (due to the Newcastle Harbour breakwaters), but excluding the impacts of sea level rise;
- a 'likely' erosion scenario including short and medium term erosion, ongoing recession, and future recession due to sea level rise of 0.4 m by 2100 (equivalent to the current rate of sea level rise); and
- an 'unlikely' erosion scenario including short and medium term erosion, ongoing recession, and future recession due to sea level rise of 0.9 m by 2100 (equivalent to highest emission scenario along which we are tracking). The 'unlikely' scenario is the typical conservative estimate used for planning purposes in NSW.

As shown in Figure 1, all land proposed for residential, purposes is located well landward of the 2100 'unlikely' erosion hazard. The Stockton Rifle Range footprint is at least 200 m from the 2100 'unlikely' coastal erosion hazard line, with habitable buildings within the residential zones even further landward, at least 350 m from this hazard line.

The coastal erosion risk to the proposed rezoning of the Stockton Rifle Range site (as per the Planning Proposal) is considered to be extremely low. No further mitigation of this risk is required.



Title:

2100 Erosion Hazards for the Stockton Rifle Range Masterplan

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Reduced Foundation Capacity Hazard

Immediately following a storm erosion event, a near vertical erosion escarpment of substantial height can be left in the dunes or beach ridge. At some time after the erosion event, the escarpment may slump and the slope adjust to a more stable angle. This slumping may occur suddenly and poses a risk to structures located immediately behind the dune escarpment within this zone of slope adjustment and reduced foundation capacity. The width of the reduced foundation capacity zone is directly dependent on the height of the dunes, with higher dunes resulting in a wider zone.

Caution is required in assessing and applying the dune instability hazard for 2100. The present day height of dunes/land in the region of the 2100 erosion hazard may not accurately represent the actual height of the dunes by that time. Activities including development for residential purposes, community uses, and even dune rehabilitation may lower or heighten the dunes over time. However, as the best proxy for the potential region of reduced foundation capacity that may affect the Stockton Rifle Range development, the average, maximum and minimum dune heights along the erosion hazard scenario lines (i.e. 'almost certain', 'likely' and 'unlikely', see Figure 1) were used to calculate the potential region of reduced foundation capacity.

Should the erosion escarpment reach the 'unlikely' hazard scenario line and dune heights remain at their current level by 2100, the zone of slope adjustment and reduced foundation capacity may average 9 m and range from 5 to 23 m width landward of the 'unlikely' erosion hazard scenario.

Being located at least 200 m from the 'unlikely' coastal erosion hazard line, residential zones given in the Planning Proposal are not expected to be at risk from reduced foundation capacity of the dunes by 2100.

Wave Overtopping Hazard

Detailed analysis of wave run up and the subsequent potential for wave overtopping of dune barriers during an extreme storm by 2100 was undertaken.

Assuming that existing dune heights along the 2100 'unlikely' erosion hazard scenario lines remain at the same height as at present, there is a substantial potential for wave overtopping particularly at very low lying sections of dune. However, even at the high overtopping rates identified, wave overtopping would not be expected to extend more than 50 m landward of the 'unlikely' erosion hazard line, and is expected to percolate quickly into the dune sands. As such, the proposed new zones, particularly residential zones, are not expected to be at risk from wave overtopping of coastal barriers by 2100.

Sand Drift and Dune Rehabilitation

The key coastal issue identified for the Stockton Rifle Range site is managing sand drift and dune rehabilitation in balance with maintaining the substantial region of active (unvegetated) dunes on the site in order to support the existing windborne sand transport system of Stockton Bight.

Windborne or Aeolian sediment transport allows the transfer of sand from the sub-aerial beach into the dunes behind. This sand drift is a natural phenomenon, however it can pose a hazard where coastal developments are being overwhelmed by windborne sediment, or significant volumes of sediment are being lost from the active beach system.

Windborne transport of sand can be an important component of the coastal sediment transport system. This is particularly the case on the Stockton Rifle Range site, which forms part of the active pathway for sand transport via the extensive transgressive dune system of Stockton Bight. The lack of vegetation within this

dunal system is highly important for allowing the transgression of sand along Stockton Beach towards Birubi Point and beyond. This forms a significant portion of the natural northerly sand transport within the coastal system. As such, it is vital that this vast active system remains unvegetated, to avoid detrimental erosion impacts updrift. If the entire site were to be revegetated, this may cause erosion impacts on and updrift of the site, as the natural transport of sand by wind is impeded.

For the Stockton Rifle Range site, managing potential sand drift into the proposed development must be balanced with retaining the active dunal areas on the site. It is recommended that dune remediation be limited to the area of existing dune vegetation on the seaward boundary of the proposed development footprint (i.e., not the seaward boundary of the site). Extending dune revegetation activities seaward of this should be avoided, and careful maintenance of dune vegetation within this boundary is required. Provided that the full hierarchy of dune vegetation structure (i.e. a hierarchy of vegetation types and heights from primary species to secondary species then tertiary species that includes small trees) is used within this footprint, the sand drift issues should be effectively managed.

Risk Mitigation

The proposed rezoning and subdivision of the Stockton Rifle Range site is not expected to be at risk from coastal erosion, reduced dune foundation capacity or wave overtopping by 2100. As such, the Planning Proposal can be accepted with no further mitigation of these risks required.

As noted above, any works to rehabilitate dunal vegetation on site must be cautious of the active and unvegetated dune regions on the site, which are part of one of the largest transgressive dune systems in Australia.

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1 Introduction

1.1 Purpose of the Planning Proposal

Defence Housing Australia (DHA) has recently purchased two surplus Defence sites at Stockton with the objective of obtaining the necessary planning approvals and developing them for a mix of housing for Australian Defence Force (Defence) personnel and the private market. DHA has an ongoing requirement for additional housing in Newcastle, to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards.

One of these sites is the Stockton Rifle Range site (Lot 5 DP233358) on Stockton Beach within the Port Stephens local government area (LGA). The site covers an area of 111.35 ha, and is currently zoned for E2 Environmental Conservation.

DHA are seeking to rezone this site to allow for:

- Low density residential development;
- Protection and management of areas of high-value vegetation or environmentally sensitive areas (RE2);

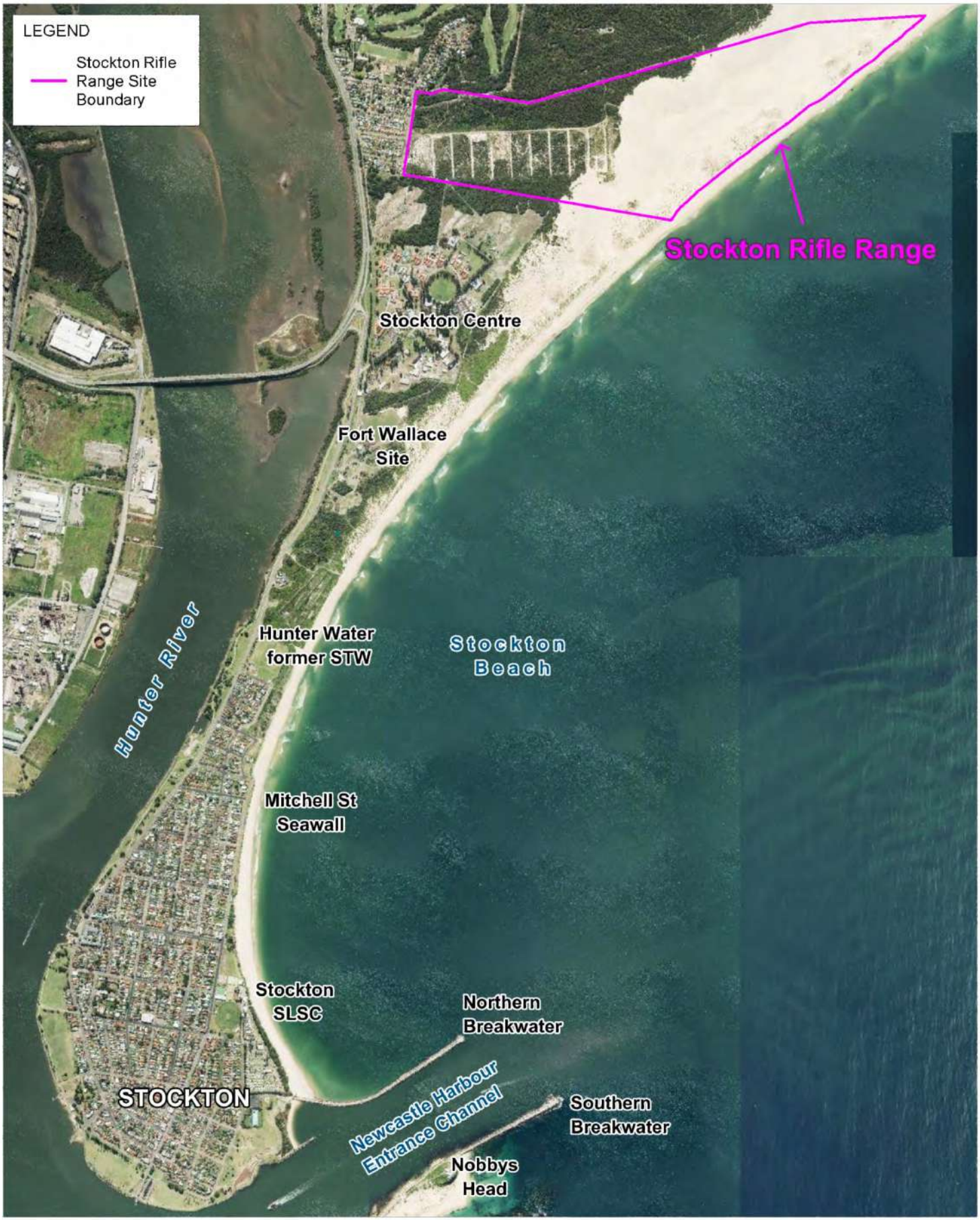
The Planning Proposal will amend the land use / zoning controls, height controls and lot size controls for the site.

This report provides an assessment of coastal hazards by 2100 that may impact upon the Stockton Rifle Range site and proposed rezoning in particular. Where impacts may occur, this report provides recommended mitigation measures to reduce the risks from coastal hazards to the Stockton Rifle Range rezoning proposal. The following coastal hazards are assessed in this report:

- **Erosion**, over the short and medium term, due to long term recession processes, and due to sea level rise in future;
- **Dune Stability and Reduced Foundation Capacity** for buildings in relation to erosion escarpments in dunes;
- **Wave Overtopping**, due to high tides, ocean water levels during storms, and in the future due to sea level rise; and
- **Sand Drift**, whereby natural windborne sand transport from active dunes engulfs nearby properties.

1.2 The Stockton Rifle Range Site

The Stockton Rifle Range site lies on Stockton Beach in NSW around 5.2 km north of Newcastle Harbour entrance, as shown in Figure 1-1. The site lies north of the existing residential development at Stockton, and adjacent to the Stockton Centre. The entire site extends to the shoreline of Stockton Beach, however the proposed development footprint will not extend onto the foredunes or beach.



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Locality Plan for Stockton Rifle Range

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2 Coastal Setting

2.1 Stockton Beach

Stockton Beach is located at the southern end of the larger embayed section of sandy coast known as Stockton Bight. The northern breakwater of the Hunter River entrance forms the southern end of the beach unit. The southern end of Stockton Beach faces east-north-east. Towards the north, the shoreline curves in a long arc, facing progressively more southwards to culminate at Birubi Point, Anna Bay some 32 km to the north.

The southern 5km or so of Stockton Beach experiences lower waves averaging around 1 m (Short, 2007), as it lies in the wave shadow created by the Newcastle Harbour entrance breakwaters. The surf zone at this end generally displays a single attached sand bar cut by rips, with the sand bar becoming detached towards the north.

Particularly north of Fort Wallace and the Stockton Centre, the beach becomes increasingly exposed to wave energy, as it extends beyond the wave shadow created by the Harbour breakwaters and arcs to face into the dominant southerly swell direction. The surf zone is described as high energy, with a well-developed double sand bar system, with both bars cut frequently by rips and separated by a deep wide trough (Short, 2007). In very big seas, the northern end of the beach (Birubi Point) will develop a third outer sand bar (Short, 2007).

In the nearshore zone off Stockton Bight, outcropping of rock reef is not evident in the surfzone, and the beach extends as a long, sandy embayment. The continental shelf is slightly wider through this region particularly out to the 40 m contour, which may have assisted in the onshore supply of sediment to the shoreline. Birubi Point forms a bedrock anchor that has repeatedly trapped northward littoral sediment transport to form Stockton Bight over previous interglacial periods.

2.1.1 Stockton Sand Dunes

The Stockton Sand Dunes are the largest and most active transverse dune system in NSW. The sand dunes extend some 25 km roughly from Fern Bay to Birubi Point in the north, and up to 3 km inland. Sands in some parts of the dune field are believed to pre-date the last two glacial periods (i.e. > 500,000 years old). A key aspect of these active dunes is that they are un-vegetated. This allows for sand to be blown into and northwards along the dunes, thus forming an important part of the coastal sediment transport system. That is, an important portion of the sediment transport occurring along Stockton Beach is actually above the water, on land via these active sand dunes.

2.1.2 The Rifle Range Site

The Rifle Range site includes beach frontage on Stockton Beach. The site's coastal frontage encompasses a considerable area of active transgressive dunes, which are naturally unvegetated. Closer to the shoreline, patchy vegetation is present. Fronting the site, the beach itself is fairly wide, and the surf zone typically displays a deep trough then single detached bar cut by rips. In the right conditions, the beach can provide decent surfing conditions.

The beach does not currently exhibit signs of erosion even after the recent June 2016 storms (see Figure 2-1). The June 2016 event arrived from a more north easterly direction, and so caused

substantial damage to southern end of Stockton Beach. In general, the site does not presently appear to be greatly affected by ongoing recession due to the harbour breakwaters, unlike the southern part of Stockton Beach (see Section 2.1.4).

The dunes at Stockton Rifle Range vary considerably in height across the site. The foredune crest is typically 5 -6 m in height, but dune heights across the site may be as low as 1-2 m and as high as 20 m AHD. Dune vegetation is very patchy adjacent to the shoreline, then generally not absent, before becoming well established from around 500 m from the shoreline.

Figure 2-1 Beach appears accreted, historical recession not presently evident

2.1.3 History of Newcastle Harbour Construction

The history of construction of the breakwaters and dredging activities that have formed the Port of Newcastle entrance are as follows (Umwelt, 2002; DHI, 2006):

- Between 1812 and 1846, the Macquarie Pier was constructed between Newcastle mainland and Nobbys Island (now Nobbys Head);
- Dredging of the Newcastle Harbour entrance commenced in 1859, as the entrance was still hazardous for ships;
- In 1875 the extension of the southern breakwater from Nobbys commenced, and following several storms, was completed in 1891;
- Between 1898 and 1912, the northern breakwater was constructed, measuring nearly 1140 m;
- In 1961, depths across the harbour entrance were around -8 m. To enable safer passage, the harbour entrance was deepened to -11 m between 1962 and 1967;
- A further channel deepening project commenced between 1967 to 1976, to increase depths through the channel to -12.8 m;
- Channel deepening continued between 1977 and 1983 to further deepen the entrance in line with Port expansion activities that continue to the present; and

- At the present time, the navigation channel is maintained at a depth of -18 m, with dredged material typically placed at an offshore disposal site.

2.1.4 History of Recession and Remediation on Stockton Beach

Stockton Beach is known to have experienced ongoing recession, overlain on the natural periods of erosion and accretion. A number of studies have been undertaken over time, confirming that Stockton Beach is experiencing ongoing recession as a result of the cessation of littoral drift past the Newcastle Harbour Breakwaters into the beach. Previous detailed investigations include:

- *Newcastle Coastline Hazards Definition Study* (WBM, 2000)
- *Shifting Sands at Stockton Beach* (Umwelt, 2002);
- *Stockton Beach Coastal Processes Study* (DHI 2006); and
- *Stockton Beach Coastal Processes Study Addendum – Revised Coastal Erosion Hazard Lines 2011* (DHI, 2011).

Northerly littoral drift of up to 30,000 m^3/year has been impeded from passing the Hunter River entrance and supplying Stockton Beach by the construction of the southern then northern breakwaters. Littoral drift past the entrance breakwaters has not been able to re-establish because the Harbour channel is regularly dredged to a depth of 18 m, to allow for the passage of coal and other container ships. Fluvial sand supply from the Hunter River that may also have assisted to supply Stockton Beach has also ceased due to entrance dredging. The result has been ongoing recession of Stockton Beach, occurring as erosion and steepening of the surfzone, reduced beach width and progressive erosion into the back beach dunes and more recently, development.

Recession has previously threatened development in the central section of the beach along Mitchell Street as well as facilities such as the Stockton Beach Surf Life Saving Club (SLSC) house and pavilion, at the southern end of the beach (see Figure 2-2). Four treatment ponds were constructed in the late 1960's on HWC's Wastewater Treatment Works (adjacent to Fort Wallace). One pond has been lost to erosion and the next most seaward pond is now under threat.

In 1989 in response to the erosion threat, a substantial rock seawall was constructed between Pembroke Street and Stone Street to protect the adjacent section of Mitchell Street and residential properties (see Figure 2-3). A sandbag wall with a design life of 5 years was also constructed in November 1996 to provide interim protection for the Stockton SLSC. The sandbag wall was implemented as a short term solution, however, it is still present and functional some 20 years later today. In June 2011, the sandbag wall was extended at the base of the SLSC towards the north. The sandbag structure was recently exposed during storms in June 2016.

Stockton Beach – July 1999, looking south to SLSC, with clear evidence of recession

Stockton Beach – June 2011, looking south to SLSC, in relatively accreted state

Stockton Beach – July 2016, looking south to SLSC, with recession again evident following storms in June 2016.

Figure 2-2 Stockton Beach Key Area of Recession over time

Mitchell St Seawall – July 1999, with no sand in front of structure and severely affected beach access and amenity.

Mitchell St Seawall – June 2011, with sand naturally accreted onto structure, allowing beach access.

Mitchell St Seawall – July 2016, after recent storms is again eroded of sand, making beach access dangerous.

Figure 2-3 Stockton Beach Mitchell St Seawall and Recession over time

A dune system was formed between the northern breakwater and Pembroke Street, and north of the rock seawall to Meredith Street during the period 1988 to 1991. Severe erosion in the mid-1990s effectively removed these dune reconstruction works. In the late 1990s, a new dune system was constructed south from the SLSC and seaward of the Stockton Caravan Park. Between the SLSC and Mitchell St seawall, a dune system is absent and the general ground level is as low as 4.0m AHD in places (see Figure 2-2). This area was further eroded during the June 2016 storms.

Approximately 130,000 m^3 of sand was dredged from the Harbour entrance in August 2009 and placed off Stockton Beach. The placement event was generally agreed to be a success and represents the first documented nourishment event for Stockton Beach. Over recent years, some small volumes of suitable dredged material (~5,000 m^3 per episode) have been placed at Stockton Beach by the Port's maintenance dredger. While this is a valuable exercise, it has not fully replicated the lost regional sand supply of up to 30,000 m^3/year into Stockton Beach. As such, recession is expected to be ongoing.

2.2 Coastal Processes

The occurrence of coastal risks such as erosion and inundation occur due to the interaction of different coastal processes with the sediments and structure of a coastline, as described by its geology and geomorphology, outlined for Stockton Beach in Section 2.1.

Coastal drivers operating on coastlines such as Stockton Beach include:

- Waves
- Oceanic water levels
- Sea level rise

These drivers interact to generate:

- Cross-shore sediment transport,
- Longshore sediment transport, and
- Aeolian sediment transport within active dunes.

Depending on these interactions, coastal hazards such as erosion (short term, medium term, recession), wave overtopping and inundation, and sand drift may occur. A brief description of the coastal processes relevant to the hazard assessment of Stockton Beach is provided in Table 2-1.

Table 2-1 Summary of Coastal Processes Relevant to Stockton Beach

Coastal Process	Description	Measured parameter
Waves	**Significant Wave Height** Significant wave height (H_s) varies in response to the different wave generation sources that occur throughout the year, as well as larger scale climate cycles such as the El Nino Southern Oscillation. East coast low cyclones are known to generate the largest waves on the NSW coast.	Average H_s: 1.6 m 100 year Average Recurrence Interval (ARI) 6 hour duration H_s = 8.7 m (based on measured wave data from Sydney)
	Wave Direction Waves on the NSW coast are dominantly south east in origin. Wave direction occur in response to the different wave generation sources and their occurrence during the year, e.g. tropical cyclones occur to the north in summer; east coast low cyclones from May to July that can produce more northerly storms; and mid-latitude cyclones throughout the year that generate the predominant south easterly swell	Average Wave Direction: SE to S, with slight shift towards ESE in summer.
Water levels	**Astronomical Tide** NSW tides are micro-tidal (i.e. <2.0 m range) and semi diurnal (high and low occurs twice a day) with significant diurnal inequalities (the two high and two low tide levels are different in any one day).	Port of Newcastle Highest Astronomical Tide: 1.1 m AHD Lowest Astronomical Tide: -0.9 m AHD

Coastal Process	Description	Measured parameter
	Elevated water levels Elevated ocean water levels during storms occur due to a combination of: • Astronomical tide • Barometric pressure set up • Wind set up	100 year ARI ocean water level: 1.44 m AHD (DECCW, 2010)
	Wave Set Up Wave set up adds to the elevated water levels at the beach. Wave set up is generated by the breaking of waves, and increases to a maximum at the beach face. A typical measure of wave set up for hazard estimation is 15% of the offshore wave height. A 6 hour duration H_s is typically used, as this is likely to coincide with a high tide.	Wave set up: 1.3 m, (calculated as 15% of the100 year ARI 6 hr duration H_s of 8.7 m)
Sediment Transport	**Longshore Sediment Transport** Longshore sediment transport occurs when waves arrive obliquely to the shoreline, generating a current along shore. Depending on the wave direction, transport may be directed upcoast or downcoast. On the NSW coast, the net longshore sediment transport is northerly, due to the predominance of southeasterly waves. The volume of transport also tends to increase towards the north of NSW, as headlands are fewer (and so, there is less interruption of the sediment transport) and sand reserves greater.	Regional longshore sediment transport rate: up to 30,000 m^3/year (based on investigations by various authors including: WBM, 2000; Umwelt, 2002; DHI, 2006)
	Cross-shore sediment transport High waves during storms tend to generate offshore transport of sand eroded from the beach and nearshore. Rip currents are directed offshore, and contribute to beach erosion during storms. During calm conditions, lower waves tend to generate transport of sand back onshore, to help rebuild the beach.	N/A
	Aeolian (Windborne) Sediment transport Aeolian or windborne sediment transport originates from the dry sub-aerial upper beach face and berm and unvegetated incipient dunes and foredunes, supplying sediment to landward foredunes. Aeolian transport is the key builder of foredunes particularly where vegetation enables the windblown sediment to be captured and stabilised.	N/A
Sea Level Rise	**Sea level rise** Sea level rise is occurring at present, and the rate of rise is projected to increase in response to human-induced climate change.	Detailed discussion of sea level rise scenarios investigated for this report is given in Section 2.2.

2.3 Sea Level Rise

2.3.1 Sea Level Rise Measurements to Date

Global mean sea level rose about 1.6 mm/year on average during the 20th Century (CSIRO, 2016a). Since 1992, high quality measurements of sea level rise have been made by satellite altimeters. From 1992 to present, Global Mean Sea Level (GMSL) has risen at a rate of around 3.2 ± 0.4 mm/year (CSIRO, 2016b). The rate of sea level rise over the past 20 years is therefore about double that of the previous century. If the rate of sea level rise were to remain at its present level of 3.2 mm/year, sea level can be expected to be nearly 0.3 m higher than at present by 2100.

Projections for sea level rise of about 0.9 m by 2100 (above 1990 sea level), as given by CSIRO (2015) and IPCC (2014), are based on the rate of sea level rise more than doubling from its present rate of 3.2 mm/year. This is not unreasonable given that the rate of sea level rise has already doubled over the last 20 years. The current rate of rise is also tracking along the rate expected under the highest carbon emission scenario modelled by CSIRO (2015) and IPCC (2014).

2.3.2 Sea Level Rise Projections used in this Assessment

The CSIRO released new regional projections for Australia in 2015, which are the most relevant to this coastal hazard assessment. The CSIRO (2015) suggest a 'likely' range for sea level rise of 0.45 to 0.88m by 2090 for the highest emission scenario (along which sea level rise is currently tracking, see Section 2.3.1).

The 2015 CSIRO projections are almost identical to the former *NSW Sea Level Rise Policy Statement 2009* benchmarks of 0.4 m and 0.9 m rise above 1990 mean sea level by 2050 and 2100 respectively. These benchmarks were used by Newcastle City Council in deriving hazard estimates for Stockton Beach (as per the DHI (2011) study). The former benchmarks were based upon the latest reports by the IPCC (2007) and CSIRO (2007) available at that time. The recent IPCC report in 2014 also provides very similar projections to the 2007 IPCC report.

For this study three sea level rise scenarios were considered as shown in Table 2-2, representing:

- no further sea level rise occurs in the future;
- sea level rise remains at its current rate of ~ 3.2 mm/yr to the end of the century; and
- the rate of sea level rise increases as projected for the highest emission scenario by CSIRO (2015), and along which sea level rise has been tracking to date (i.e. the rate of rise doubles over the remainder of this century).

Because the projections from 2007 and 2014/2015 are so similar, the sea level rise scenarios applied are consistent with the projections used by DHI (2011) and Council.

It should be noted that small differences of 1 to 5 cm between exact projections are likely to make no appreciable difference in the position of a hazard line, or level of inundation, particularly at the scale of interest to this study.

Table 2-2 Sea Level Rise Projections used for this Assessment

Scenario	SLR Value Adopted	Rational and Reference
No SLR	**0.0 m**	A “no sea level rise” scenario provides a benchmark of coastal risk that is expected to occur regardless of the rate and impact of sea level rise.
SLR at current rate (~3.2 mm/year)	**0.4 m** (above 1990 levels)	This scenario represents current rate of sea level rise of 3.2 mm/year ± 0.4 mm (CSIRO 2016b) prevailing to the end of the century. However, this scenario also represents the lower value estimate given by CSIRO (2015) for the highest emission scenario, of 0.45m by 2090.
SLR at projected rate	**0.9 m** (above 1990 levels)	This scenario represents the upper value given by CSIRO (2015) for the highest emission scenario, of 0.88 m by 2090. As a demonstration of the similarities between previous and current scientific projections, this SLR value is also consistent with the benchmarks previously prescribed by the NSW Government for studies of this kind, including DHI (2011).

3 Coastal Hazard Assessment

3.1 General Provisions

Application of 2100 Timeframe for this Coastal Hazards Assessment

Given the proposed development at Stockton Rifle Range represents a new subdivision, it is typical for local councils (including Newcastle City Council) to apply a 100 year design life to such developments. Therefore, the risk to the subdivision from coastal hazards by 2100 has been investigated. The application of the 2100 hazard extent is particularly important given that Stockton is experiencing ongoing recession (not related to sea level rise).

Use of Existing Hazard Calculations

The coastal hazard definition given in this assessment has relied on existing information in the DHI (2006, 2011) reports because this is the information currently approved and being used by Newcastle City Council for coastal planning purposes.

3.2 Beach Erosion Hazard

3.2.1 Definitions

The following modes of erosion have been included in the definition of the 2100 erosion hazard for the Stockton Rifle Range site on Stockton Beach:

- **Short term erosion**, during a severe storm or storms in close succession (hours to days). Storms involve increased wave heights and ocean water levels (tide, barometric pressure set up, wind set up, wave set up) resulting in waves attacking the beach berm and dunes. The storm waves and water levels generate cross shore (offshore) and longshore sand transport simultaneously, resulting in erosion of the beach, berm and foredune. For example, storms on June 6, 2016 generated significant erosion of the beach and back beach area particularly at the southern end of Stockton Beach (see Figure 2-2).
- **Medium term erosion**, relating to 5-10 year cycles in the wave and water level climates, which are related to large scale climate cycles such as the El Nino Southern Oscillation. For example, there has recently been a shift from El Nino conditions (typically associated with lower storminess and a more dominant southerly wave direction) to La Nina conditions (typically associated with greater storminess and a slight shift in average wave direction towards the east/north). The direction of longshore sediment transport is directly related to the incoming wave direction, and so, slight shifts in wave direction over 5-10 year cycles can have a significant effect on longshore sediment transport direction and volume, and therefore, sand reserves within a beach system.
- **Long term recession**, (ongoing recession) being the long term, permanent loss of sediment from a beach system, resulting in an ongoing loss of beach and dune width. Stockton Beach has been experiencing recession over the last 100 years or so in relation to the construction of the Newcastle Harbour Breakwaters (commencing in the early 1800s to present, refer Section 3.2.2.2). Beaches such as Stockton that are experiencing long term recession are characterised

by a prominent back beach escarpment which moves landward over time after storm events, rather than recovering fully to the pre-storm position.

- **Future recession due to sea level rise**, where the beach and dune shift upward and landward in response to the rise in sea level. This is commonly represented by the Bruun Rule (Bruun, 1962), as in Figure 3-1 below. The coastline structure in terms of headlands, reefs and artificial structures such as breakwaters and seawalls will also control how recession due to sea level rise occurs, due to the structures' control on longshore sediment transport. While newer modelling techniques are available to assess recession due to sea level rise (e.g. Patterson, 2013, Cowell et al 1992, 1995), it remains accepted industry practise to apply the Bruun Rule (1962) to determine the extent of recession due to sea level rise.

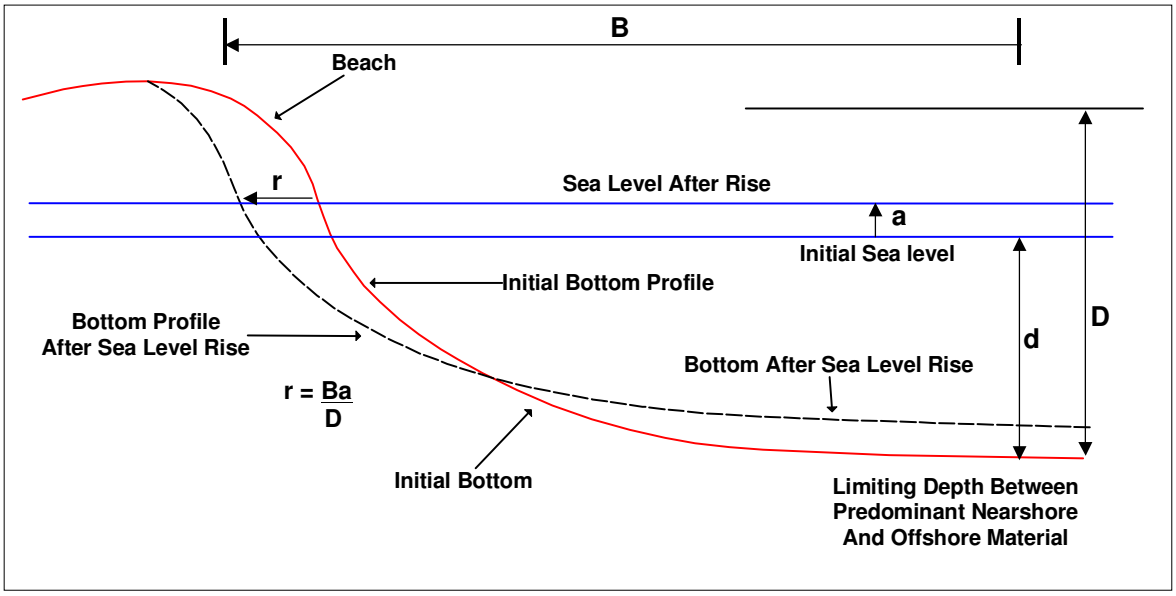


Figure 3-1 Bruun (1962) Concept of Recession due to Sea Level Rise

3.2.2 Calculations

3.2.2.1 Short and Medium Term Erosion

Potential short term erosion for Stockton Beach was analysed by DHI (2006) using a dune erosion model and application of storm conditions from May & June 1974, as well as June 1999 that arrived from the east to east-south-east and so more directly impacted the southern end of Stockton Beach. While the design storm approach can be problematic, Stockton Beach is experiencing long term recession and therefore it is difficult to separate short term events from the long term recession signal in beach survey and photogrammetric data. The maximum erosion estimates adopted by DHI (2006) ranged from 5 m at Stockton Tourist Park to 17 m at Meredith Street, 22 m at Fort Wallace and 24.5 m at the LGA Boundary, as in Table 3-1. The increase in the extent of storm erosion towards the north reflects the increased exposure of the beach to the pre-dominant south easterly waves experienced on the NSW coast.

Using the photogrammetric data, DHI (2006) also estimated erosion relating to medium term wave climate variability, such as enhanced storminess or more easterly wave direction over a sustained

period. DHI (2006) provided a best estimate for medium term erosion of 18 m north of the Mitchell St seawall, which is applicable to the study site, as given in Table 3-1.

Table 3-1 Short and Medium Term Erosion Estimates (adapted from DHI, 2006)

Location	Short term erosion[1]	Medium term erosion
Fort Wallace	22	18
Stockton Centre	24	18
Newcastle/Port Stephens LGA Boundary (Stockton Rifle Range)	25	18

[1] *Erosion has been rounded to the nearest metre, to reflect the uncertainty in erosion estimates (refer Section 3.2.4 also).*

3.2.2.2 Long term Recession

It is well documented that Stockton Beach is experience ongoing recession due to the Newcastle Harbour entrance breakwaters (e.g. WBM, 2000, Umwelt 2002, DHI 2006). The breakwaters have cut off the supply of sediment from the southern beaches across the river mouth and into Stockton Beach. The erosion of beaches updrift of river entrance training walls is a well known phenomenon on the NSW coast (e.g. has occurred at Coffs Harbour, Richmond River, Tweed River and others).

Unlike most other places on the NSW coast, the Hunter River entrance and Stockton beach system has not been able to adjust to the construction of the Harbour Breakwaters. Bypassing of the southern breakwater is very likely to be occurring, however, the marine sand is removed by dredging to retain the entrance depth at 18 m to facilitate the passage of coal ships into the Port of Newcastle. Any sediment that in not dredged remains in water depths at or greater than 18 m, which is too deep for significant wave driven currents to form to transport the sediment back onto Stockton Beach (DHI, 2006). Therefore, the loss of up to 30,000 m^3/year of sand into Stockton Beach is, and will continue to be, ongoing.

The pattern of recession varies along Stockton Beach. The northern breakwater acts to shadow the southern end of Stockton Beach from south easterly swells, and a complex pattern of sediment transport is generated towards the south and then captured against the northern breakwater (DHI, 2006). Both the WBM (2000) and Umwelt (2002) studies also identified a slight accretionary trend at the southern end of Stockton Beach. North of this, the recession starts at low rates increasing to its peak of 1.3 m/year loss at the former Sewage Treatment Ponds, before reducing again to around 0.8 m/year loss at Fort Wallace and extending to the LGA Boundary at Stockton Rifle Range (DHI, 2006).

DHI (2006, 2011) used model results to determine best estimates of shoreline retreat along Stockton Beach, which are reproduced for the study site in Table 3-2. These rates were found to be in good agreement with historical recession rates of 1 to 1.3 m/year along the beach (DHI, 2006).

Periodically, dredged marine sand from the Harbour entrance is placed on Stockton Beach (around 5,000 m^3 per episode, once or twice a year). However, this is insufficient to fully replace the yearly loss to the beach. As such, the recession rates provided by DHI (2006, 2011) have been applied for this assessment.

Table 3-2 Ongoing Recession Rate at Stockton Beach from DHI (2011)

Location	Recession (m/year)
Fort Wallace / Stockton Centre	-0.8
Newcastle/Port Stephens LGA Boundary (Stockton Rifle Range)	-0.8

3.2.2.3 Future Recession due to Sea Level Rise

DHI (2011) calculated recession due to sea level rise using the standard Bruun Rule (1962). Long sandy shorelines such as the central portion of Stockton Beach, can reasonably be expected to respond in the uniform, two-dimensional manner described by Bruun (1962), because headlands and reefs are not present and so, sea level rise cannot reduce longshore sediment transport past these structures. However, the southern portion of Stockton Beach is also expected to behave in accordance with the Bruun Rule (1962). The longshore supply into the southern end of Stockton Beach has already been interrupted by the harbour breakwaters (and without recovery due to the ongoing dredging). Sea level rise cannot further reduce longshore transport past the harbour breakwaters. In this case, assessment of recession due to sea level rise with the Bruun Rule (1962) is suitable at Stockton Beach.

DHI (2011) estimated 28 m recession due to a sea level rise of 0.4 m (above 1990 levels) and 68 m for a sea level rise of 0.9 m, as given in Table 3-3 below.

Table 3-3 Future Recession Due to Sea Level Rise (from DHI, 2011)

Sea level rise (above 1990 level)	Recession
0.4 m	28 m
0.9 m	68 m

3.2.3 Potential Impacts

In order to understand the profile of risk to the Stockton Rifle Range site, three scenarios for the erosion hazard by 2100 were investigated, as follows:

- 'Almost certain' erosion by 2100, comprising the addition of short term erosion, medium term erosion, ongoing recession, but no recession due to sea level rise (i.e. a 0.0 m sea level rise was adopted, see Section 2.3.2);
- 'Likely' erosion by 2100, being the addition of short term erosion, medium term erosion, ongoing recession, and recession due to sea level rise of 0.4 m (equivalent to the current rate of sea level rise, see Section 2.3.2) ; and
- 'Unlikely' erosion by 2100 being the addition of short and medium term erosion, ongoing recession, and future recession due to sea level rise of 0.9 m by 2100 (equivalent to highest emission scenario along which we are tracking, see Section 2.3.2).

The 'unlikely' scenario represents the conservative hazard estimate that is typically used for planning purposes in NSW. The combination of calculations into the probable erosion extents described above is provided in Table 3-4. The definition of the erosion hazard scenarios in terms of 'likelihood' or a descriptive probability has been used by BMT WBM in numerous other coastal hazard assessments (for example, see BMT WBM, 2015), and is provided in Table 3-5 below.

The erosion hazard scenarios for 2100 have been mapped for the Stockton Rifle Range planning proposal zoning (and indicative masterplan layout) in Figure 3-2.

From Figure 3-2, it is evident that the Stockton Rifle Range footprint is at least 200 m from the 2100 'unlikely' coastal erosion hazard line, with habitable buildings within the residential zones even further landward, at least 350 m from this hazard line.

The coastal erosion risk to the proposed rezoning of the Stockton Rifle Range site (as per the Planning Proposal) is considered to be extremely low. No further mitigation of this risk is required.

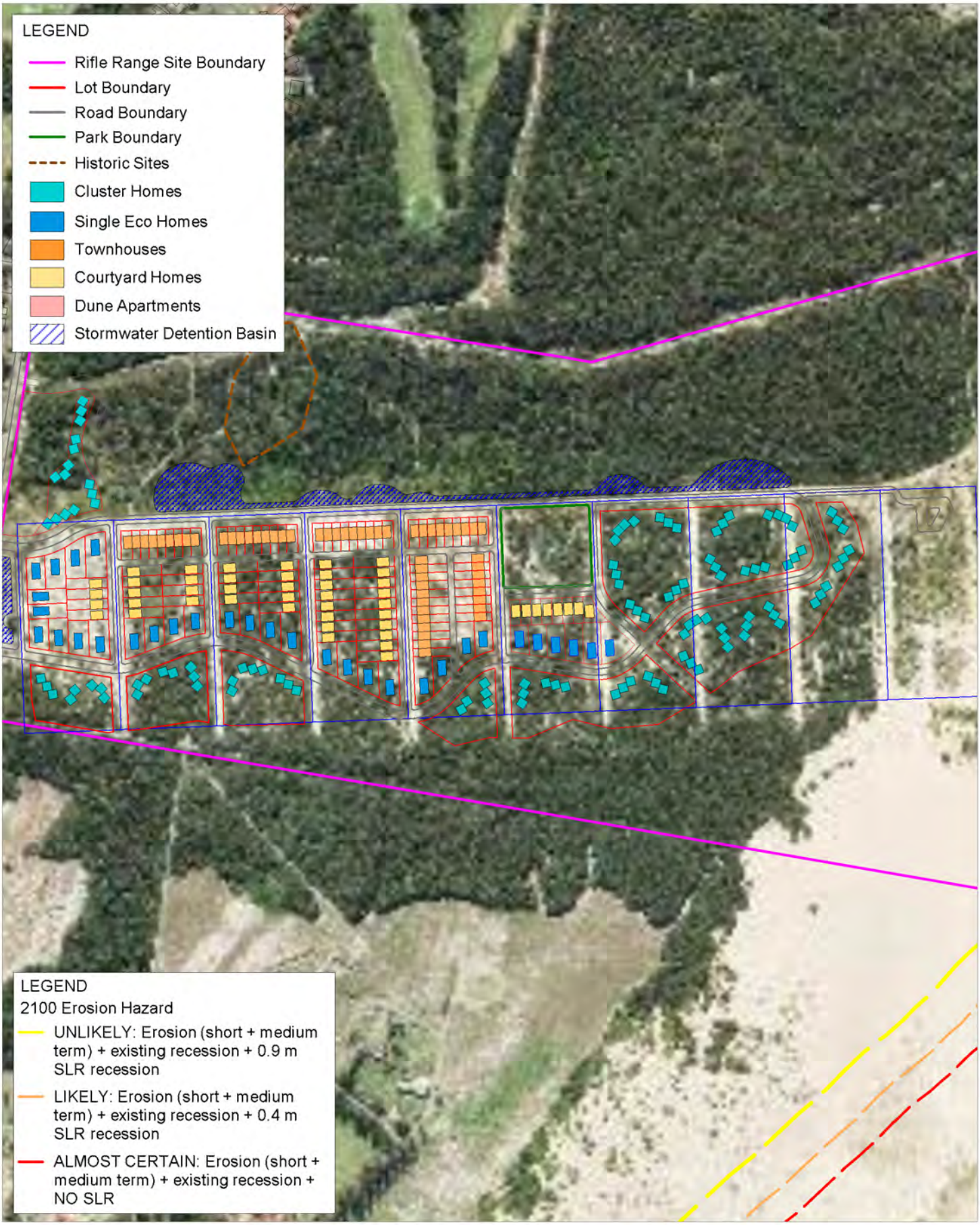
Table 3-4 2100 Erosion Hazard for the Stockton Rifle Range Site

Erosion Likelihood for 2100	Erosion modes included	Calculations[1] for 2100	Total recession distance (fr. 4m AHD beach contour)
Almost Certain	Short term erosion Medium term erosion Ongoing recession NO recession due to sea level rise	25 m 18 m 0.8 m/yr 0 m	115 m
Likely	Short term erosion Medium term erosion Ongoing recession Recession due to 0.4 m sea level rise	25 m 18 m 0.8 m/yr 28 m	143 m
Unlikely	Short term erosion Medium term erosion Ongoing recession Recession due to 0.9 m sea level rise	25 m 18 m 0.8 m/yr 68 m	183 m

1 All calculations sourced from DHI (2006), except recession due to sea level rise sourced from DHI (2011).

Table 3-5 Risk Likelihood for Coastal Hazards (100 year timeframe)

Likelihood	Description
Almost Certain	There is a high possibility the event will occur as there is a history of frequent occurrence
Likely	It is likely the event will occur as there is a history of casual occurrence
Unlikely	There is a low possibility that the event will occur, however, there is a history of infrequent and isolated occurrence



Title:

2100 Erosion Hazards for the Stockton Rifle Range Masterplan

Figure: 3-2

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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Approx. Scale

BMT WBM

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3.2.4 Uncertainties in Erosion Hazard estimates

Uncertainty in defining coastal erosion hazards particularly over long timeframes (50 years +) is an inherent feature of all coastal assessments. Uncertainty in coastal hazard estimation arises due to:

- the complexity of the coastal system, and limitations of our understanding of the interactions within this complex system;
- due to this complexity, the requirement for assumptions when replicating the coastal system via modelling or other techniques,
- the uncertainties associated with climate change, particularly the rate and extent of sea level rise over long timeframes; and
- the uncertainties of how the coastal system will respond to sea level rise, particularly as this will be combined with existing recession at Stockton Beach.

With such uncertainties in mind, three scenarios for the occurrence of coastal erosion to the 2100 timeframe were investigated (being 'almost certain', 'likely' and 'unlikely', as noted above), to provide more transparency regarding how erosion estimates are derived and combined.

The key areas of uncertainty in the erosion hazard estimate relating to Stockton Beach are listed then explained below:

- the extent of ongoing recession;
- the response of the shoreline to sea level rise, and
- the potential for mitigation measures such as beach nourishment being implemented on Stockton Beach before 2100 (e.g. by State/Local government to manage the existing risks downdrift of Stockton Rifle Range).

It could be argued that the rate of ongoing recession occurring at the Stockton Rifle Range site is overestimated. The current state of the beach and dunes at the Stockton Rifle Range site are stable to accreted, and is not typical for a receding beach. By comparison, the southern end of Stockton Beach did experience a period of relative accretion as shown in Figure 2-2, however the dunes and beach were not as accreted as is currently evident at Stockton Rifle Range.

The height and width of the sand dunes on the Stockton Rifle Range site actually represent a substantial store of sand. When the beach recedes into these dunes, the sand will be liberated and can supply the coastal system. The existing substantial stores of sand in the dunes in front of the proposed subdivision may assist to reduce the rate of future recession, but have not been taken into account when deriving the erosion hazard estimates. Modelling techniques available to determine future recession either due to historical influences (as in DHI, 2006); or due to sea level rise with the Bruun Rule (as calculated by DHI, 2011), are not currently able to include such sand reserves in their calculation.

The Bruun Rule (1962) that was used to estimate recession due to sea level rise is known to have significant limitations (for example, refer Ranasinghe *et al*, 2007). Any one of these limitations may present an error in the sea level rise recession extent used in this coastal hazard assessment. For example, recession calculated with the Bruun Rule (1962) is entirely dependent upon the offshore

slope applied. If the bathymetric data is of poor quality or is analysed differently, then a difference in the calculated extent of recession could occur. While the NSW Government has supplied guidance on this matter, selecting the distance/depth offshore from which to measure this slope (called the depth of closure), is an ongoing source of argument and discussion within the coastal science community.

Lastly, Stockton Beach has been subject to many and ongoing investigations by the state and local government regarding methods to ameliorate the existing recession issue. The most recent such study was the Stockton Beach Sand Scoping and Funding Feasibility Study (WorleyParsons, 2011). The WorleyParsons (2011) report identified suitable sediment sources for use as beach nourishment on Stockton Beach. The report recommended: episodic trucking of sand from further north on Stockton Beach to the southern areas affected by recession; continued episodic use of dredged marine sand from Newcastle Harbour on the beach; lobbying of developments within the Port of Newcastle to access marine sand reserves that are liberated during site works; and, while it is currently not politically viable, the dredging and use of sand from offshore (i.e. > 30-40 m water depth) remains a technically and financially viable option.

Given the feasibility of beach nourishment activities described above, it is very possible that both small and large scale nourishment programs may commence on Stockton Beach well before the 2100 timeframe for coastal risks for which this development has been designed for. Such programs will invariably reduce the potential for erosion impacts to the Stockton Rifle Range site.

3.3 Dune Stability and Reduced Foundation Capacity Hazard

3.3.1 Definition

Immediately following a storm erosion event, a near vertical erosion escarpment of substantial height can be left in the dune or beach ridge. At some time after the erosion event, the escarpment may slump, and the slope may adjust to a more stable angle. This slumping may occur suddenly, and poses a risk to structures located immediately behind the dune escarpment.

The schema of Nielsen *et al.* (1992) is the accepted method for determining the zone behind a dune escarpment that remains unstable, as follows (see Figure 3-3):

- *Zone of Slope Adjustment:* the area landward of the vertical erosion escarpment crest that may be expected to collapse after the storm event; and
- *Zone of Reduced Foundation Capacity:* the area landward of the zone of slope adjustment that is unstable being in proximity to the storm erosion and dune slumping.

As shown in Figure 3-3, these zones are shaped as a wedge, and so, stable foundation can be reached below the zones. Developments in the immediate vicinity of beaches with the potential to be affected by the zone of reduced foundation capacity may require foundation piles that penetrate to the stable foundation zone (see Figure 3-4).

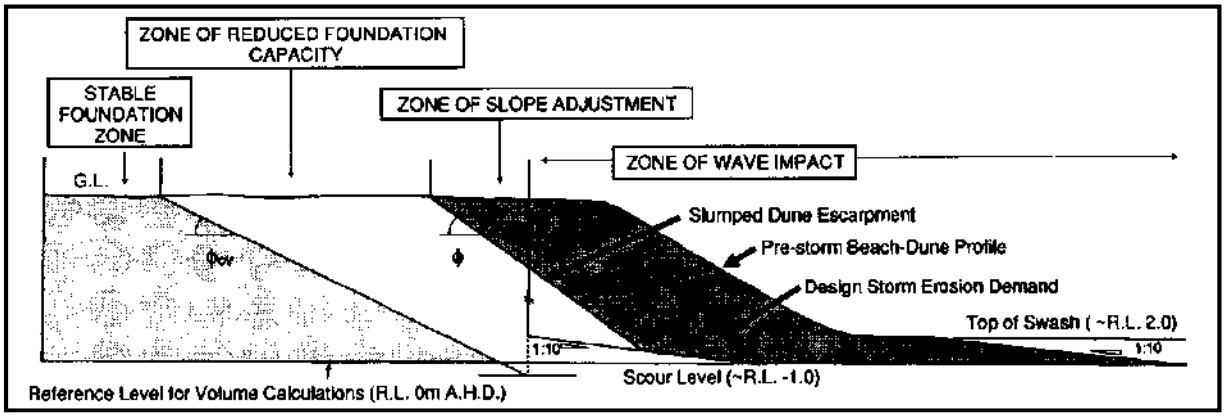

Figure 3-3 Zones of instability after Storm Erosion (From Nielsen *et al.*, (1992)

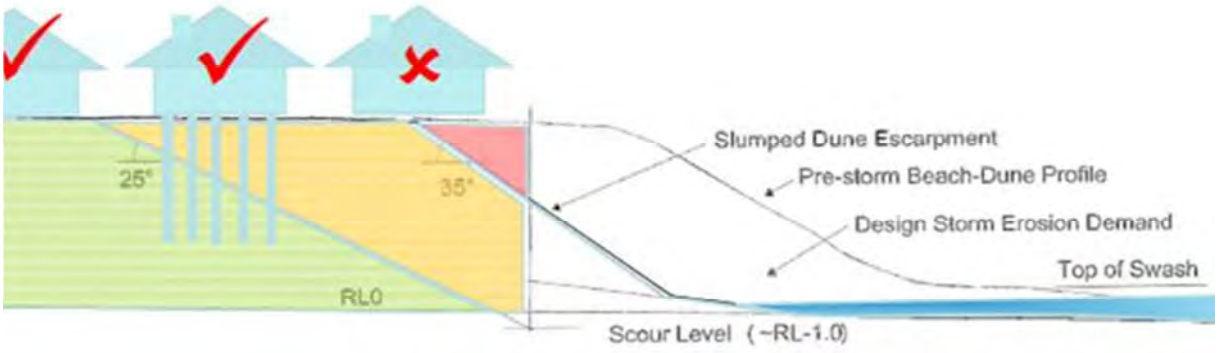

Figure 3-4 Using Foundation Piles to access the Stable Foundation Zone

3.3.2 Calculation

For the purpose of applying the Nielsen *et al.* (1992) schema to beach-scale assessments, it is accepted to assume that the entire dunal system comprises homogeneous sand, which allows an angle of repose of 35° to be applied in the calculation. This is very likely to be a suitable assumption for Stockton Beach given the long geologic history of sand accumulation in Stockton Bight. However, expert geotechnical engineering assessment is required to properly establish the zone and foundation requirements on an individual development basis.

The width of the zone of reduced foundation capacity is also directly dependent upon the height of the dunes. This is problematic where calculations must be made for the presumed position of the erosion escarpment in 2100. The present day height of dunes/land in the region of the 2100 erosion hazard may not accurately represent the actual height of the dunes by that time. Activities including development for residential purposes, community uses, and even dune rehabilitation may lower or heighten the dunes over time.

To provide an indication of the potential zone of reduced foundation capacity behind the 2100 erosion hazard zones, the existing topographic information for dune height has had to be used. Table 3-6 provides the average, maximum and minimum height of dunes along each of the erosion

hazard lines fronting the masterplan lot boundary. These dune values have been used to calculate the average and range for the zone of slope adjustment plus zone of reduced foundation capacity that may exist landward of the erosion hazard lines.

The zone of reduced foundation capacity has not been mapped, because, in addition to these zones being based on present day, not future dune heights, the dunes themselves vary considerably in height.

The assessment of risk has considered the distance of proposed buildings in the masterplan layout from the erosion hazard lines, to determine where properties may potentially be at risk of dune instability, should erosion progress to the estimated level by 2100.

Table 3-6 Indicative Zone of Reduced Foundation Capacity Landward of Erosion Hazard Scenarios

Erosion Scenario		Dune Height (m AHD)[1]	Zone of Slope Adjustment [2]	Zone of Reduced Foundation Capacity [2]	Total for both zones [3]
'Almost certain' erosion hazard	Average	3.5	1.1	8.6	10
	Maximum	6	2.9	12.1	15
	Minimum	2	0.0	6.4	6
'Likely' erosion hazard	Average	3	0.7	7.9	9
	Maximum	7.5	3.9	14.3	18
	Minimum	1.5	-0.4	5.7	5
'Unlikely' erosion hazard	Average	3	0.7	7.9	9
	Maximum	9.5	5.4	17.1	23
	Minimum	1.5	-0.4	5.7	5

1 Calculation assumes that surface of dunal system is approximately level (see Figure 3-3).
2 Calculated as per Nielsen et al 1992, in Figure 3-3.
3 Values rounded to nearest m, to reflect uncertainty and assumptions that affect accuracy of calculation.

3.3.3 Potential Impacts

The zone of reduced foundation capacity that may be present by 2100 has not been mapped, to avoid presenting a false certainty to these calculations that are derived for a somewhat unknown future scenario.

At most, the zone of slope adjustment and reduced foundation capacity behind 2100 'unlikely' erosion hazard scenario may extend to 23 m (see Table 3-6). Even at this maximum width, it is not expected that reduced foundation capacity hazards will affected the proposed development, which lies at least 200 m from the 'unlikely' erosion hazard line.

3.4 Wave Overtopping

3.4.1 Definition

The coastal inundation hazard comprises:

- Elevated ocean water levels, comprising the addition of astronomical tide, barometric pressure set up, wind set up, and wave set up at the shoreline, which may inundate rivers, creeks, lagoons etc. hydraulically connected to the ocean; and
- Wave run up and overtopping of the shoreline, where waves overwash coastal barriers such as dunes and seawalls.

Wave overtopping is the inundation hazard of interest to this assessment, to determine the potential for the overtopping of frontal dunes during storms. The actual height of wave run up does not present a hazard unless the run-up is overtopping coastal barriers at a rate or volume that would cause a significant impact to pedestrians or land and assets behind.

There are no hydraulic connections to the ocean whereby oceanic waters may penetrate to inundate low lying areas on the Stockton Rifle Range site, and so coastal inundation from elevated ocean water levels alone (and which are lower than the wave run up level) were not considered further.

Sea level rise will contribute to elevated ocean water levels and wave run up in the future, and is therefore included in the wave overtopping assessment for 2100.

3.4.2 Calculations

For a coastal protection structure, including a natural dune barrier, wave run-up and subsequent overtopping depends, amongst other things, on:

- hydraulic parameters such as: ocean water level, wave height, wave period, wave direction, water depth; and
- structural parameters such as: the seawall roughness and porosity (random rock armour or smooth concrete surface); slope (sloping, composite, vertical, stepped); and crest levels. Dune sand barriers are considered equivalent to smooth concrete surfaces.

Run-up on a Sandy Beach

The 2% run-up level ($R_{2\%}$) has been derived based on the findings of Nielsen and Hanslow (1991), who indicate:

$$R_{2\%} = 0.58 \times \tan\beta \times \sqrt{H_{0_{RMS}} \times L_{0_{TZ}}} \times \sqrt{ln(50)}$$

Where
β = slope of the beach face (assumed to be 0.10);
$H_{0_{RMS}}$ = deepwater RMS wave height $\approx H_s/\sqrt{2}$;
$L_{0_{TZ}}$ = deepwater wavelength corresponding to zero crossing wave period;
x = exceedence level

The run-up level derived from the above equation is added to the still water level (i.e. the addition of tide, water level anomaly caused by barometric pressure set up and wind set up, plus wave set up), plus sea level rise for 2100 of 0.0 m (almost certain); 0.4 m (likely); and 0.9 m (unlikely).

Wave run up levels for the 2100 are listed in Table 3-7.

Table 3-7 2100 Wave Run Up Hazard, Stockton Beach

Stockton Beach	2100 Wave Run Up Hazard
Almost Certain (no SLR)	5.4 m
Likely (0.4 m SLR)	5.8 m
Unlikely (0.9 m)	6.3 m

Overtopping Rate for a Rock Armoured or Stepped Slope

The present standard for engineering calculation of wave overtopping of various structures is provided by *EurOtop Wave Overtopping of Sea Defences and Related Structures: Assessment Manual* (Pullen *et al,.* 2007) ('the Eurotop Manual').

The mean overtopping discharge is calculated from the relationship provided in Chapter 6 of the Eurotop manual (Pullen *et al.*, 2007).

$$\frac{q}{\sqrt{g \times H_{m0}^3}} = 0.2 \times e^{-2.3 \times \frac{R_c}{H_{m0} \times \gamma_f \times \gamma_\beta}}$$

Where

$q =$ mean overtopping discharge rate (l/s);

$H_{m0} =$ Depth limited spectral significant wave height (m)

$R_c =$ distance of freeboard crest above still water level (m);

$\gamma_f =$ factor for effect of roughness elements (set to 0.60);

$\gamma_\beta =$ factor for effect of roughness elements (set to 1.00, assuming orthogonal wave approach)

The following values were applied in these equations:

- 100 year ARI 6 hour duration wave height (Hs) of 8.7 m;
- 100 year ARI elevated ocean water level of 1.44 m AHD;
- Dune crest height, as measured along the position of the 2100 erosion hazard scenarios (as per Section 3.3.2 also);
- Wave set up calculated from spectral wave modelling (SWAN) at Stockton Beach (using model results from other studies completed by BMT WBM in the Newcastle region, i.e. BMT WBM 2014); and
- Sea level rise of 0.0 m (almost certain); 0.4 m (likely); and 0.9 m (unlikely);

- A nearshore slope out to the 20 m depth contour calculated as -0.008, used in the transformation of waves from offshore to shore.
- The depth limited spectral significant wave height (H_{mo}), which describes the transformation of waves through the breaker zone, was calculated using a graphical method utilising charts derived from the findings of Van der Meer (1990), as recommended in the Eurotop manual; and
- Roughness elements of 1, as natural dune barriers are assumed to behave like smooth concrete for the purpose of the wave overtopping calculation.

Table 3-8 Potential Overtopping Rates for the 2100 Hazard Scenarios

Erosion Scenario	Dune Height	Dune Height	Wave Run Up	Overtopping Rate (l/m/s)
'Almost certain' erosion hazard	Average	3.5	5.4 m	147.0
	Maximum	6		0.0
	Minimum	2		936.3
'Likely' erosion hazard	Average[4]	3	5.8 m	532.8
	Maximum	7.5		0.0
	Minimum	1.5		2,861.3
'Unlikely' erosion hazard	Average	3	6.3 m	1,190.2
	Maximum	9.5		0.0
	Minimum	1.5		5,268.8

Table 3-9 Average wave overtopping volume limits resulting in damage (Eurotop, 2007)

At Risk	Average permissible overtopping (l/s/m)
Pedestrian[1]	0.10 to 10
Motor vehicles[2]	0.01 to 50
Damage to paving (landward of the crest)	200
Damage to grasses/turf (landward of the crest)	50
Seawall structure (crest)[3]	200
Buildings and assets[4]	1

Notes:
[1] Assumes that pedestrians have a clear view of the sea and able to tolerate getting wet through to trained staff expecting to get wet. All limits assume non violent, low velocity overtopping.
[2] Lower limits apply to high speed vehicles while upper limits apply to low speed vehicles, pulsating flows at low depths.
[3] Limit for no damage to a well protected crest
[4] Limit for damage, discharge measured at the building or asset

3.4.3 Potential Impacts

The average dune heights currently present along each of the 2100 erosion hazard lines are of sufficient height to protect the proposed development from wave overtopping. For the minimum dune height measured along the 'likely' and 'unlikely' hazard lines, there is potential for wave overtopping, should the dunes be eroded to these hazard lines in the future.

Wave overtopping rates in Table 3-8 have been compared to the guideline overtopping rates given in the Eurotop Manual in Table 3-9. For the minimum dune heights, wave overtopping rates may potentially damage structures and pose a risk to pedestrians or vehicles, should they be located on or immediately adjacent to the dune crest at the time that such overtopping occurs. Given the site is dominantly composed of sand, it can be expected that wave overtopping will be quickly absorbed into the porous sand, rather than continue to flow further landward to create an inundation issue on the site.

Based on the above, and the limited extent of low-lying dunes, the potential for overtopping to cause adverse impact to the proposed development is considered very low. Furthermore, continued maintenance of dune heights at or above 6 m AHD over time, which can generally be achieved through maintenance of appropriate vegetation, will adequately mitigate the potential for overtopping during extreme storm conditions in future.

3.5 Sand Drift

Windborne or Aeolian sediment transport allows the transfer of sand from the sub-aerial beach into the dunes behind. This sand drift is a natural phenomenon, however it can pose a hazard where coastal developments are being overwhelmed by windborne sediment, or significant volumes of sediment are being lost from the active beach system. For example, windblown sand can bury roads, stormwater drains and property located immediately behind an active or poorly vegetated dune system. Sand drift posing a hazard can be initiated by the degeneration or destruction of dune vegetation.

Dune vegetation plays an important role in minimising the detrimental effects of sand drift by acting to trap windblown sand, helping to build up the dune and keep the sand within the active beach system. In fact, the adequate maintenance of dune vegetation also assists to ameliorate other coastal hazards. Dune systems act as reservoirs to supply sand to the active beach during periods of erosion. If sand is lost inland through windborne transport, the volume of sand available to supply the erosion demand is less and therefore the erosion extent will be greater. Similarly, properly functioning dunal vegetation complexes also assist to ameliorate coastal inundation, as the capture of windblown sand helps to build dunes to greater heights, reducing the potential for wave overtopping.

Windborne transport of sand can be an important component of the coastal sediment transport system. This is particularly the case on the Stockton Rifle Range site, which contains a substantial area of active (naturally unvegetated) dune. The Stockton Bight beach system extends some 32 kilometres to the north east. Aeolian processes are significant within this highly active and vast transgressive dune system. The lack of dune vegetation within this dunal system is highly important for allowing the transgression of sand along Stockton Beach towards Birubi Point and beyond. In this case, a significant portion of the natural northerly sand transport is via the land-based portion

of the coastal system. As such, it is vital that this vast active system is and should remain naturally unvegetated.

For the Stockton Rifle Range site, it is important that managing potential sand drift into the proposed development is balanced with retaining the natural values of the site. It is highly important that dune remediation be limited to areas with existing dune vegetation, and be avoided (and restricted from) on the active, unvegetated dune regions. If the entire site were to be revegetated, this may cause erosion impacts on and updrift of the site, as the natural transport of sand by wind is impeded.

4 Risk Mitigation

4.1 Summary of Potential Coastal Risks by 2100

Based upon the coastal hazard assessment detailed in Chapter 3, the key risk identified for the Stockton Rifle Range site is managing sand drift while maintaining the active, unvegetated region of dunes on the site.

Development allowed by the planning proposal as shown in the Master Plan (see Figure 3-2) is not expected to be affected by coastal erosion, wave overtopping or reduced foundation capacity by 2100. No further mitigation of these risks is required.

4.2 Risk Mitigation Measures

4.2.1 Dune Rehabilitation and Maintenance

The natural occurrence of Aeolian transport within the substantial area of active dunes on the Stockton Rifle Range site is an important element of the entire Stockton Bight coastal system.

Windborne sand transport may however pose a risk to development, such as proposed on the Stockton Rifle Range site.

In order to mitigate the potential for sand ingress into the proposed development, and maintain the active Aeolian sand transport system on the site, it is recommended that dune rehabilitation is limited to the area of existing (but in areas patchy) dune vegetation immediately adjacent (seaward) on the Stockton Rifle Range site. Extending dune revegetation activities seaward of this should be avoided, and careful maintenance of dune vegetation within this boundary is required. Provided that the full hierarchy of dune vegetation structure (i.e. a hierarchy of vegetation types and heights from primary species to secondary species then tertiary species that includes small trees) is used within this footprint, sand drift issues shall be effectively managed.

5 References

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BMT WBM Bangalow
6/20 Byron Street, Bangalow 2479
Tel +61 2 6687 0466 Fax +61 2 66870422
Email bmtwbm@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Brisbane
Level 8, 200 Creek Street, Brisbane 4000
PO Box 203, Spring Hill QLD 4004
Tel +61 7 3831 6744 Fax +61 7 3832 3627
Email bmtwbm@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Denver
8200 S. Akron Street, #B120
Centennial, Denver Colorado 80112 USA
Tel +1 303 792 9814 Fax +1 303 792 9742
Email denver@bmtwbm.com
Web www.bmtwbm.com

BMT WBM London
International House, 1st Floor
St Katharine's Way, London E1W 1AY
Email london@bmtwbm.co.uk
Web www.bmtwbm.com

BMT WBM Mackay
PO Box 4447, Mackay QLD 4740
Tel +61 7 4953 5144 Fax +61 7 4953 5132
Email mackay@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Melbourne
Level 5, 99 King Street, Melbourne 3000
PO Box 604, Collins Street West VIC 8007
Tel +61 3 8620 6100 Fax +61 3 8620 6105
Email melbourne@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Newcastle
126 Belford Street, Broadmeadow 2292
PO Box 266, Broadmeadow NSW 2292
Tel +61 2 4940 8882 Fax +61 2 4940 8887
Email newcastle@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Perth
Level 3, 20 Parkland Road, Osborne, WA 6017
PO Box 1027, Innaloo WA 6918
Tel +61 8 9328 2029 Fax +61 8 9486 7588
Email perth@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Sydney
Suite G2, 13-15 Smail Street, Ultimo, Sydney 2007
Tel +61 2 8960 7755 Fax +61 2 8960 7745
Email sydney@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Vancouver
Suite 401, 611 Alexander Street
Vancouver British Columbia V6A 1E1 Canada
Tel +1 604 683 5777 Fax +1 604 608 3232
Email vancouver@bmtwbm.com
Web www.bmtwbm.com

NSW Site Auditor Scheme
SITE AUDIT STATEMENT

A site audit statement summarises the findings of a site audit. For full details of the site auditor's findings, evaluations and conclusions, refer to the associated site audit report.

This form was approved under the* Contaminated Land Management Act 1997 *on 26 March 2009. For more information about completing this form, go to Part IV.

PART I: Site audit identification

Site audit statement no. 150B ……

This site audit is a ~~**statutory audit**~~**/non-statutory audit*** within the meaning of the *Contaminated Land Management Act 1997*.

Site auditor details (as accredited under the *Contaminated Land Management Act 1997*)

Name **Dr Ian C Swane** …….. Company **Sinclair Knight Merz** …….

Address **100 Christie Street, St Leonards NSW** ……..

…… Postcode **2065** …...

Phone **02 9928 2126** …….. Fax **02 9928 2224** ……

Site details

Address **Stockton Rifle Range, Popplewell Road, Fern Bay, NSW** ……

…… Postcode **2295** …...

Property description *(attach a list if several properties are included in the site audit)*

Lot 5 DP 233358 at Fern Bay (Certificate of Title attached – Figure 1) ……

Local Government Area **Port Stephens Council** ……..

Area of site (e.g. hectares) **111 ha** ……

Current zoning **Zone 7(a) Environmental Protection** ……..

To the best of my knowledge, the site ~~**is**~~**/is not*** the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

~~**Declaration/Order/Agreement/Proposal/Notice* no(s)** ……~~..

Site audit commissioned by

Name **Ms Vicki Pearce** …….. Company **Australian Government, Department of Defence** ……

Address **Property Disposal Unit, BP3-2-A024, Brindabella Park, Canberra ACT** …….

……. Postcode **1225** …...

Phone **(02) 6266 8024** …….. Fax **(02) 6266 8276** ……

Name and phone number of contact person (if different from above)

……

Purpose of site audit

☑ A. To determine land use suitability *(please specify intended use[s])*

For the purpose of this audit, Defence has divided the Site into two types of areas referred to as *"unrestricted landuse"* and *"non-development landuse"*[1]. The *"unrestricted landuse"* category refers to those areas where the most sensitive landuse would be *"standard"* residential (HIL A). The *"non-development landuse"* includes heritage or ecologically constrained areas where the most sensitive landuse would be open space/parkland (HIL E). A plan showing the location of these two area types across the site is provided in Figure 2 (attached).

~~**OR**~~

~~☐ B(i) To determine the nature and extent of contamination, and/or~~

~~☐ B(ii) To determine the appropriateness of an **investigation/remedial action/management plan***, and/or~~

~~☐ B(iii) To determine if the land can be made suitable for a particular use or uses by implementation of a specified **remedial action plan/management plan*** *(please specify intended use[s])*~~

~~……~~

Information sources for site audit

Consultancy(ies) which conducted the site investigation(s) and/or remediation

GHD, SMEC, Milsearch, GETEX, Alpha Geoscience & Gibson Nominees ……

[1] SMEC email 22 July 2008

Title(s) of report(s) reviewed

1. GHD. September 2003. *"Preliminary Contamination Site Investigation, Former Stockton Rifle Range, Fern Bay"*. Prepared for CSIG – Canberra
2. SMEC. March 2008. *"Stockton Rifle Range Contamination Assessment Final"*. Prepared for the Department of Defence (2 volumes)
3. SMEC. March 2008. *"Stockton Rifle Range Remedial Action Plan: Final"*. Prepared for the Department of Defence
4. SMEC. 8 September 2008. *"Stockton Delineation Sampling, June 2008"*. 9 pages plus attachments. Prepared for the Department of Defence
5. SMEC. 6 November 2008. *"Remediation Specification Stockton Rifle Range"*, 36 pages. Prepared for the Department of Defence
6. SMEC. 19 June 2009. *"Stockton Rifle Range – Validation Sampling Analysis and Quality Plan"*, Version 3. Prepared for the Department of Defence
7. SMEC. 5 March 2010. *"Stockton Rifle Range Validation Report"*. Prepared for the Department of Defence
8. SMEC. May 2010. *"Final Stockton Rifle Range Site Environmental Management Plan"*. Prepared for the Department of Defence. 37 pages

Other information reviewed (including previous site audit reports and statements relating to the site)

9. Port Stephens Council. November 2006. *"Contaminated Land Policy, PSC2006-2097".* Minute 298 23 July 2002 (amended 28 November 2006). 13 pages
10. DECC. 6 November 2008. *"Specific Immobilisation Approval 2008-S-18 – Lead Contaminated Soil, Department of Defence – Small Arm Target Shooting Range – Stockton, Newcastle NSW"*. 7 pages
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12. Ecotone Ecological Consultants. 16 October 2003. *"Preliminary Flora and Fauna Constraints Assessment for the Defence Land at Stockton Rifle Range"*. Prepared for GHD
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20. Alpha Geoscience. August 2007. *"Geophysical Survey EM-61, Stockton Rifle Range and Fort Wallace, Stockton"*. Prepared for WSP Environmental and the Department of Defence. 17 pages
21. SKM. 18 September 2008. *"Site Audit Report on a Remedial Action Plan for Stockton Rifle Range, Fern Bay, NSW"*. Prepared for the Department of Defence
22. SKM. 18 September 2008. Site Audit Statement 150 for Stockton Rifle Range, Fern Bay, NSW. Prepared for the Department of Defence. 10 pages

23. SMEC. 13 November 2008. Letter *"450065005 – Stage 3 Fort Wallace and Stockton Rifle Range, Environmental Consultant Variation 3 – Potential Asbestos Waste Investigation Revision 3"*. 4 pages
24. SMEC. 17 April 2009. Letter *"Stockton Rifle Range Remediation Validation Approach Clarification"*. 4 pages
25. Gibson Nominees (2 March 2010) Letter *"Former Stockton Rifle Range: Explosive Ordnance-Related Contamination Issues"*. 5 pages
26. SMEC. 18 March 2010. Letter providing additional information

Site audit report

Title **Site Audit Report for the Remediation of Stockton Rifle Range, Fern Bay, NSW, Site Audit 150B by Dr Ian Swane** ……

Report no. **150B** …….. Date **10 May 2010** …….

PART II: Auditor's findings

Please complete either Section A or Section B, **not** both. *(Strike out the irrelevant section.)*

Use Section A where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land use(s).

Use Section B where the audit is to determine the nature and extent of contamination and/or the appropriateness of an investigation or remedial action or management plan and/or whether the site can be made suitable for a specified land use or uses subject to the successful implementation of a remedial action or management plan.

Section A

☑ **I certify that, in my opinion, the *"unrestricted landuse"* portion of the site (refer Figure 2) is SUITABLE for the following use(s)** *(tick all appropriate uses and strike out those not applicable)*:

- ~~☐ Residential, including substantial vegetable garden and poultry~~
- ~~☐ Residential, including substantial vegetable garden, excluding poultry~~
- ☑ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry
- ☑ Day care centre, preschool, primary school
- ☑ Residential with minimal opportunity for soil access, including units
- ☑ Secondary school
- ☑ Park, recreational open space, playing field
- ☑ Commercial/industrial
- ☑ Other *(please specify)* **Defence uses** ……

AND

☑ **I certify that, in my opinion, the *"non-development landuse"* portion of the site (refer Figure 2) is SUITABLE for the following use(s)** *(tick all appropriate uses and strike out those not applicable)*:

- ~~☐ Residential, including substantial vegetable garden and poultry~~
- ~~☐ Residential, including substantial vegetable garden, excluding poultry~~
- ~~☐ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
- ~~☐ Day care centre, preschool, primary school~~
- ☑ Residential with minimal opportunity for soil access, including units
- ☑ Secondary school
- ☑ Park, recreational open space, playing field
- ☑ Commercial/industrial
- ☑ Other *(please specify)* **Defence uses** ……

subject to compliance with the following environmental management plans *(insert title, date and author of plan)* **in light of contamination remaining on the site:**

SMEC (May 2010) *"Final Stockton Rifle Range Site Environmental Management Plan"*

~~**OR**~~

~~☐ **I certify that, in my opinion, the site is NOT SUITABLE for any use due to the risk of harm from contamination.**~~

Overall comments

1. **This site audit statement should be read in conjunction with the site audit report.** ……
2. **This site audit statement applies to the condition of the site at the time the last assessment was undertaken by SMEC in December 2009. The property owner is responsible for ensuring the site remains in a suitable condition.** ..
3. **The main areas where remediation works were conducted at the site are shown in Figure 3. The work comprised:**
   a) **The excavation of lead contaminated soils and spent bullet waste from the Stop Butt (RAC 1), the 10th firing yard (RAC 2), and the Auxiliary Range (RAC 3) followed by the treatment and off-site disposal of over 7,000 tonnes of this material.**
   b) **The excavation of 16,023m^3 of material from the firing mounds, stripped topsoil and access road subgrade material and its placement in the depression between the target mantle and the western side of the Stop Butt, as shown in Figure 4.**
   c) **The excavation of buried waste near the main access road (RAC 4), a north-eastern area (RAC 5a), and a former septic tank (RAC6) followed by off-site disposal.**
   d) **The removal and clearance of fragments of asbestos sheeting.**
   e) **The use of 5,500m^3 of excavated soil to backfill various areas of the site, as shown in Figure 5. Some of this material was screened while some was unscreened (refer to as "scrape material"). The available data**

indicate that, on average, 11 spent bullets remain per 100m^2 area where screened soils were backfilled, while 84 spent bullets remain per 100m^2 area where unscreened soils were backfilled.

4. **The remediation works generally followed the RAP previously reviewed by the Site Auditor (refer Site Audit Statement 150 dated 18/09/09). The main exceptions were that some excavated material containing spent bullet waste was reused on-site rather than disposed off-site and the stockpile and treatment area was not lined. The Site Auditor considers that these exceptions will not have a significant impact on the health of future users or the environment.** ……
5. **A Defence-accredited UXO specialist from Gibson Nominees (Ref [25]) has advised that the risk of UXO being present at the Stockton Rifle Range site is very low and does not prevent the site being used for sensitive land uses that include residential with accessible soil. Gibson Nominees also advised that the Defence National UXO Office is satisfied that the requirements of both the Commonwealth Policy on the Management of Land Affected by Unexploded Ordnance and Defence Instruction (General) Administration 63-1 – Management of Land Affected by Unexploded Ordnance – in respect to action to be taken prior to disposal of potentially EO contaminated land have been complied with. The known retention of spent bullets at some areas of the site is considered to be an aesthetic issue that future users of the site need to understand.** ……
6. **Other fill and waste materials remain at the site. These mainly comprise small quantities of building and demolition waste, gravel and imported clayey soils containing trace quantities of slag.** ……
7. **Acid sulphate soils may be present at the site and should be managed in accordance with Port Stephens Council policy.** ……
8. **Groundwater must not be extracted from the Stockton Rifle Range site unless additional monitoring confirms that any changes to water levels induced by groundwater extraction would not impact acid sulphate soils, and confirms that the water is suitable for the proposed uses. Any extraction of groundwater should be approved by Port Stephens Council.**
9. **The purpose of the EMP is to manage contamination risks posed by Defence waste (eg. spent bullets), asbestos fragments, waste material (eg. building & demolition waste, dumped rubbish) and unexpected findings (eg. UXO) remaining at the site. The EMP also provides guidance on the removal of materials from the site.** ……
10. **The EMP has been reviewed and approved in writing by Port Stephens Council. The EMP is to be implemented through a notation of the site planning certificate issued in accordance with Section 149 of the Environmental Planning and Assessment Act 1979.** ……
11. **Waste material buried under the sand capping layer at the Target Mantle (Figure 4) must not be disturbed unless the work is undertaken in accordance with an excavation plan acceptable to Port Stephens Council.**
12. **Any excavated soil or buried material removed from the site must be disposed at a suitable licensed landfill in accordance with DECCW waste regulations.** ……
13. **Any excavated soil removed from the former Stop Butt, Auxiliary Range or other filled areas must be either disposed at a suitably licensed landfill in accordance with DECCW waste regulations or retained on-site if chemical testing validates the soil as being suitable for the area where it is to be placed. These filled areas are shown on Figure 5.** ……
14. **No excavated soil from the open space/non-development landuse area shall be relocated onto the proposed residential/unrestricted landuse area unless**

chemical testing validates the soil as being suitable for the area where it is to be placed and the work is undertaken in accordance with an approval from Port Stephens Council. ……

15. **One approach to notify future owners of the need to comply with the EMP and the requirements of the site audit statement would be to place a positive covenant on the land title. A registered survey plan prepared by a licensed surveyor could also be obtained to accurately define the two types of areas referred to as *"unrestricted landuse"* and *"non-development landuse"*.** ……

~~Section B~~

~~Purpose of the plan[2] which is the subject of the audit: ……~~

~~**I certify that, in my opinion:**~~

- ☐ ~~the nature and extent of the contamination HAS/HAS NOT* been appropriately determined~~

~~**AND/OR**~~

- ☐ ~~the investigation/remedial action plan/management plan* IS/IS NOT* appropriate for the purpose stated above~~

~~**AND/OR**~~

- ☐ ~~the site CAN BE MADE SUITABLE for the following uses *(tick all appropriate uses and strike out those not applicable)*:~~
  - ☐ ~~Residential, including substantial vegetable garden and poultry~~
  - ☐ ~~Residential, including substantial vegetable garden, excluding poultry~~
  - ☐ ~~Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
  - ☐ ~~Day care centre, preschool, primary school~~
  - ☐ ~~Residential with minimal opportunity for soil access, including units~~
  - ☐ ~~Secondary school~~
  - ☐ ~~Park, recreational open space, playing field~~
  - ☐ ~~Commercial/industrial~~
  - ☐ ~~Other *(please specify)* ……~~

~~**if the site is remediated/managed* in accordance with the following remedial action plan/management plan*** *(insert title, date and author of plan)*~~

~~……~~

~~**subject to compliance with the following condition(s):** ……~~

~~**Overall comments** ……~~

[2] For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

PART III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority under the *Contaminated Land Management Act 1997* (Accreditation No. 9821).

I certify that:

- I have completed the site audit free of any conflicts of interest as defined in the *Contaminated Land Management Act 1997,* and
- with due regard to relevant laws and guidelines, I have examined and am familiar with the reports and information referred to in Part I of this site audit, and
- on the basis of inquiries I have made of those individuals immediately responsible for making those reports and obtaining the information referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete, and
- this statement is, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties under the *Contaminated Land Management Act 1997* for wilfully making false or misleading statements.

Signed ……. Date **10 MAY 2010** …….

PART IV: Explanatory notes

To be complete, a site audit statement form must be issued with all four parts.

How to complete this form

Part I identifies the auditor, the site, the purpose of the audit and the information used by the auditor in making the site audit findings.

Part II contains the auditor's opinion of the suitability of the site for specified uses or of the appropriateness of an investigation, or remedial action or management plan which may enable a particular use. It sets out succinct and definitive information to assist decision-making about the use(s) of the site or a plan or proposal to manage or remediate the site.

The auditor is to complete either Section A or Section B of Part II, **not** both.

In **Section A** the auditor may conclude that the land is *suitable* for a specified use(s) OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further remediation or investigation of the site was needed to render the site fit for the specified use(s). Any **condition** imposed should be limited to implementation of an environmental management plan to help ensure the site remains safe for the specified use(s). The plan should be legally enforceable: for example a requirement of a notice under the *Contaminated Land Management Act 1997* (CLM Act) or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of the *Environmental Planning and Assessment Act 1979*.

Auditors may also include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

In **Section B** the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or whether land can be made suitable for a particular land use or uses upon implementation of a remedial action or management plan.

By certifying that a site *can be made suitable* for a use or uses if remediated or managed in accordance with a specified plan, the auditor declares that, at the time the audit was completed, there was sufficient information satisfying guidelines made or approved under the CLM Act to determine that implementation of the plan was feasible and would enable the specified use(s) of the site in the future.

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement.

Auditors may also include **comments** which are observations in light of the audit which provide a more complete understanding of the environmental context to aid decision-making in relation to the site.

In **Part III** the auditor certifies his/her standing as an accredited auditor under the CLM Act and makes other relevant declarations.

Where to send completed forms

In addition to furnishing a copy of the audit statement to the person(s) who commissioned the site audit, statutory site audit statements must be sent to:

Department of Environment and Climate Change (NSW)
Contaminated Sites Section
PO Box A290, SYDNEY SOUTH NSW 1232
Fax: (02) 9995 5930

AND

the **local council** for the land which is the subject of the audit.

Figure 1 NSW Land Title Certificate for Stockton Rifle Range

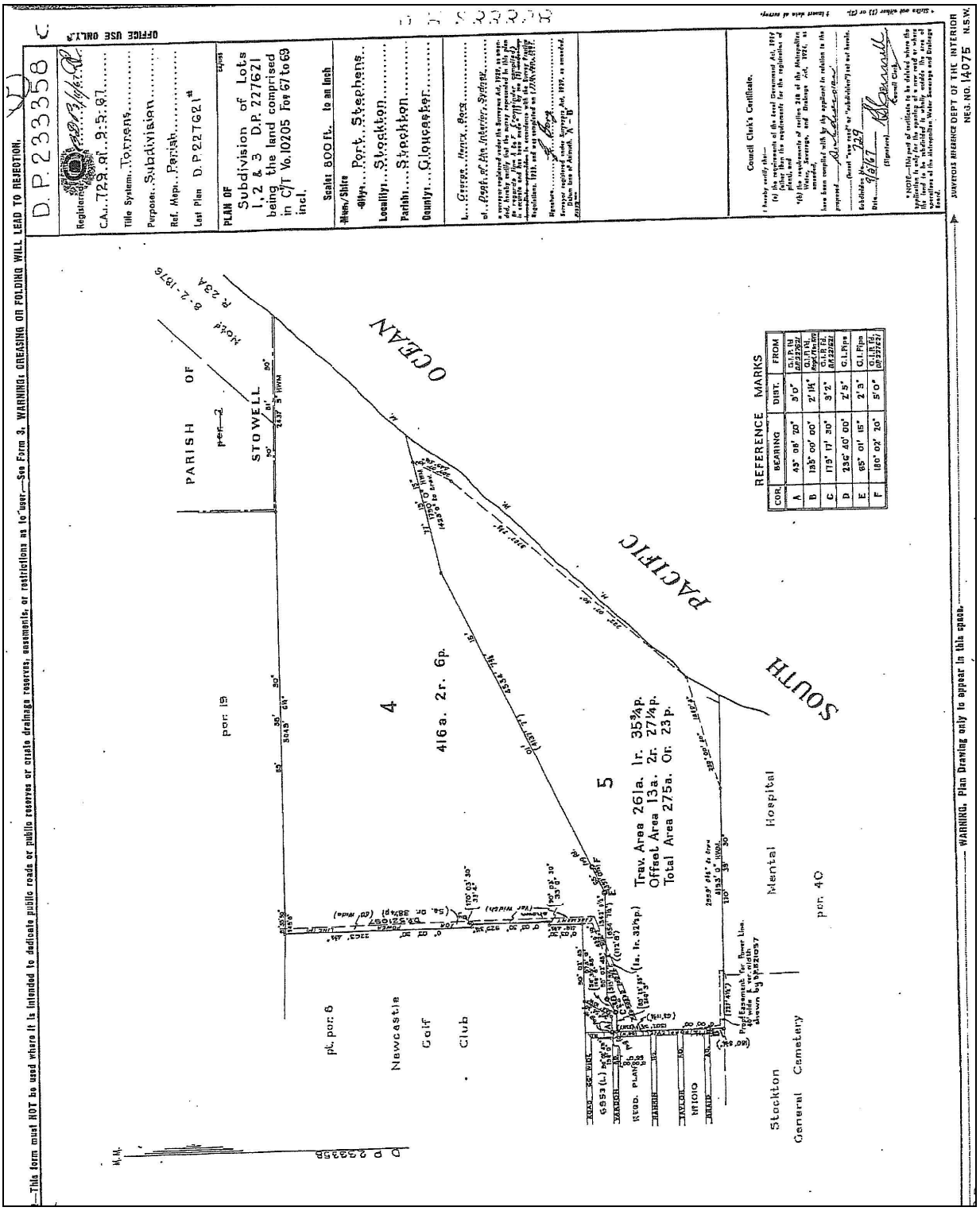


Figure 2 Location of Proposed Landuse Areas

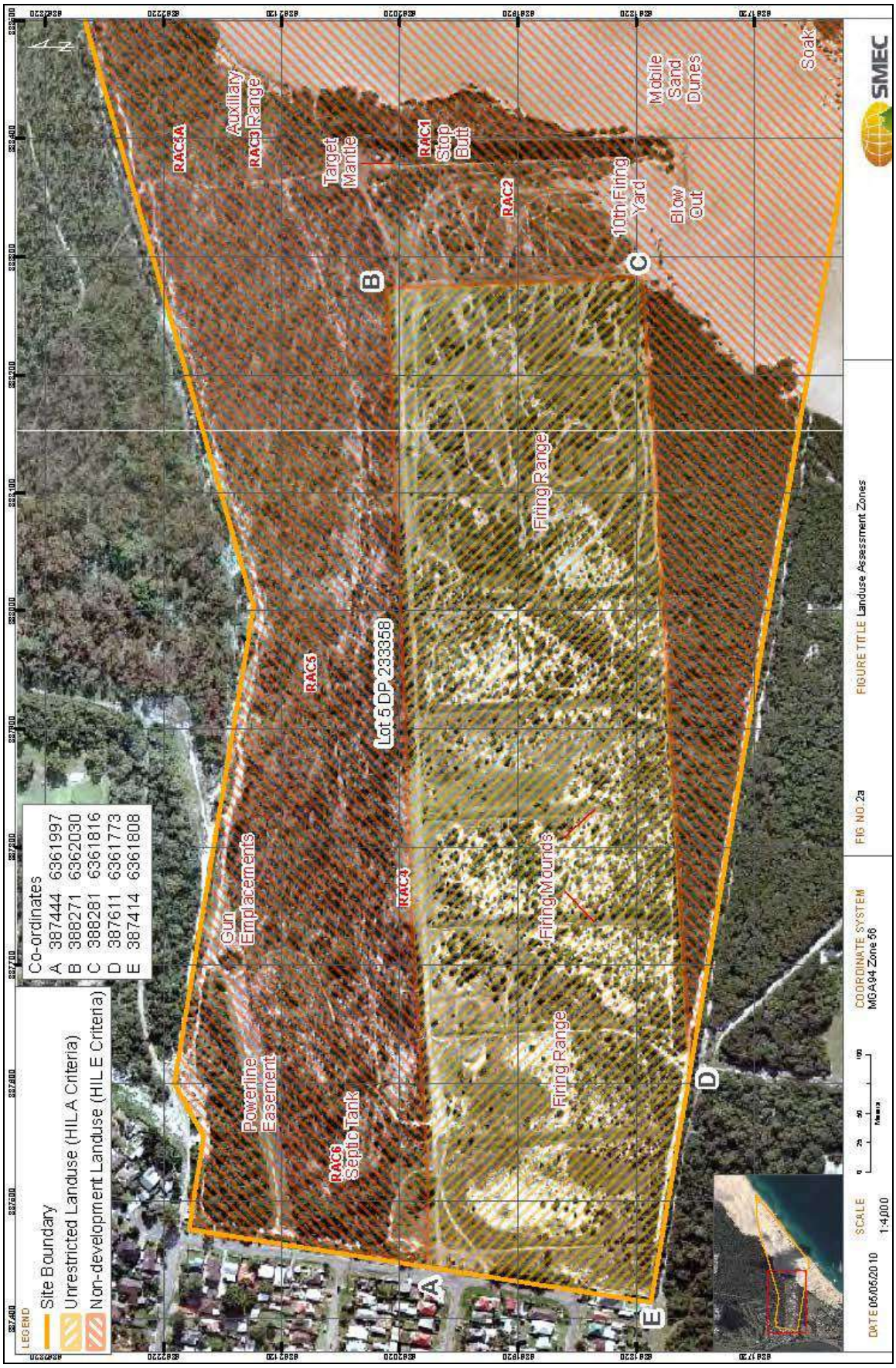


Figure 3 Location of Main Remediation Areas

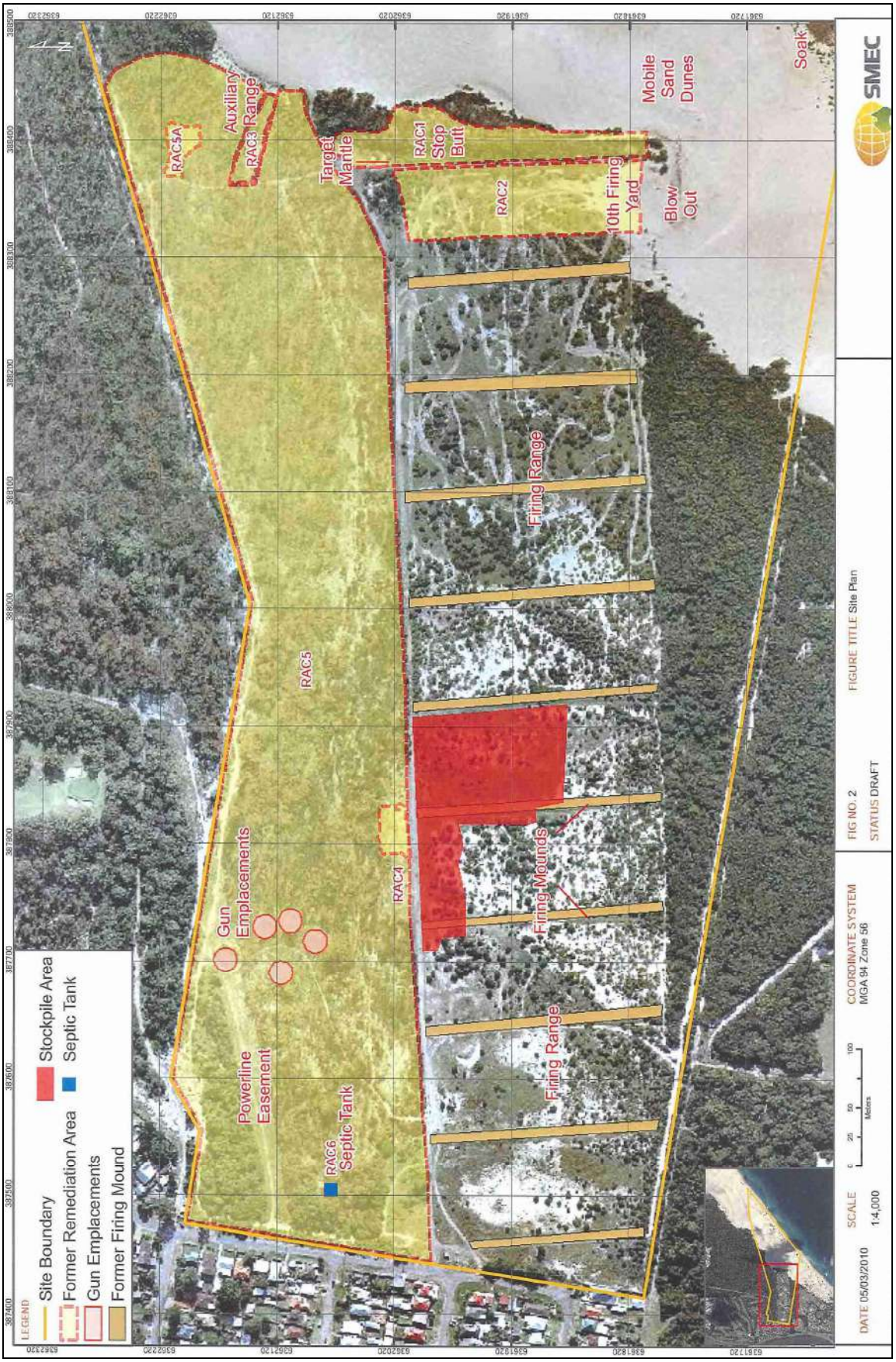


Figure 4 Design of Target Mantle Backfill Area

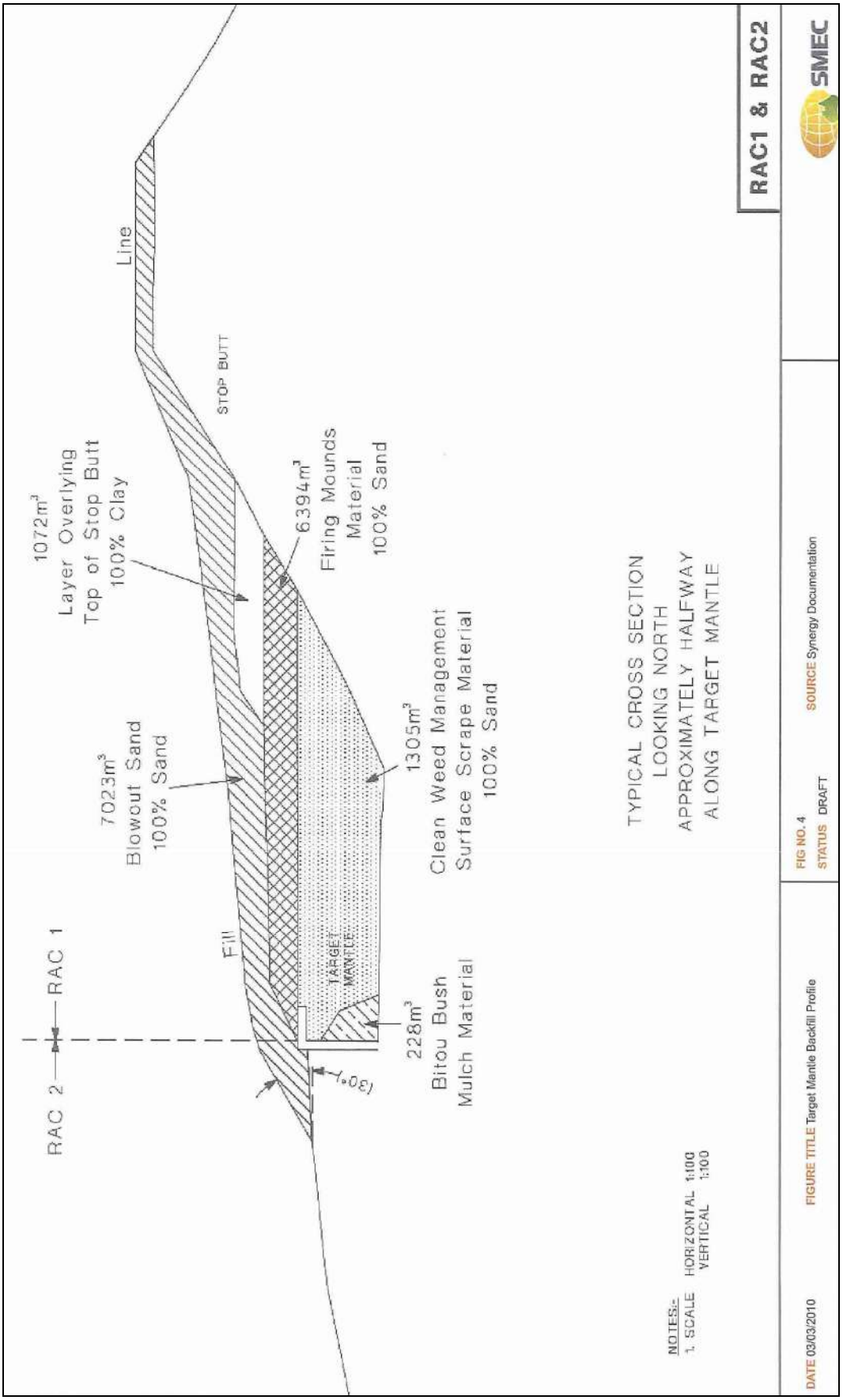
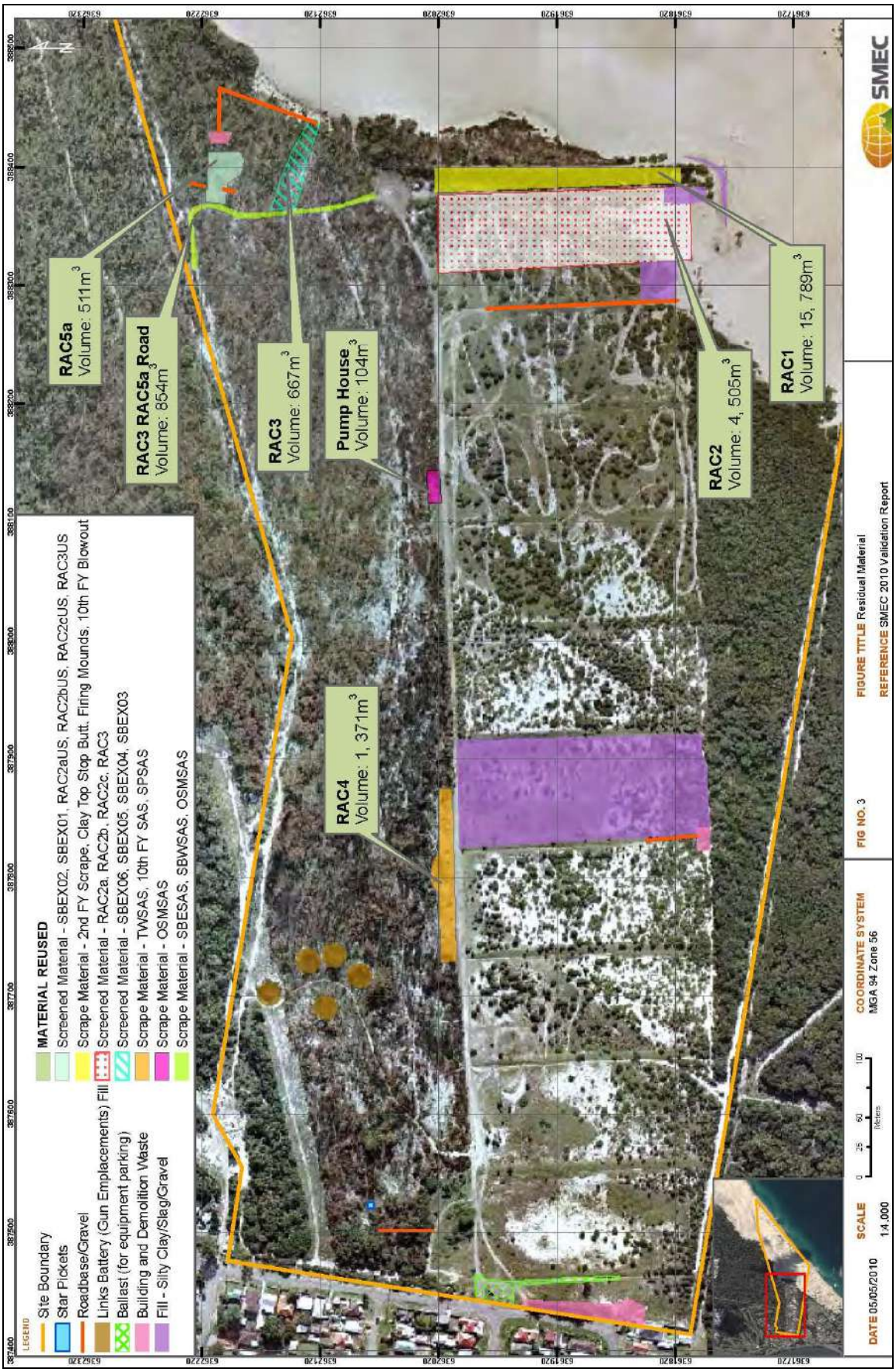


Figure 5 Residual Materials Remaining On-site



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DHA

RIFLE RANGE
DEFENCE HOUSING PROJECT

Ecological Assessment Report

FINAL

May 2018

RIFLE RANGE
DEFENCE HOUSING PROJECT

Ecological Assessment Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Defence Housing Australia

Project Director:	Rebecca Vere
Project Manager:	Kate Connolly
Report No.	3764/R02/Final
Date:	May 2018

Newcastle

75 York Street
Teralba NSW 2284

Ph. 02 4950 5322

www.umwelt.com.au

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	**Date**	**Name**	**Date**
Final	Rebecca Vere	29/05/2018	Rebecca Vere	29/05/2018

Executive Summary

Umwelt (Australia) Pty Limited (Umwelt) has been commissioned by Defence Housing Australia (DHA) to prepare an Ecological Assessment for a rezoning application for the land known as the Rifle Range, the boundary of which is Lot 5 DP233358 (the Study Area) in Fern Bay, NSW. It is proposed to rezone the Study Area from the current Environmental Conservation (E2) to Low Density Residential (R2) and National Parks and Reserve (E1) under the Port Stephens Local Environmental Plan (LEP) 2013 to allow for a residential subdivision and conservation.

DHA has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle-based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. In response to this, DHA have recently purchased two sites: Fort Wallace, Stockton, NSW and the Rifle Range, Fern Bay, NSW. DHA intends to obtain the necessary planning approvals to develop these sites for residential use with a mix of housing suitable for both Australian Defence Force (ADF) personnel and the private market.

The proposed Master Plan for the Rifle Range site includes a mix of residential typologies including townhouses, coastal cluster houses, courtyard homes, dune apartments and single eco-homes primarily placed within the former Rifle Range footprint. The Master Plan has sought to focus development within the previously disturbed areas of the site.

This Ecological Assessment was prepared to be appended to the Planning Proposal to rezone the Rifle Range site.

The Rifle Range site contains five native vegetation communities including Frontal Dune Blackbutt-Apple Forest, Mahogany-Baloskion Swamp Forest, Coastal Tea-tree – Banksia Scrub, Foredune Spinifex and Beach Wetlands. A wide range of flora and fauna species have been recorded within and surrounding the Study Area as part of previous ecological surveys.

Five threatened species and one community listed under the TSC Act and/or EPBC Act have been recorded being likely *Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC*, potential Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*), grey-headed flying-fox (*Pteropus poliocephalus*), little bentwing-bat (*Miniopterus australis*), eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) and east coast freetail-bat (*Mormopterus norfolkensis*). Additionally, preferred and supplementary koala habitat occurs on the site, however the koala has not been recorded.

As the proposed rezoning has focused on the retention of as much intact vegetation as possible, the impacts to local biodiversity and threatened species are minimal. Based on the current Master Plan, it is considered unlikely that the potential redevelopment of the site for residential uses would result in a significant impact on threatened species and communities occurring or with the potential to occur on the site.

A range of mitigation and management measures are proposed to minimise the adverse impacts of the rezoning on local biodiversity. The rezoning aims to protect approximately 80 hectares of the site, via a proposed rezoning to National Parks and Reserves (E1) under the Port Stephens LEP or to be secured under a Biodiversity Stewardship Site.

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Appendix E	Preliminary Koala Plan of Management

List of Abbreviations and Acronyms

Abbreviation/ Acronym	Definition
ADF	Australian Defence Force
APZ	Asset Protection Zone
BC Act	*Biodiversity Conservation Act 2016*
BVT	Biometric Vegetation Type
CKPoM	Comprehensive Koala Plan of Management
DHA	Defence Housing Australia
DoEE	Commonwealth Department of the Environment and Energy (formerly DoE)
EEC	Endangered Ecological Community
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
IBRA	Interim Biogeographic Regionalisation for Australia
KPoM	Koala Plan of Management
LEP	Local Environmental Plan
LGA	Local Government Area
NPWS	National Parks and Wildlife Service
MNES	Matters of National Environmental Significance
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
RAAF	Royal Australian Air Force
SAT	Spot Assessment Technique
SEPP	State Environmental Planning Policy
TEC	Threatened Ecological Community
TSC Act	*Threatened Species Conservation Act 1995*
VIS	Vegetation Information System

1.0 Introduction

Umwelt (Australia) Pty Limited (Umwelt) has been commissioned by Defence Housing Australia (DHA)) to prepare an Ecological Assessment for a rezoning application for the land known as the Rifle Range, the boundary of which is Lot 5 DP233358 (the Study Area) in Fern Bay, NSW (refer to **Figure 1.1**). It is proposed to rezone the Study Area from the current Environmental Conservation (E2) to Low Density Residential (R2) and National Parks and Reserve (E1) under the Port Stephens Local Environmental Plan (LEP) 2013 to allow for a residential subdivision and conservation.

The Study Area has been subject to ongoing investigations (including ecological survey) as a potential development site since 2008. The ecological features identified as part of such investigations (including current and previous field survey) have been used to guide the design of an appropriate Master Plan that informs the planning proposal, with the aim of providing a development approach which balances the economic potential of the study area with appropriate biodiversity conservation outcomes for the broader Stockton area.

1.1 Project Description

DHA has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle-based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. In response to this, DHA have recently purchased two sites: Fort Wallace, Stockton, NSW and the Rifle Range, Fern Bay, NSW. DHA intends to obtain the necessary planning approvals to develop these sites for residential use with a mix of housing suitable for both Australian Defence Force (ADF) personnel and the private market.

The two sites are located close to the Royal Australian Air Force (RAAF) Base Williamtown which lies 11 to 12 kilometres to the north of the sites. The Newcastle central business district lies a few kilometres to the south across the Hunter River.

1.1.1 Proposed Master Plan – Rifle Range

The proposed Master Plan for the Rifle Range site includes a mix of residential typologies primarily placed within the former Rifle Range footprint (refer to **Figure 1.2**). The Master Plan has sought to retain the Rifle Range landscape and focus development within the previously disturbed areas of the site. The residential typologies for the Rifle Range include the following:

- ***Townhouses*** – up to 68 attached 1-3 storey dwellings with a lightweight design that facilitates layouts that are responsive to site features and context.
- ***Coastal cluster houses*** – up to 120 townhouse style dwellings set within natural landscape areas. Private open space is limited to decks and immediate terrace areas attached to each dwelling.
- ***Courtyard homes*** – up to 48 large courtyard family homes including 4 bedrooms, 3 bathrooms, open plan living space, single garage and an ample rear garden.
- ***Single eco-homes*** – up to 16 lightweight, climate responsive individual homes set within generous lots.
- ***Dune apartments*** – up to 66 small scale apartments with 1-3 bedrooms each, in blocks up to four stories.

Image Source: Nearmap (May2016)
Data Source: LPI NSW (2009)

0 1.0 2.0 2.5km
1:50 000

Legend

- Site Boundary
- National Park
- State Conservation Area
- Regional Park
- Hunter Estuary Wetlands Ramsar Site

FIGURE 1.1

Locality Map

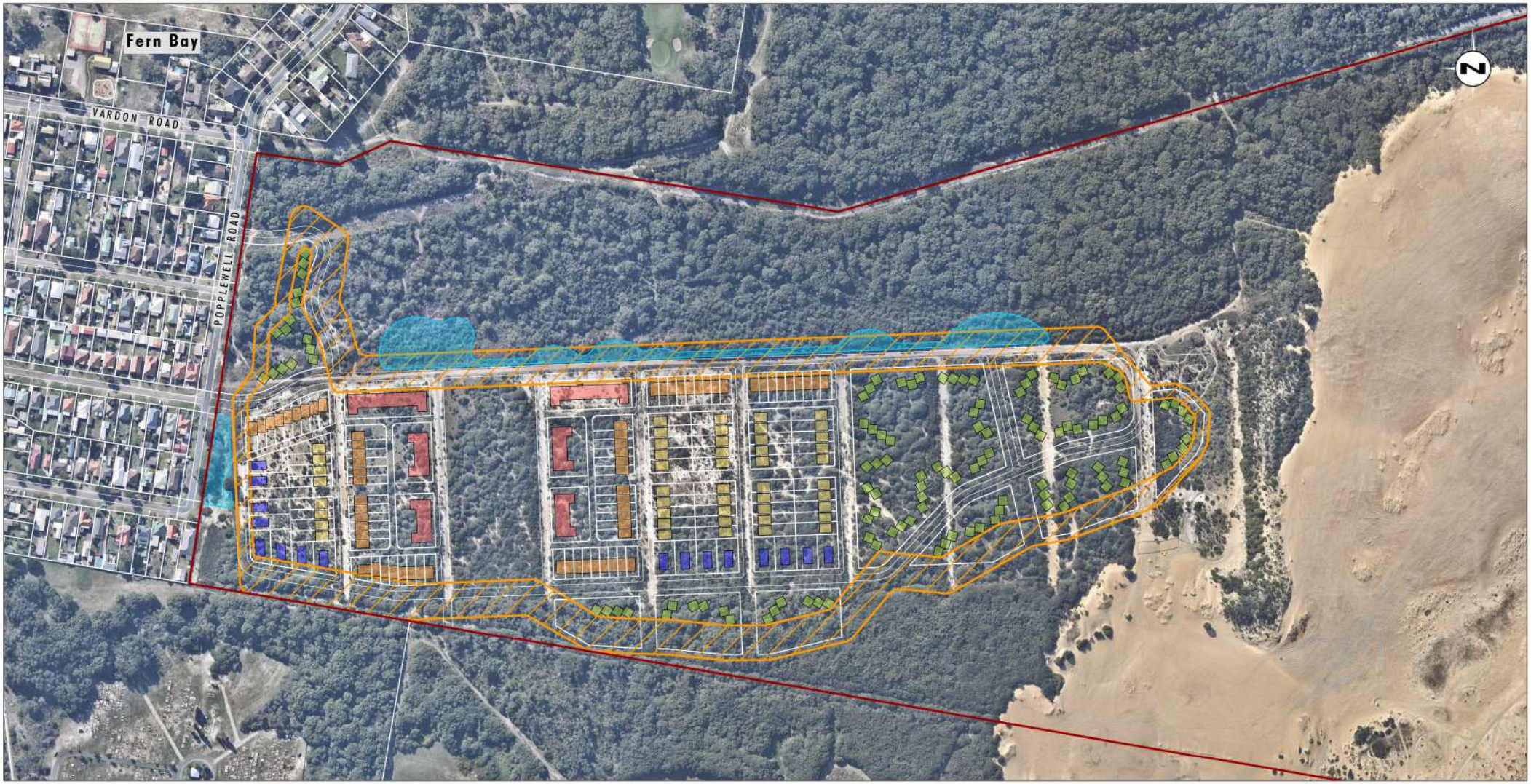

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2009), Architectus (2018)

0 100 200 250m
1:5000

Legend

- Site Boundary
- Asset Protection Zone
- Stormwater Detention Basin (Subject to design resolution)
- Dune Apartment
- Townhouse
- Courtyard Home
- Cluster Home
- Single Eco Home

FIGURE 1.2

Proposed Master Plan

File Name (A4): R02/3764_002.dgn
20180524 16.08

1.1.2 Guiding Principles

It is envisaged that a residential development at the Rifle Range would develop the site and the areas of Stockton and Fern Bay as unique coastal communities with strong links to Newcastle and the growing Hunter region. The Master Plan aims to provide residential housing while balancing the natural coastal environment and cultural heritage assets of the site.

Guiding principles for the rezoning of the Rifle Range, which have shaped the design considerations of the Master Plan, include the following:

- ***Touch lightly on the land*** – raised building (no slabs), working with the existing natural topography to minimise earthworks.
- ***Embrace the coastal ecology*** – minimisation of private open space and boundary fencing, native endemic planting only, maximise views to the ocean, dunes, river and bushland.
- ***Celebrate history and cultural heritage*** – retain heritage structures, connect with the Worimi reserve.
- ***Create a diverse community*** – mix of building typologies for defence, private and affordable housing needs, recreational opportunities for visitors.
- ***Open the gates to the public*** – provide public access via the local road, pedestrian and cycle networks, controlled access to the beach and dunes.
- ***Utilise interesting architectural forms*** – staggered building heights, natural materials and finishes, varied street setbacks.

1.2 Approval Pathway

This Ecological Assessment is part of a suite of specialist assessments of the site that have informed consideration of the site's potential for redevelopment. These assessments have been used as the basis of master plan options and the development of a recommended Master Plan, which has subsequently informed proposed revised planning controls for the site with respect to land use, height of buildings, and heritage.

It is intended that a Planning Proposal will be lodged with Port Stephens Council, seeking support of the strategic merit of the proposal to proceed to a Gateway Determination by the Department of Planning and Environment (DPE). It is intended that the Planning Proposal, if supported by both Council and DPE, would then proceed to public exhibition and finalisation through an amendment to the LEP. Key outcomes of the Master Plan may be established in a site specific Development Control Plan or Stage 1 Development Application. Appropriate approvals will then be sought for the subdivision and development of the site under the amended planning controls.

The Master Plan has been used as a demonstration of how the site could appropriately accommodate residential uses in response to best practice urban design and planning principles. Where appropriate, this report has considered the likely impacts of the Master Plan on the ecology of the site to enable as detailed an assessment as possible. However, it is acknowledged that further detailed work will be undertaken and consideration given to potential ecological impacts at the subdivision and detailed design stage.

1.3 Objectives of the Ecological Assessment

This Ecological Assessment will be appended to the Planning Proposal to rezone the Rifle Range. Specifically, the objectives of the Ecological Assessment are to:

- describe the flora and fauna species and other significant ecological features recorded within the Study Area and locality from previous studies on the site, local studies and ecological database searches
- identify any threatened species, endangered populations, threatened ecological communities (TECs), or their habitats listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act), and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), that may be adversely affected as a result of the proposal
- assess the potential impact of the proposal in relation to identified and potential significant ecological features, according to the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the EPBC Act and
- develop impact mitigation measures (including consideration of offsetting opportunities) to avoid or reduce any potential significant impacts of the proposal on the significant ecological values of the Study Area.

The *Biodiversity Conservation Act 2016* was implemented on 25 August 2017, repealing the TSC Act. It should be noted that this Ecological Assessment was prepared and submitted to Council prior to the repeal of the TSC Act (February 2017). This report (Version 6) has been updated to reflect the changes requested following Council's review of the Planning Proposal in relation to housing densities.

The assessments in this report have not been updated to reflect the minor changes in relation to the replacement of the TSC Act by the BC Act. It is understood that threatened entities previously listed under the TSC Act were automatically transferred to be listed under the BC Act and the amended Assessment of Significance Test (now outlined in Section 7.3 of the BC Act) does not materially change the assessment outcome. Consideration of the BC Act and its implications on the Project will be addressed at the DA phase of the project, as required.

1.4 Document Outline

The Ecological Assessment includes the following sections:

- Section 1 – provides the introduction to the report
- Section 2 – outlines the methods used in the ecological assessment
- Section 3 - describes the ecological features of the Study Area
- Section 4 – assesses the likely impacts on significant ecological features
- Section 5 – describes impact avoidance, mitigation and offsetting opportunities
- Section 6 – outlines recommendations for additional ecological investigations during the development application phase of the project
- Section 7 - provides a list of references used throughout the report and analysis.

2.0 Methods

The methods employed as part of the desktop and field components of the Ecological Assessment are discussed in the following sections, including those of the current and previous surveys within the Study Area.

2.1 Literature Review

A review of all relevant and available literature was undertaken in order to gain a holistic understanding of the ecological values of the Study Area. Documents reviewed included regional vegetation mapping reports, site-specific monitoring surveys, ecological surveys undertaken in the vicinity of the Study Area and also relevant ecological database searches.

The following key documents were reviewed during the preparation of this Ecological Assessment:

- Ecological Constraints Assessment – Rifle Range, Stockton Peninsula (Kleinfelder 2015)
- Ecological Constraints Report, Stockton Rifle Range, Stockton, NSW (SMEC 2008)
- Vegetation of the Worimi Conservation Lands Port Stephens, NSW: Worimi NP, Worimi SCA and Worimi RP (Bell and Driscoll 2010)
- Fern Bay Seaside Village Ecology Assessment Report (ERM 2009)
- Worimi Regional Park Vegetation Management Plan (ERM 2009)
- Worimi Conservation Lands Plan of Management (OEH 2015)
- Port Stephens Council Comprehensive Koala Plan of Management (PSC 2002)
- Port Stephens Council Koala Habitat Planning Map (PSC 2007)
- Greater Hunter Native Vegetation Mapping (Sivertsen *et al.* 2011).

2.2 Database Searches

In order to identify threatened species, endangered populations and TECs with the potential to occur in the Study Area, a review of relevant ecological databases was completed. These database sources comprised:

- Office of Environment and Heritage (OEH) Threatened Species Profile Database for known/predicted threatened species and TECs in the Karuah-Manning Interim Biogeographic Regionalisation for Australia (IBRA) subregion, accessed September 2016
- OEH BioNet Atlas of NSW Wildlife database and mapping tool (OEH 2016), accessed in September 2016
- PlantNET (Royal Botanic Gardens Sydney) database search for Rare or Threatened Australian Plant species within the Port Stephens LGA, accessed September 2016
- Department of Environment and Energy (DoEE) Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed September 2016
- VIS Classification Database (OEH 2016), accessed September 2016.

2.3 Field Surveys

2.3.1 Previous Field Surveys

Ecological field surveys have been carried out in the Study Area over many years and seasons including in December 2002 (Ecotone 2003), April 2007 (SMEC 2008) and October 2015 (Kleinfelder 2015). Throughout these surveys, the following has been undertaken:

- Flora surveys including four 20m x 20m quadrats
- Diurnal fauna observations including signs of presence surveys and targeted bird surveys
- Habitat assessments
- Nocturnal spotlighting, call playback and Anabat surveys and
- Reconnaissance vegetation mapping and weed mapping.

The results of these surveys have been reviewed as part of the literature review outlined in **Section 2.1**.

2.3.2 Ecological Site Inspection

A site inspection was undertaken by Umwelt ecologists on 25 May 2016 in order to complete ground-truthing of previous surveys and identification of any important ecological features. This included:

- Rapid vegetation mapping reconnaissance
- Recording dominant weed species and infestations
- Habitat assessments for threatened species
- Diurnal bird surveys
- Spot Assessment Technique (SAT) surveys for koala (*Phascolarctos cinereus*) as per Phillips and Callaghan (1995)
- Call playback for masked owl (*Tyto novaehollandiae*), powerful owl (*Ninox s*trenua), squirrel glider (*Petaurus norfolcensis*) and koala
- Spotlighting searches for nocturnal threatened fauna
- Two remote camera survey locations over seven nights targeting ground-dwelling threatened mammal species
- One Anabat survey location over seven nights targeted threatened micro-bat species and
- Opportunistic observations throughout the site inspection.

Remote cameras and the Anabat were set up on 25 May 2016 and collected after seven nights on 1 June 2016.

2.3.3 Targeted Orchid Surveys

Site walkovers of the Study Area were undertaken by two Umwelt ecologists on 8 September 2016 to determine the presence or otherwise of sand doubletail (*Diuris arenaria*) and rough doubletail (*Diuris praecox*) within suitable habitats within the Study Area. Both species are known to occur along the Tomaree Peninsula in sandy soils in associated with sclerophyll forest and disturbed habitat margins.

The timing of these surveys was dependent on the known flowering times of these species within the Port Stephens area. Furthermore, known records of the threatened orchids (control sites) were visited prior to the surveys to confirm the flowering of the species in the local area. Survey was undertaken in early September 2016 to cover the beginning of the sand doubletail flowering period and the end of the rough doubletail flowering period as per the flowering times outlined in **Table 2.1**.

Table 2.1 Threatened Orchid Species Known Flowering Period in Port Stephens

Targeted Orchid Species	Flowering Period
sand doubletail (*Diuris arenaria*)	August to September
rough doubletail (*Diuris praecox*)	July to September

2.3.4 Habitat Tree Survey and Biometric Plots and Transects

Hollow-bearing tree surveys, koala feed tree surveys and biometric plots and transects were undertaken by two Umwelt ecologists on 1 November 2016 to provide further information on the following features of the Study Area:

- Presence or otherwise of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions endangered ecological community (EEC)
- Distribution and size of hollow-bearing trees
- Distribution and identification of preferred koala feed tree species and
- Floristic composition of the vegetation communities across the site for potential future assessment pathways.

2.3.4.1 Habitat Tree Survey

Hollow-bearing trees and preferred koala feed trees were surveyed across the Study Area by undertaking walking transects and marking suitable features as a GPS waypoint. Hollow-bearing trees were recorded with information on tree species, hollow size, number and tree diameter at breast height (DBH). Preferred koala feed trees (as per the Port Stephens Comprehensive Koala Plan of Management (CKPoM)) were recorded including information on species and general description.

2.3.4.2 Plot and Transect Surveys

A total of five systematic plots/transect surveys were conducted across the Study Area during the surveys undertaken for this assessment. At each plot/transect data was recorded according to Section 5 of the BBAM (OEH 2014). This involved setting out 20 x 50 metre and 20 x 20 metre plots and a 50 metre transect.

The location of each quadrat was recorded using a hand-held GPS with accuracy of ± 5 metres. The Map Grid of Australia (MGA) coordinate system was used.

At each plot/transect, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 metre plot. Searches of each 20 x 20 metre plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of the shrub, mid-storey, canopy and emergent layers were also thoroughly examined. Effort was made to search the tree canopy and tree trunks for mistletoes, vines and epiphytes.

For each flora species recorded in the plot, the following data was collected in accordance with Table 1 of the BBAM (OEH 2014):

- stratum/layer in which the species occurs
- growth form
- scientific name and common name
- cover
- abundance.

At each standard flora plot, 10 points along a 50 metre transect were assessed for:

- percentage native overstorey cover
- percentage native mid-storey cover.

In addition, 50 points along a 50 metre transect were assessed for:

- percentage native groundcover (grass)
- percentage native groundcover (shrubs)
- percentage native ground cover (other)
- percentage exotic plant cover.

Additional details were recorded in each quadrat, including soil texture, drainage and depth; site disturbances; physiography (position in the landscape); and vegetation structure (strata percentage covers, heights and dominant species). Photographic records were also taken at each site.

Meandering transects were also undertaken through vegetation units across the Study Area to enable floristic sampling across a much larger area than systematic plots, allowing the survey to achieve a combination of detailed observation and broader appreciation. Records along transects supplemented floristic sampling carried out as part of plot survey.

3.0 Results

3.1 Ecological Local Context

The Rifle Range (Study Area) is situated on a sand peninsula that occurs between the Hunter River and Stockton Beach, north of Newcastle, NSW. The Study Area is located within the Port Stephens Council Local Government Area (LGA) and in the NSW North Coast Bioregion and the Karuah Manning subregion.

Table 3.1 Study Area Location in the Landscape

Rifle Range	
IBRA (V7) Bioregion	NSW North Coast
IBRA (V7) Subregion	Karuah Manning
Major Catchment Area	Hunter/Central Rivers
Mitchell Landscape	Sydney – Newcastle Barriers and Beaches
LGA	Port Stephens Council
Lot and DP	Lot 5 DP233358

The Study Area is approximately 112 hectares in size and is broadly located between Popplewell Road, Fern Bay, and the high water mark at Stockton Beach. The land is currently zoned as E2 Environmental Conservation under the Port Stephens Council Local Environmental Plan (LEP) 2013.

The Study Area is surrounded by residential development and conservation lands including housing to the west of Popplewell Road, coastal dunes to the east and the Worimi Regional Park adjoining the northern portion of the site. The Worimi Regional Park constitutes part of the wider Worimi Conservation Lands that provide an important habitat link within a broader wildlife corridor from the Hunter Wetlands National Park in the northwest, Tomaree National Park and Tilligerry State Conservation Area in the north. The majority of the Worimi Conservation Lands are dominated by blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*) forests (OEH 2015). Connectivity from the Worimi Conservation Lands to the south of the Study Area is currently severed by urban development and historic disturbances.

Vegetation in the Study Area has been subjected to several human disturbances including activities during the active use of the Rifle Range, vehicle recreation and illicit dumping. These disturbances have led to a reduction in vegetation condition, particularly within the former firing mounds. Retained vegetation in the northern portion of the Study Area adjoins the Worimi Regional Park and represents the highest quality vegetation and habitats on the site. Fauna habitats in the locality include forests, coastal sand scrub and sand dunes.

3.2 Flora and Native Vegetation

A total of 89 flora species have been recorded in the Study Area following floristic surveys undertaken by SMEC (2008), Kleinfelder (2015) and Umwelt. A full list of the flora species recorded during surveys of the Study Area is presented in **Appendix A**.

Five native vegetation community types have been mapped within the Study Area, being:

- Frontal Dune Blackbutt-Apple Forest
- Mahogany-Baloskion Swamp Forest
- Coastal Tea-tree – Banksia Scrub
- Foredune Spinifex
- Beach Wetlands.

These communities have been aligned with the Vegetation of the Worimi Conservation Lands (Bell and Driscoll 2010) and assigned (where possible) to Plant Community Types (PCTs) and Biometric Vegetation Types (BVTs) as per the Vegetation Information System (VIS).

Table 3.2 outlines the native vegetation community types within the Study Area. **Figure 3.1** shows vegetation mapping of the Study Area.

Table 3.2 Vegetation Communities in the Study Area

Vegetation Community (Bell and Driscoll 2010)	Likely Associated PCT/BVT	Area within the Study Area (ha)
Frontal Dune Blackbutt-Apple Forest	PCT1646/HU860 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	17.5
Mahogany-Baloskion Swamp Forest	PCT1725/HU939 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast	2.3
Coastal Tea-tree – Banksia Scrub	PCT1646/HU860 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	20.5
Foredune Spinifex	PCT1204/(no equivalent BVT) – Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion	1.4
Beach Wetlands	No equivalent PCT or BVT	3.2
Cleared land/sand dunes	No equivalent PCT or BVT	66.7
Total		**111.6**

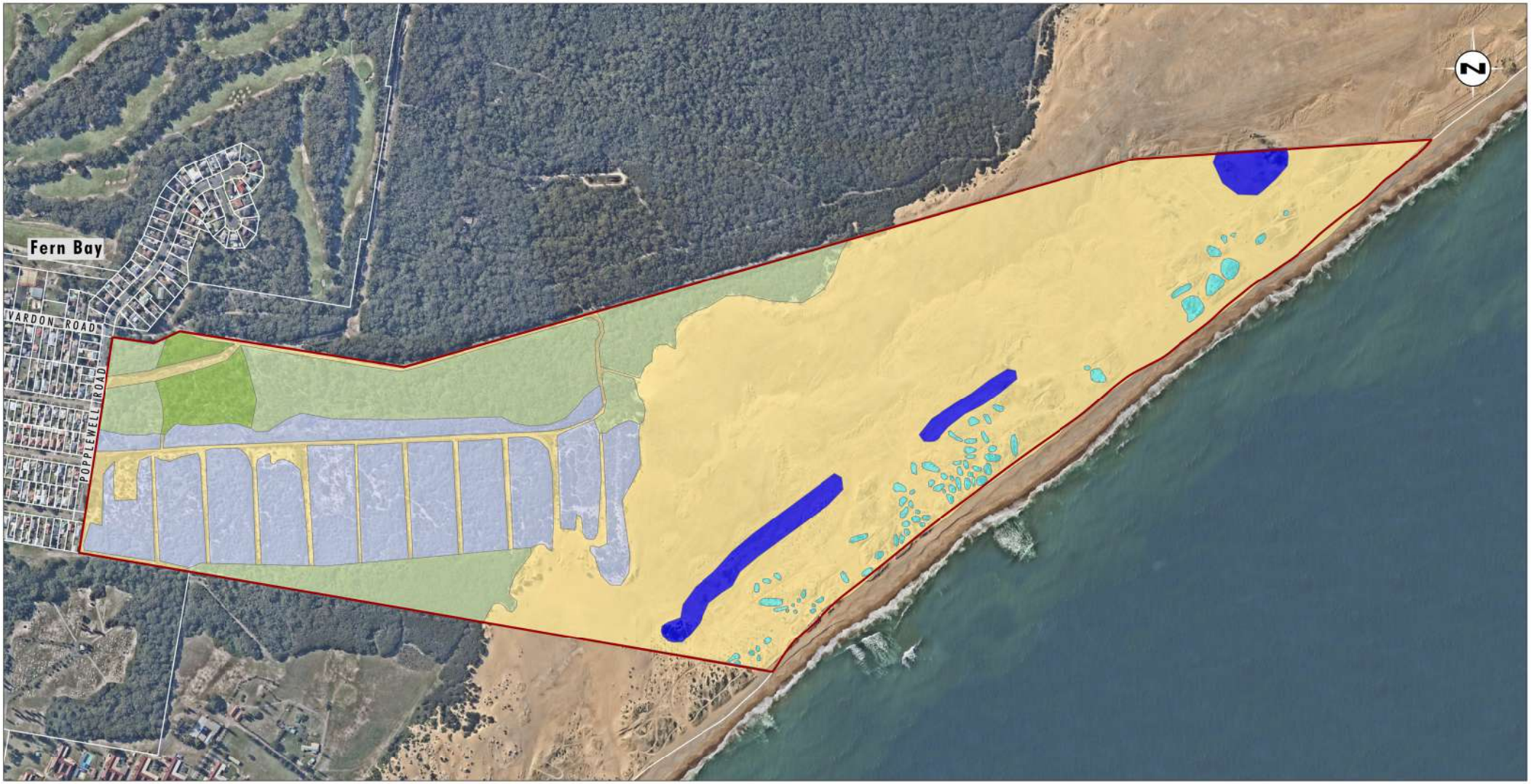

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2009)

0 100 250 500m
1:10 000

Legend

- Site Boundary
- Frontal Dune Blackbutt-Apple Forest
- Mahogany-Baloskion Swamp Forest
- Coastal Tea-tree-Banksia Scrub
- Beach Wetlands
- Foredune Spinifex
- Cleared Land/Sand Dunes

FIGURE 3.1

Preliminary Vegetation Community Mapping

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20180524 16.13

3.2.1 Vegetation Community Descriptions

Tables 3.3 to **3.7** below describe the vegetation communities occurring in the Study Area.

Table 3.3 Frontal Dune Blackbutt-Apple Forest

Community Name	Frontal Dune Blackbutt-Apple Forest	
Likely Plant Community Type (PCT)	PCT1646/HU860 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	
Vegetation Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Vegetation Class	Coastal Dune Dry Sclerophyll Forests	
Total Area in Study Area (ha)	17.5	
General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. This vegetation community condition class is located primarily to the north of the Study Area adjoining the habitats of Worimi Regional Park. This community also occurs in a smaller patch to the south of the Study Area.	
Floristic Description	This community is a moderately open forest with a shrubby understorey. The canopy is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis*). The midstorey was dominated by old man banksia (*Banksia serrata*), Sydney golden wattle (*Acacia longifolia*) and coastal tea-tree (*Leptospermum laevigatum*), with occasional coast banksia (*B. integrifolia*). The ground cover consisted primarily of bracken fern (*Pteridium esculentum*) with spiny-headed mat-rush (*Lomandra longifolia*), raspwort (*Gonocarpus teucrioides*), blue flax lily (*Dianella caerulea*), blady grass (*Imperata cylindrica*) and kangaroo grass (*Themeda triandra*) also present. The exotic bitou bush (*Chrysanthemoides monilifera*) and lantana (*Lantana camara*) also occur in this community.	
TSC Act Status	This vegetation community does not conform to a TEC listed under the TSC Act.	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

Table 3.4 Mahogany-Baloskion Swamp Forest

Community Name	Mahogany-Baloskion Swamp Forest	
Likely Plant Community Type (PCT)	PCT1725/HU939 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast	
Vegetation Formation	Forested Wetlands	
Vegetation Class	Coastal Swamp Forests	
Total Area in Study Area (ha)	2.3	
General Description	This vegetation community occurs on a low lying area in the west of the Study Area and is located either side of the Frontal Dune Blackbutt-Apple Forest resulting in ecotonal influences.	
Floristic Description	This community is characterised by a canopy of swamp mahogany (*Eucalyptus robusta*) with occurrences of likely hybrids of swamp mahogany and Earp's gum (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*). Common midstorey species include coast teatree (*Leptospermum laevigatum*), tantoon (*Leptospermum polygalifolium*), tree broom-heath (*Monotoca elliptica*) and common fringe-myrtle (*Calytrix tetragona*). The native groundcover is dominated by pomax (*Pomax umbellata*), spiny-headed mat-rush (*Lomandra longifolia*), blue flax-lily (*Dianella caerulea*) and bracken fern (*Pteridium esculentum*).	
TSC Act Status	This vegetation community does not conform to a TEC listed under the TSC Act due to the low number of characteristic flora species and lack of association with an alluvial floodplain (refer to **Section 3.4.1.4**).	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

Table 3.5 Coastal Tea-tree – Banksia Scrub

Community Name	Coastal Tea-tree – Banksia Scrub	
Likely Plant Community Type (PCT)	PCT1646/HU860 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	
Vegetation Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Vegetation Class	Coastal Dune Dry Sclerophyll Forests	
Total Area in Study Area (ha)	20.5	
General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. This vegetation community condition class is likely to be derived from the Frontal Dune Blackbutt-Apple Forest occurring in the north and south of the Study Area. Historical disturbances from the former use of the Rifle Range have modified this community with groundcovers and shrubs now dominating. This community is likely to have previously conformed to the Frontal Dune Blackbutt-Apple Forest. This community occurs in the central portion of the Study Area associated with the Rifle Range footprint.	
Floristic Description	This community occurs as a shrubland and is primarily dominated by coastal tea-tree (*Leptospermum laevigatum*) with occurrences of coastal wattle (*Acacia longifolia* subsp. *sophorae*), tree broom-heath (*Monotoca elliptica*) and coast banksia (*Banksia integrifolia*). The native groundcover consisted primarily of pig face (*Carpobrotus glaucescens*), spiny-headed mat-rush (*Lomandra longifolia*), *Hibbertia* sp. and kidney weed (*Dichondra repens*). The exotic bitou bush (*Chrysanthemoides monilifera*) and lantana (*Lantana camara*) also occur in this community. Disturbance of this community is varied with some areas recently cleared with sparse vegetation cover and other areas presenting dense coastal tea-tree stands. This community also extends to the dune margins to the east of the Study Area where it is dominated by bitou bush (*Chrysanthemoides monilifera*) with occurrences of pig face (*Carpobrotus glaucescens*). Other exotic vegetation on the dune margins includes prickly pear (*Opuntia stricta*), African love grass (*Eragrostis curvula*) and buffalo grass (*Stenotaphrum secundatum*).	
TSC Act Status	This vegetation community does not conform to a TEC listed under the TSC Act.	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

Table 3.6 Foredune Spinifex

Community Name	Foredune Spinifex	
Likely Plant Community Type (PCT)	PCT1204/(no equivalent BVT) – Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion	
Vegetation Formation	Grasslands	
Vegetation Class	Maritime Grasslands	
Total Area in Study Area (ha)	1.4	
General Description	This vegetation community occurs on the incipient foredunes on the far eastern sections of the Study Area. This community occurs sporadically along the mobile sands of Stockton Bight, and is characterised by the colonising, sand-stabilising grass *Spinifex sericeus*. These are often temporary communities found growing on mobile sand deposits such as beach foredunes and dune blowouts. Beach spinifex grassland is found across beach strands in New South Wales.	
Floristic Description	The dominant species in this community is hairy spinifex (*Spinifex sericeus*) with patches of bitou bush (*Chrysanthemoides monilifera*). In some areas, bitou bush appears to be dominant and threatening the persistence of the spinifex community.	
TSC Act Status	This vegetation community does not conform to a TEC listed under the TSC Act.	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

Table 3.7 Beach Wetlands

Community Name	Beach Wetlands	
Likely Plant Community Type (PCT)	No equivalent PCT	
Vegetation Formation	N/A	
Vegetation Class	N/A	
Total Area in Study Area (ha)	3.2	
General Description	This community occurs within depressions along the dune system. Beach wetlands form where fresh groundwater meets the surface, typically at the foot of larger sand dunes, and allows simple ecosystems of perennial and ephemeral wetland species to survive. A range of floristic variations of this community are known to occur along Stockton Beach. Two of these variants, *Carex* meadows and *Ficinia* reedlands, occur to the east of the Study Area on the dunes.	
Floristic Description	This vegetation community occurs as two variants within the Study Area, the first being *Carex pumila* meadows, which is dominated by *Carex pumila*, occasional *Ficinia nodosa* and the exotic *Hydrocotyle bonariensis*. The second variant includes *Ficinia* reedlands, dominated by *Ficinia nodosa*, *Juncus pallidus*, *Hydrocotyle bonariensis* with wetland margins containing coast banksia (*Banksia integrifolia*) and bitou bush (*Chrysanthemoides monilifera*). At the time of survey these areas did not contain standing water and it is likely that these wetlands are dynamic in response to wet periods.	
TSC Act Status	This vegetation community is likely to conform to Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC (refer to **Section 3.4.1.4**).	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

3.3 Fauna and Fauna Habitats

3.3.1 Fauna Species

A wide range of fauna species have been recorded within and surrounding the Study Area as part of previous ecological surveys.

Thirty seven bird, ten mammal, two reptile and two amphibian species have been previously recorded in the Study Area utilising a wide range of habitats. Of these, four threatened species listed under the TSC Act and/or EPBC Act have been recorded. These are further discussed in **Section 3.4**.

Commonly recorded species observed in the forest and shrubland habitats include laughing kookaburra (*Dacelo novaeguineae*), grey butcherbird (*Cracticus torquatus*), red-browed finch (*Neochmia temporalis*), red wattlebird (*Anthochaera carunculata*) and swamp wallaby (*Wallabia bicolor*). Introduced fauna species observed within the Study Area include feral cat (*Felix catus*), red fox (*Vulpes vulpes*) and the European rabbit (*Oryctolagus cuniculus*). A full fauna list for the Study Area is included in **Appendix B**.

3.3.2 Fauna Habitats

Several general fauna habitat types occur in the Study Area. Each of these broad habitat types has a range of characteristics which influence the habitat value, and the range of fauna species that are likely to be identified within each type. The broad habitat types recorded within the Study Area consist of forest, shrubland and dune spinifex/wetland habitat.

Forested habitats of the Study Area are dominated by eucalypts species which are likely to provide a seasonally prolific nectar resource for birds such as honeyeaters and lorikeets. The forested habitats of the Study Area contain limited hollow resources due a general lack of mature and old growth trees. The forest understorey provides potential foraging habitat for micro-bats, macropods, birds and some limited nesting potential in protected areas for small woodland birds. The ground cover is dense with several fallen hollow branches and trees providing foraging and refuge resources for reptiles and small terrestrial mammals. Water resources are limited within this habitat type.

The shrubland habitat in the central portion of the Study Area may provide habitat resources for a wide range of nectarivorous species. This habitat is considered to be derived from the surrounding forest habitat, with the community likely a result of ground disturbance in this area. Small birds such as the brown quail (*Coturnix ypsilophora*), superb fairy wren (*Malurus cyaneus*) and red-browed finch (*Neochmia temporalis*), and reptiles such as the eastern striped skink (*Ctenotus robustus*) are provided foraging habitat as well as refuge habitat within the dense shrub layers.

The dune spinifex and wetland habitat in the Study Area is subject to coastal winds with minimal vegetation and no fauna species were recorded at the time of the surveys. Despite this, it is likely that sea birds such as gulls and terns would occasionally utilise these areas for foraging or roosting. Common species such as silver gull (*Chroicocephalus novaehollandiae*), crested tern (*Thalasseus bergii*) and red-capped plovers (*Charadrius ruficapillus*) are likely to occur in these habitats. There is potential for migratory wader birds to forage along the tideline or nest on sandflats between the dunes immediately behind the beach.

3.3.2.1 Hollow-bearing Trees

Seventeen hollow bearing trees were identified within the Study Area, primarily in the northern extent of remnant vegetation. The locations of these trees were recorded using a handheld GPS. A total of 7 tiny hollows (<25mm diameter), 14 small hollows (26-50mm diameter), and 5 medium hollows (51 – 100mm diameter) were identified (refer to **Table 3.8**). These results demonstrate a low number of habitat trees with predominantly smaller sized hollows. These were typically formed at the end of spouts while a small number were found within trunks of stags or trees with a substantial amount of dieback. These observations were not unexpected given hollows associated with viable habitat are characteristic of older, mature to over-mature trees, which do not occur within the Study Area.

Table 3.8 Hollow-bearing Trees within the Study Area

Tree Species	DBH (mm)	Number of Hollows				
		Tiny <25mm	Small 26-50mm	Medium 51-100mm	Large 100-300mm	Extra Large 301+
blackbutt *Eucalyptus pilularis*	500	3	-	-	-	-
blackbutt *Eucalyptus pilularis*	400	-	2	-	-	-
blackbutt *Eucalyptus pilularis*	500	-	1	-	-	-
smooth-barked apple *Angophora costata*	800	-	1	-	-	-
blackbutt *Eucalyptus pilularis*	800	-	1	-	-	-
blackbutt *Eucalyptus pilularis*	600	-	2	1	-	-
unknown (substantial dieback)	400	-	-	1	-	-
stag (dead tree)	300	1	1	-	-	-
stag	300	1	-	-	-	-
stag	300	2	-	-	-	-
blackbutt *Eucalyptus pilularis*	400	-	1	-	-	-
smooth-barked apple *Angophora costata*	300	-	1	-	-	-

Tree Species	DBH (mm)	Number of Hollows				
		Tiny <25mm	Small 26-50mm	Medium 51-100mm	Large 100-300mm	Extra Large 301+
smooth-barked apple *Angophora costata*	600	-	-	1	-	-
blackbutt *Eucalyptus pilularis*	800	-	-	1	-	-
blackbutt *Eucalyptus pilularis*	300	-	-	1	-	-
blackbutt *Eucalyptus pilularis*	400	-	1	-	-	-
blackbutt *Eucalyptus pilularis*	500	-	3	-	-	-
Total		**7**	**14**	**5**	**0**	**0**

3.3.2.2 Koala Habitat

Koalas feed on the foliage of eucalypt tree species and in some areas exhibit extremely strong preferences for particular eucalypt species. State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) (currently under review) lists preferred koala feed trees as does the Comprehensive Koala Plan of Management (CKPoM) (PSC 2002) and the Approved Recovery Plan for the Koala (DECC 2008). One of these feed species, swamp mahogany (*Eucalyptus robusta*), is known to occur in the Study Area. Furthermore, an additional hybrid species being *Eucalyptus parramattensis* subsp. *decadens* x *robusta*, was likely recorded within the Study Area. These species are outlined in **Table 3.9** below as well as counts of preferred feed tree species in the Study Area as a result of the koala habitat tree survey.

Table 3.9 Preferred/Primary Koala Feed Trees

Preferred/Primary Koala Feed Tree Species	SEPP 44	Port Stephens Comprehensive Koala Plan of Management	Approved Recovery Plan for the Koala^	Number Recorded in the Study Area
swamp mahogany *Eucalyptus robusta*	✓	✓	✓	148
Parramatta red gum *Eucalyptus parramattensis*	-	✓	✓	2 (likely hybrid with *E. robusta*)
forest red gum *Eucalyptus tereticornis*	✓	✓	✓	-

Preferred/Primary Koala Feed Tree Species	SEPP 44	Port Stephens Comprehensive Koala Plan of Management	Approved Recovery Plan for the Koala^	Number Recorded in the Study Area
tallowwood *Eucalyptus microcorys*	✓	-	✓	-
grey gum *Eucalyptus punctata*	✓	-	-	-
ribbon or manna gum *Eucalyptus viminalis*	✓	-	-	-
river red gum *Eucalyptus camaldulensis*	✓	-	-	-
broad-leaved scribbly gum *Eucalyptus haemastoma*	✓	-	-	-
scribbly gum *Eucalyptus signata*	✓	-	-	-
white box *Eucalyptus albens*	✓	-	-	-
bimble box or poplar box *Eucalyptus populnea*	✓	-	-	-
cabbage gum *Eucalyptus amplifolia*	-	-	✓	-
			Total	**150**

^Appendix 2 – North Coast Koala Management Area

Koala habitat in the Port Stephens LGA has been mapped and presented in the Port Stephens Council Koala Plan of Management (PSC 2002). Koala habitat identification was undertaken by Lunney *et al.* (1998) and incorporated into the CKPoM which identified the following habitat types for koalas in the Port Stephens area:

- Preferred koala habitat
- Supplementary koala habitat
- Marginal koala habitat
- Habitat buffers
- Habitat linking areas.

Preferred habitat on the coastal strip of Port Stephens generally occurs in the intact Swamp Sclerophyll Forest community and supplementary habitat includes areas where the Swamp Sclerophyll Forest intergrades with the Smooth-barked Apple Blackbutt Forest vegetation community. The Port Stephens Koala Habitat Planning Map (PSC 2007) maps the Study Area as 'mainly cleared' with edges of 'supplementary habitat' occurring to the north of the site in association with the Frontal Dune Blackbutt-Apple Forest and the Worimi Conservation Lands.

However, based on the habitat categories by Lunney *et al.* (1998), it is likely that the Mahogany-Baloskion Swamp Forest would meet the definition of Category B vegetation detailed by Lunney *et al.* (1998) and therefore would be considered preferred koala habitat in the Port Stephens LGA. The Frontal Dune Blackbutt-Apple Forest is likely to confirm to Category C vegetation and would be considered supplementary koala habitat. The remaining vegetation in the Study Area is classified as 'other vegetation'. Koala habitat within the Study Area, mapped by Umwelt in consideration of Lunney *et al.* (1998), is shown in **Figure 3.2**.

The koala was targeted during surveys undertaken in May 2016 including SAT, call playback and spotlighting surveys (refer to **Section 2.3.2**). No evidence (scats, scratches, etc) of koala occupation was recorded in the Study Area. While the koala has not been specifically recorded within the Study Area, the species has been recorded as recently as 2015 in habitats associated with Fern Bay approximately 1.5km north of the Study Area.

An assessment of the proposed rezoning under the performance criteria for rezoning proposals in accordance with Appendix 2 the CKPoM (PSC 2002) is provided in **Section 4.6**.

3.4 Important Ecological Features

3.4.1 Threatened Species, Populations and Communities

Threatened species relevant to the Study Area are discussed in the sections below and shown in **Figure 3.2**.

3.4.1.1 Threatened Flora Species

No threatened flora species listed under the TSC or EPBC Acts have been previously recorded within the Study Area.

A range of threatened flora species have been previously recorded in the wider locality in similar habitats. **Table 3.10** below outlines the threatened flora species that have been recorded in the Study Area or are likely to occur in the Study Area due to local records and the availability of suitable habitat. A full list and assessment of the threatened species previously recorded within 10km of the Study Area is provided in **Appendix C**.

Table 3.10 Threatened Flora Species Recorded or Likely to Occur in the Study Area

Species Name	TSC Act	EPBC Act	Records and Further Information
Earp's gum *Eucalyptus parramattensis* subsp. *decadens*	V	V	An atypical eucalypt was recorded within the Study Area that may be *Eucalyptus parramattensis* subsp. *decadens* x *robusta*. This species is known to hybridise with *Eucalyptus robusta* in the Worimi Regional Park just north of the Study Area (Bell and Driscoll 2010). The location of this individual is shown in **Figure 3.2**. Neither the OEH profile (OEH 2016) or the approved Commonwealth conservation advice (TSSC 2014) for this species discusses the inclusion of hybrids in the listed species. Most specimens present within Worimi (and surrounds) exhibit stronger characteristics of *Eucalyptus robusta* rather than *Eucalyptus parramattensis* subsp. *decadens* (Bell and Driscoll 2010). Samples of two potential Earps gum hybrids from the Study Area have been sent to the Royal Botanic Gardens in Sydney for formal identification.
sand doubletail *Diuris arenaria*	E	-	Not recorded within the Study Area. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats and has been recorded along the Tomaree Peninsula. This species was subject to targeted surveys on 8 September 2016 during the known flowering period for the species. It was not recorded within the Study Area, despite other known populations flowering in the locality.
rough doubletail *Diuris praecox*	V	V	Not recorded within the Study Area. Previously recorded in Fern Bay within 2km to the northeast of the Study Area in similar habitats. This species was subject to targeted surveys on 8 September 2016 during the known flowering period for the species. It was not recorded within the Study Area, despite other known populations flowering in the locality.
coast groundsel *Senecio spathulatus*	E	-	Not recorded within the Study Area. Has been previously recorded on the Stockton sand dunes approximately 10km northeast of the Study Area (Bell and Driscoll 2010). Likely to occur on the sand dunes in the east of the Study Area.

Notes:
V vulnerable
E endangered

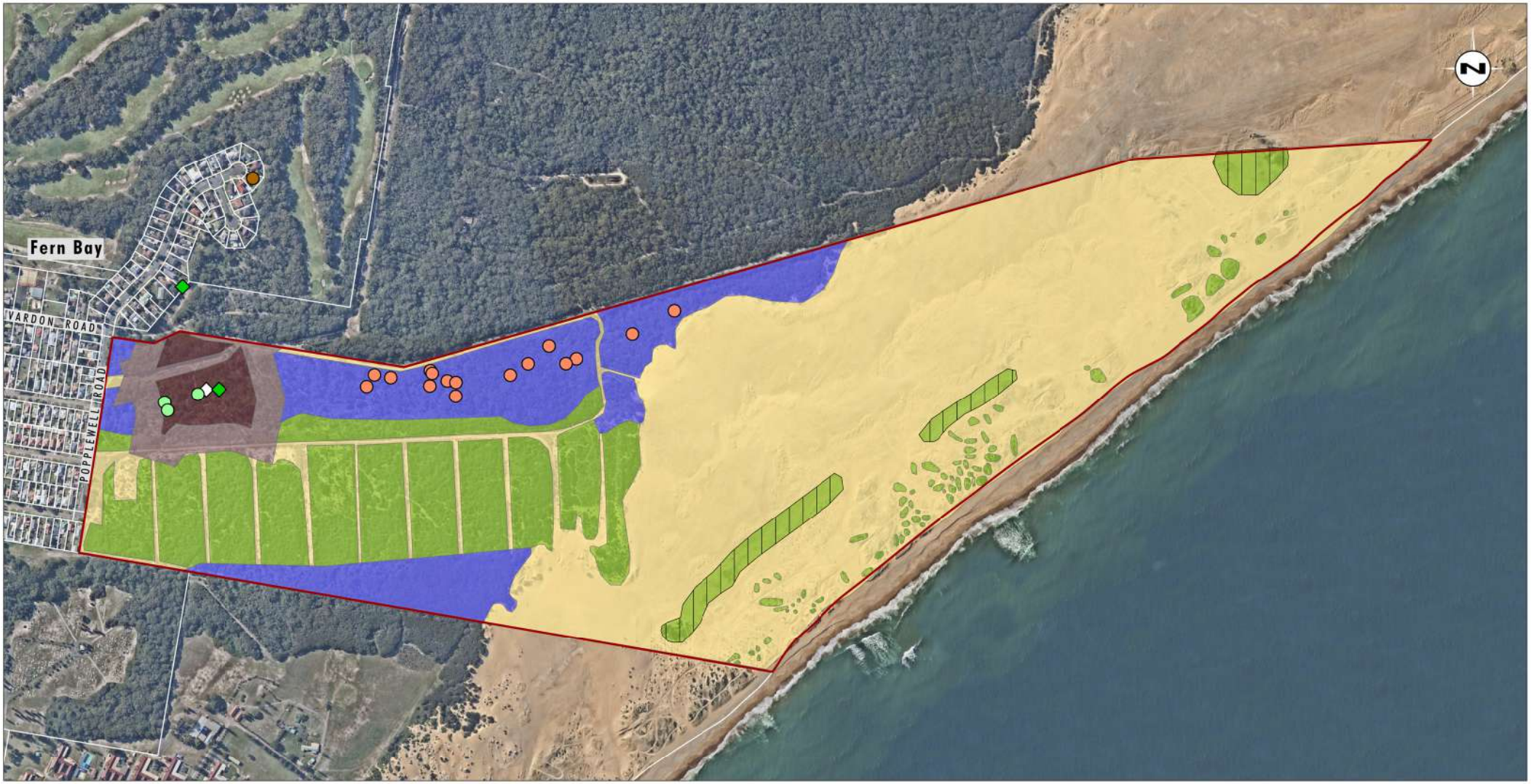

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2009), Atlas (2016)

0 100 250 500m
1:10 000

Legend

- Site Boundary
- Hollow-bearing Trees

Koala Habitat Entities:

- Preferred Koala Habitat
- 50m Buffer around Preferred Koala Habitat
- Supplementary Koala Habitat
- Other Vegetation
- Mainly Cleared

Threatened Species:

- Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC
- Eastern Bentwing-bat
- Little Bentwing-bat
- Powerful Owl
- *Eucalyptus parramattensis* subsp. *decadens x robusta*

FIGURE 3.2

Significant Ecological Features of the Study Area

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3.4.1.2 Threatened Fauna Species

Four threatened fauna species listed under the TSC or EPBC Acts have been previously recorded within the Study Area being:

- grey-headed flying-fox (*Pteropus poliocephalus*), listed as vulnerable under the TSC and EPBC Acts
- little bentwing-bat (*Miniopterus australis*), listed as vulnerable under the TSC Act
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), listed as vulnerable under the TSC Act
- east coast freetail-bat (*Mormopterus norfolkensis*), listed as vulnerable under the TSC Act.

Table 3.11 below outlines the threatened fauna species that have been recorded in the Study Area or are likely to occur in the Study Area due to local records and the availability of suitable habitat. A full list and assessment of the threatened species previously recorded within 10km of the Study Area is provided in **Appendix C**.

Table 3.11 Threatened Fauna Species Recorded or Likely to Occur in the Study Area

Species Name	TSC Act	EPBC Act	Records and Further Information
Amphibians			
wallum froglet *Crinia tinnula*	V	-	Not recorded within the Study Area. This species has been recorded in adjacent habitat associated with Fern Bay and swamp forests. Usually associated with wallum heaths and wet soak habitat.
Birds			
little tern *Sternula albifrons*	E	-	Not recorded within the Study Area. Previously recorded nesting in mined dunes along the south-western edge of the Worimi Conservation Lands. Likely to utilise the sandy habitats of the Study Area for nesting.
powerful owl *Ninox strenua*	V	-	Not recorded within the Study Area. Previously recorded in Fern Bay and within the Worimi Regional Park. Hollow resources are limited in the Study Area. Likely to utilise the Study Area for foraging resources.
masked owl *Tyto novaehollandiae*	V	-	Not recorded within the Study Area. Previously recorded in Fern Bay and within the Worimi Regional Park. Hollow resources are limited in the Study Area. Likely to utilise the Study Area for foraging resources.

Species Name	TSC Act	EPBC Act	Records and Further Information
white-bellied sea eagle *Haliaeetus leucogaster*	V	-	**Recorded** within the Study Area during the surveys undertaken in September 2016. The Study Area is likely to provide suitable foraging habitat and potential nesting habitat for the species, however no nests have been recorded in the Study Area.
Mammals			
New Holland mouse *Pseudomys novaehollandiae*	-	V	Not recorded within the Study Area. Known to occur in the Worimi Conservation Lands in similar habitats to that of the Study Area. It is associated with heathlands and vegetation sand dunes and is found to peak in abundance 3 to 5 years following a fire. The last fire to impact the Study Area occurred in late 2006 and would have likely resulted in suitable habitat for the species.
koala *Phascolarctos cinereus*	V	V	Not recorded within the Study Area. The Study Area contains two preferred koala feed trees, being swamp mahogany (*Eucalyptus robusta*) and likely Earps gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*) occurring in the northwest of the site in the Mahogany-Baloskion Swamp Forest. This species has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park. This species was targeted during surveys undertaken in May 2016 including SAT surveys, call playback and spotlighting (refer to **Section 2.3.2**). No evidence (scats, scratches, etc) of koala occupation was recorded in the Study Area. 150 preferred koala feed trees occur in the Study Area. The Study Area is unlikely to be core habitat for the Port Stephens koala population, however individuals may occur infrequently as they move through the landscape around Fern Bay.
squirrel glider *Petaurus norfolcensis*	V	-	Not recorded within the Study Area. This species has been recorded in adjacent similar habitat associated with Fern Bay. *Banksia serrata* in the forest understorey provides suitable foraging habitat for the species, however it is noted that hollow resources in the Study Area occur in low densities.

Species Name	TSC Act	EPBC Act	Records and Further Information
grey-headed flying-fox *Pteropus poliocephalus*	V	V	**Recorded** within the Study Area. Up to five individuals were observed foraging in the forested habitats of the Study Area in April 2007. No flying-fox camps have been recorded in the Study Area. The Study Area is likely to provide suitable foraging habitat for the species.
little bentwing-bat *Miniopterus australis*	V	-	**Recorded** within the Study Area. Detected on site using an Anabat detector in May 2016 in the forested habitats in the Study Area. The Study Area is likely to provide suitable foraging habitat for the species and potential hollow-bearing tree roosting habitat.
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	**Recorded** within the Study Area. Detected on site using an Anabat detector in May 2016 in the forested habitats in the Study Area. The Study Area is likely to provide suitable foraging habitat for the species.
east coast freetail-bat *Mormopterus norfolkensis*	V	-	**Recorded** within the Study Area. Detected on site using an Anabat detector in April 2007 (SMEC 2008) in the forested habitats in the Study Area. The Study Area is likely to provide suitable foraging habitat for the species and potential hollow-bearing tree roosting habitat.
greater broad-nosed bat *Scoteanax rueppellii*	V	-	Not recorded within the Study Area. Previously recorded in Fern Bay within 2km to the northeast of the Study Area in similar habitats. The Study Area is likely to provide suitable foraging habitat for the species and potential hollow-bearing tree roosting habitat.

Notes:

V vulnerable
E endangered
CE critically endangered

3.4.1.3 Endangered Populations

No endangered populations listed under the TSC or EPBC Acts have been previously recorded within the Study Area.

One endangered population is known to occur within the Port Stephens LGA, being the Emu population (*Dromaius novaehollandiae*) in the NSW North Coast Bioregion and Port Stephens LGA. The population is of significant conservation value as the last known population in northern coastal NSW, however this species has not been recorded within the Study Area or the locality and it is unlikely to occur.

3.4.1.4 Threatened Ecological Communities

One likely threatened ecological community (TEC) was recorded within the Study Area, being *Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC* listed under the TSC Act associated with the beach wetlands occurring in the east of Study Area. While the Study Area is not within the Sydney Basin Bioregion according to the current Version 7 of the IBRA Bioregion mapping (DSEWPC 2012), the EEC was gazetted in 2000 (NSWSC 2000), and, as per advice from OEH, TECs determined prior to March 2013 are to use mapping from Version 4.0 of the IBRA Bioregion mapping (Thackway and Cresswell 1995). As such, for the purposes of determining the presence or otherwise of ecological communities in the Study Area, the beach wetlands within the Study Area occur within the Sydney Basin Bioregion (Version 4.0 IBRA mapping) and conform to *Sydney Freshwater Wetlands EEC*.

No other threatened ecological communities listed under the TSC or EPBC Acts have been recorded within the Study Area. Further investigations into the presence or otherwise of *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions EEC* under the TSC Act have been undertaken and are detailed in **Appendix D**.

Table 3.12 below outlines the TECs that likely to occur in the Study Area due to local records and the availability of suitable habitat. A full list of the TECs previously recorded within 10km of the Study Area is provided in **Appendix C**.

Table 3.12 Threatened Ecological Communities Likely to Occur in the Study Area

Species Name	TSC Act	EPBC Act	Records and Further Information
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	EEC	-	Beach wetlands within the Study Area are likely to conform to this EEC. While the Study Area is not within the Sydney Basin Bioregion according to the current Version 7 of the IBRA Bioregion mapping, the EEC was determined prior to March 2013 (NSWSC 2000).

Notes:
EEC endangered ecological community

3.4.2 Matters of National Environmental Significance

Under the Commonwealth EPBC Act, the approval of the Commonwealth Minister for DoEE is required for any action that may have a significant impact on matters of national environmental significance (MNES). These matters are:

- listed threatened species and communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- the Great Barrier Reef Marine Park
- World Heritage properties
- National Heritage places
- nuclear actions
- a water resource, in relation to coal seam gas development and large coal mining development.

One MNES, and one potential MNES, have been recorded within the Study Area, being:

- grey-headed flying-fox (*Pteropus poliocephalus*), listed as vulnerable under the EPBC Act
- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*) (possible hybrid with *Eucalyptus robusta*), listed is vulnerable under the EPBC Act.

Grey-headed flying-fox was recorded in April 2007 feeding within the Frontal Dune Blackbutt-Apple Forest in the north of the Study Area. In accordance with the draft National Recovery Plan for the species (DECCW 2009), all foraging habitat has the potential to be productive during general food shortages and to therefore provide a resource critical to survival for the species.

Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*) may occur on the site as a hybrid with *Eucalyptus robusta*. An atypical eucalypt was recorded within the Study Area that may be *Eucalyptus parramattensis* subsp. *decadens* x *robusta*. This species is known to hybridise with *Eucalyptus robusta* in the Worimi Regional Park just north of the Study Area (Bell and Driscoll 2010). The Commonwealth Approved Conservation Advice for the species (TSSC 2014) does not provide advice on the inclusion of hybrids in the listed species. Under the Precautionary Principle, it is appropriate to treat hybrids as the threatened species that forms part of the hybrid material. Further investigation into this specimen will be undertaken during the Development Application phase of the Project.

The following MNES are considered to have the potential to occur within the Study Area due to local records and the availability of suitable habitat:

- rough doubletail (*Diuris praecox*), listed as vulnerable under the EPBC Act
- swift parrot (*Lathamus discolor*), critically endangered under the EPBC Act
- regent honeyeater (*Anthochaera phrygia*) critically endangered under the EPBC Act

- koala (*Phascolarctos cinereus*), vulnerable under the EPBC Act
- New Holland mouse (*Pseudomys novaehollandiae*), vulnerable under the EPBC Act
- spotted-tailed quoll (*Dasyurus maculatus*), endangered under the EPBC Act
- long-nosed potoroo (*Potorous tridactylus*), vulnerable under the EPBC Act
- little tern (*Sternula albifrons*), migratory under the Bonn Convention, China –Australia Migratory Bird Agreement (CAMBA), Japan- Australia Migratory Bird Agreement (JAMBA) and Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA)
- crested tern (*Thalasseus bergii*), migratory under JAMBA
- white-throated needletail (*Hirundapus caudacutus*), migratory under the CAMBA, JAMBA and ROKAMBA
- fork-tailed swift (*Apus pacificus*), migratory under the CAMBA, JAMBA and ROKAMBA
- eastern osprey (*Pandion cristatus*), migratory under the Bonn Convention.

A wide range of threatened and migratory shorebird species, listed under the EPBC Act, are known to occupy the Stockton Sandspit located approximately 1km to the southwest of the Study Area. The Stockton Sandspit foreshore is one of the most important high tide roosts for shorebirds in the Hunter Estuary (Herbert 2007) containing saltmarsh, mudflats and lagoon areas suitable as foraging and roosting habitat. Species such as black-tailed godwit (*Limosa limosa*), eastern curlew (*Numenius madagascariensis*), marsh sandpiper (*Tringa stagnatilis*), great knot (*Calidris tenuirostris*), sharp-tailed sandpiper (*Calidris acuminata*) and curlew sandpiper (*Calidris ferruginea*) are regularly recorded in the summer months.

Furthermore, the Hunter Estuary Wetlands Ramsar Wetland of International Importance occurs within 250m to the west of the Study Area, mapped along the edges of the northern arm of the Hunter River. The Hunter Estuary Wetlands are listed internationally under the Ramsar Convention due to their unique mix of wetland types, importance for maintaining biological diversity and conservation of migratory shorebirds, including regularly supporting between 2 per cent and 5 per cent of the East Asian–Australasian Flyway population of eastern curlew (*Numenius madagascariensis*) (Australian Wetlands Database 2016).

3.4.3 Corridors and Connectivity

The Study Area occurs on the southern edge of extensive areas of forested habitat within the Worimi Conservation Lands that provide connectivity and movement corridors for a wide range of flora and fauna species from Stockton in the south to Tomaree and Nelson Bay in the north. The Study Area contains intact vegetation primarily along its northern boundaries. While this allows some east to west fauna movement from the coastal dune area to the Hunter River estuary, the value of this is limited due to residential areas and Nelson Bay Road to the west of the Study Area. Connectivity from the south of the site to Stockton is currently highly fragmented as a result of previous residential and urban development.

Dune habitat along the eastern portion of the Study Area contains minimal and sparse vegetation, however is part of a large coastal dune system reaching from Stockton to Nelson Bay. Consequently the dune system provides an important corridor along the length of the Newcastle Bight.

The Study Area is also broadly part of the conceptual Lower Hunter Biodiversity Conservation Corridor (the 'Green Corridor') that connects remaining areas of vegetation from the Watagans National Park in the south through to Hexham Swamp and into Port Stephens in the north (DECCW 2009). Landscape connections are important to ensure the exchange of genetic material and ensure adequate feeding areas, breeding grounds and to allow for migration for species.

4.0 Assessment of Impacts

4.1 Avoidance Measures

DHA undertook a detailed constraints study to guide the design of the Master Plan. Through this process, different development concepts were considered and DHA has sought to minimise the biodiversity impacts associated with the proposed rezoning. Key factors in selecting the location of the disturbance footprints included the likely impacts on important ecological features, including threatened species, TECs and/or their habitats.

Ecological site inspections were undertaken in May 2016 within the Study Area to provide information on the early design phase of the Master Plan. The final layout of the Master Plan was determined in consideration of the biodiversity values of the Study Area. It was found that the area north of the Study Area contained higher value vegetation and fauna habitat in structured woodland areas than the lower quality scattered woodland trees and exotic groundcovers dominating the central portion of the Study Area and therefore the disturbance area for the development was focused in the areas of lower ecological value.

In addition to avoiding areas of high conservation value, the proposed rezoning includes provision for large lots with minimal building envelopes to retain as much vegetation surrounding and within the residential buildings as possible. This should allow continued connectivity in a north/south direction across the site following the completion of construction. This was considered to provide an important mechanism particularly for the movement of species such as the koala, which is known to occur to the north of the Study Area, and also allows for the targeted selected retention of important habitat features such as hollow-bearing trees.

4.2 Assessment of Master Plan

The proposed rezoning has been designed with the aim of providing a development approach which balances the economic potential of the Study Area with appropriate biodiversity conservation outcomes for the broader Stockton area. In order to achieve this outcome, focus has been paid to the retention of as much intact vegetation as practical as well as the retention and protection of identified important ecological features of the Study Area.

The current Master Plan indicates a maximum disturbance of an estimate 17.9 hectares of vegetation within the Study Area. It is notable that this is a maximum potential impact, and does not take into account the existing disturbed nature of a substantial part of the vegetation in the area to be developed, nor vegetation that will be able to be retained within the larger lots. Impacts are inclusive of Asset Protection Zones (APZs) that will require maintenance and thinning activities to provide suitable fire protection to residential buildings across the development.

The majority of the area to be impacted comprises the previously Coastal Tea-tree – Banksia Scrub, with some impacts to the lower quality (weed infested) forest condition of this community in the northwest of the Study Area.

Section 4.1.1 describes the likely direct impacts and **Section 4.1.2** describes the likely indirect impacts associated the proposed rezoning.

4.2.1 Direct Impacts

The construction and operation of the proposed rezoning may result in a range of direct impacts on biodiversity values within the Study Area. Direct impacts include the loss of native vegetation and fauna habitats as a result of direct vegetation clearance for the construction of residential buildings, roads, gardens and parklands. Key ecological impacts include:

- the loss of native vegetation communities and fauna habitats
- reduction in known threatened species habitat, including:
    - known foraging habitat for the grey-headed flying-fox (*Pteropus poliocephalus*)
    - likely foraging habitat for threatened micro-bat species
    - buffer habitat for the koala (*Phascolarctos cinereus*).
- impacts to likely Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*) hybrids

Table 4.1 summarises the area of each vegetation community that may be impacted by the proposed rezoning and current Master Plan. It should be noted that the current Master Plan provides an indicative impact area and will likely be refined and finalised in the future development application.

A range of impact mitigation measures have been formulated to minimise the impact of vegetation loss, as discussed in **Section 5.0**.

Table 4.1 Vegetation Community Impacts as a Result of the Proposed rezoning

Vegetation Community	Area within the Study Area (ha)	Indicative Area to be Impacted by the current Master Plan (ha)^
Frontal Dune Blackbutt-Apple Forest	17.5	2.1
Mahogany-Baloskion Swamp Forest	2.3	0.0
Coastal Tea-tree – Banksia Scrub	20.5	15.9
Foredune Spinifex	1.4	0.0
Beach Wetlands	3.2	0.0
Cleared land/sand dunes	66.7	3.3
Total	**111.6**	**21.3**

^ to be refined and finalised for the development application

4.2.2 Indirect Impacts

The proposed rezoning is not expected to result in any substantial indirect impacts on the biodiversity values of surrounding lands during the construction or operational phases of the proposed rezoning. However, the following minor indirect impacts may occur during the construction and operational phases of the proposed rezoning:

- Edge effects resulting in increased weed species could invade naturally through removal of native vegetation.
- Increases in the occurrence of feral fauna species such as foxes, rabbits, pigs, dogs and cats resulting from disturbances.
- Noise impacts have the potential to adversely impact native species such as disturbing the roosting and foraging behaviour of fauna species and reducing the occupancy of areas of suitable habitat.
- Dust impacts have the potential to adversely impact native species during construction. Potential impacts include dust covering vegetation thereby reducing vegetation health and growth.
- Vehicle strike impacts on ground-dwelling fauna species with increased vehicle movements in the post-construction landscape.

Mitigation measures outlined in **Section 5.0** will minimise the potential for these indirect impacts occurring as a result of the proposed rezoning. The majority of impacts will be dealt with at the detailed Development Application stage.

4.3 Preliminary Seven Part Tests of Significance under the EP&A Act

The potential level of impact on threatened species listed under the TSC Act was assessed using a preliminary 'Seven Part Test of Significance' as detailed in Section 5A of the EP&A Act and the Threatened Species Assessment Guidelines (DECC 2007). As outlined in **Section 1.3**, the assessments in this report have not been updated to reflect the minor changes in relation to the replacement of the TSC Act by the BC Act. Threatened entities previously listed under the TSC Act were automatically transferred to be listed under the BC Act and the amended Assessment of Significance Test (now outlined in Section 7.3 of the BC Act) does not materially change the assessment outcome.

The Seven Part Tests of Significance were undertaken following an initial screening process to identify species that have a reasonable likelihood to be impacted by the proposed rezoning (refer to **Appendix C**). Preliminary assessments were undertaken for a range of species to determine the likelihood of significant impacts occurring on listed species and communities as a result of the rezoning proposal. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

The Seven Part Tests of Significance do not take into account the full range of impact mitigation strategies and offsets proposed for the development, rather they consider the impacts of the proposed rezoning without any mitigation or offsetting, consistent with the requirements of the Threatened Species Assessment Guidelines (DECC 2007). Seven Part Tests of Significance were undertaken in consideration of the following threatened species and communities listed under the TSC Act:

Threatened Ecological Communities

- *Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC*

Threatened Flora Species

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)
- rough doubletail (*Diuris praecox*)
- sand doubletail (*Diuris arenaria*)
- coast groundsel (*Senecio spathulatus*).

Threatened Fauna Species

- wallum froglet (*Crinia tinnula*)
- little tern (*Sternula albifrons*)
- regent honeyeater (*Anthochaera phrygia*)
- swift parrot (*Lathamus discolor*)
- turquoise parrot (*Neophema pulchella*)
- dusky woodswallow (*Artamus cyanopterus cyanopterus*)
- white-bellied sea eagle (*Haliaeetus leucogaster*)
- eastern osprey (*Pandion cristatus*)
- powerful owl (*Ninox strenua*)
- masked owl (*Tyto novaehollandiae*)
- koala (*Phascolarctos cinereus*)
- squirrel glider (*Petaurus norfolcensis*)
- long-nosed potoroo (*Potorous tridactylus*)
- grey-headed flying-fox (*Pteropus poliocephalus*)
- eastern false pipistrelle (*Falsistrellus tasmaniensis*)
- little bentwing-bat (*Miniopterus australis*)
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*)
- east coast freetail-bat (*Mormopterus norfolkensis*)
- hoary wattled bat (*Chalinolobus nigrogriseus*)
- greater broad-nosed bat (*Scoteanax rueppellii*)
- yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*)
- southern myotis (*Myotis macropus*).

The Seven Part Tests of Significance concluded that, based on the current Master Plan, the proposed rezoning was unlikely to result in a significant impact on threatened species or communities occurring or potentially occurring in the Study Area. Further investigations into the likely Earp's gum hybrid occurring within the Study Area is required to determine the conservation status and importance of the Earp's gum hybrid population occurring within the Study Area.

Any changes to the Master Plan following this assessment, as part of a future development application, will require a revised Seven Part Test of Significance under the EP&A Act.

4.4 Preliminary Assessments of Significance under the EPBC Act

The potential level of impact on threatened species listed under the EPBC Act was assessed using the 'Assessments of Significance' as detailed in the Significant Impact Guidelines 1.1 (DoE 2013). The assessments of significance were undertaken following an initial screening process to identify species that have a reasonable likelihood to be impacted by the proposed rezoning (refer to **Appendix C**). Preliminary assessments were undertaken for a range of species to determine the likelihood of significant impacts occurring on listed species and communities as a result of the rezoning proposal. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

As per the assessments under the EP&A Act (refer to **Section 4.3**), the assessments of significance do not take into account the full range of impact mitigation strategies and offsets proposed for the development, rather they consider the impacts of the proposed rezoning without any mitigation or offsetting.

Assessments of Significance were undertaken in consideration of the following threatened and migratory species listed under the EPBC Act:

Endangered and Critically Endangered Species

- swift parrot (*Lathamus discolor*)
- regent honeyeater (*Anthochaera phrygia*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) SE mainland population.

Vulnerable Species

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)
- rough doubletail (*Diuris praecox*)
- long-nosed potoroo (*Potorous tridactylus*)
- koala (*Phascolarctos cinereus*) combined populations of Qld, NSW and the ACT
- New Holland mouse (*Pseudomys novaehollandiae*)
- grey-headed flying-fox (*Pteropus poliocephalus*).

Migratory Species under International Conventions

- little tern (*Sternula albifrons*)
- crested tern (*Thalasseus bergii*)
- white-throated needletail (*Hirundapus caudacutus*)
- fork-tailed swift (*Apus pacificus*)
- eastern osprey (*Pandion cristatus*).

The Assessments of Significance concluded that, based on the current Master Plan, the proposed rezoning was unlikely to result in a significant impact on MNES occurring or potentially occurring in the Study Area. Further investigations into the likely Earp's gum hybrid occurring within the Study Area is required to determine the conservation status and importance of the Earp's gum hybrid population occurring within the Study Area.

Due to the nature of the proposed rezoning and that no direct or indirect impacts are likely to occur on surrounding lands, it is unlikely that the proposed rezoning would impact the Hunter Estuary Wetlands Ramsar Site or Stockton Sandspit known to provide habitat for EPBC Act-listed threatened and migratory species.

Any changes to the Master Plan following this assessment, as part of a future development application, will require a revised Assessment of Significance under the EPBC Act.

4.5 Impacts on Adjacent Conservation Areas

The Project will not result in direct impacts to the adjacent Worimi Regional Park which occurs immediately to the north of the Study Area. The proposed rezoning will be managed appropriately in order to limit the potential for indirect impacts and potential management strategies will be discussed with the Worimi Local Aboriginal Land Council and National Parks and Wildlife Service.

The Master Plan has incorporated a minimum 20 metre buffer zone between the project components and Worimi Regional Park boundaries in order to minimise the potential for indirect impacts to the conservation value of the Worimi Regional Park. Broadly, the vegetation in the northern portion of the Study Area will be retained and provide a substantial buffer area between the development and the Worimi Regional Park.

4.6 Assessment of CKPoM Performance Criteria for Rezoning Proposals

Performance criteria for rezoning requests apply only to circumstances where a request is made of Council to rezone land in relation to impacts on the koala. Consideration is to be given to the matters outlined in **Table 4.4** (from Appendix 2 of the CKPoM (PSC 2002)) when assessing rezoning requests including any amendment to the Port Stephens LEP.

Table 4.2 Assessment of Performance Criteria from CKPoM

Performance Criteria from CKPoM (Appendix 2)	Assessment of the Proposed rezoning
Rezoning proposals should:	
a) *not result in development within areas of Preferred Koala Habitat or defined Habitat Buffers*	The areas subject to disturbance within the Study Area are currently mapped identified on the Koala Habitat Planning Map (PSC 2007) as being 'mainly cleared', however it is acknowledged that the Mahogany-Baloskion Swamp Forest occurring in the north eastern portion of the Study Area is likely to conform to 'preferred habitat' with the immediate surrounds including 'habitat buffers' as per Lunney *et al.* (1998). The current Master Plan shows some encroachment into 1.6 hectares of buffer habitat around preferred mainly associated with the asset protection zones of the cluster homes. No impacts are expected to occur within the preferred koala habitat. The proposed disturbance area in this habitat is highly disturbed due to weed infestations and previous clearance and occurs on the edge of existing residential areas. No evidence of koalas has been recorded in the Study Area.
b) *allow for only low impact development within areas of Supplementary Koala Habitat and Habitat Linking Areas*	The proposed rezoning seeks to minimise the impacts on important ecological features across the site and create a residential development that aims to balance the built environment with the natural environment. The current Master Plan shows minimal impacts, being 1.6 hectares, to the identified 'supplementary habitat' associated with the Frontal Dune Blackbutt-Apple Forest in the north and south of the Study Area.
c) *minimise the removal of any individuals of preferred koala food trees, where ever they occur on the site*	The Study Area is known to contain two preferred koala feed trees, being swamp mahogany (*Eucalyptus robusta*) and likely Earp's gum hybrid (*Eucalyptus parramattensis* subsp. *decadens x robusta*), which occur in the north eastern areas associated with the Mahogany-Baloskion Swamp Forest. 150 koala feed trees have been recorded in the Study Area. The proposed rezoning includes impacts into areas containing koala feed trees. This area includes cluster homes that will require some removal of these habitat trees and APZs subject to thinning and fire break management. The current Master Plan indicates potential disturbance to two koala feed trees. Where possible, koala feed trees will be selectively retained within the development footprint. Refer to the Preliminary Koala Plan of Management in **Appendix E** for details and koala feed tree mapping.

Performance Criteria from CKPoM (Appendix 2)	Assessment of the Proposed rezoning
Rezoning proposals should:	
d) *not result in development which would sever koala movement across the site. This should include consideration of the need for maximising tree retention on the site generally and for minimising the likelihood of impediments to safe/unrestricted koala movement*	The proposed rezoning is not expected to sever movement of the koala across the site. The Study Area occurs on the southern edge of extensive areas of forested habitat within the Worimi Conservation Lands that provide connectivity and movement corridors for koala from the Study Area in the south to Tomaree and Nelson Bay in the north. While the Study Area contains intact vegetation along its northern boundary, connectivity from the south of the site to Stockton is currently highly fragmented and limited as a result of previous residential and urban development. As the proposed rezoning has sought to avoid areas of higher habitat quality and focus building footprints in existing disturbed areas of the Study Area, it is unlikely that the proposed rezoning exacerbate the existing fragmentation across the site.

5.0 Mitigation, Management and Offsets

5.1 Mitigation Strategy

DHA has sought to avoid and minimise potential impacts on the ecological values of the Study Area throughout the design and planning process. This has included avoidance and minimisation of disturbance of key vegetation communities and fauna habitats. These avoidance measures are described in detail in **Section 4.1**.

DHA has committed to the design and implementation of a comprehensive strategy to mitigate the adverse impacts of the proposed rezoning. This section details the mitigation strategies that are designed to minimise impacts on important ecological features known to occur in the areas to be disturbed as part of any residential development that would result from the rezoning, subsequent to detailed planning and approval.

5.1.1 Pre-clearance Surveys and Clearance Supervision

A robust tree felling procedure will be implemented to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of habitat trees. The tree felling procedure is designed to minimise impacts to hollow-dependent fauna, koala and hollow-dependent micro-bats.

5.1.1.1 Pre-clearance Surveys

Pre-clearance surveys will be required within areas of woody native vegetation that are to be cleared. Pre-clearance surveys will be undertaken by suitably qualified and experienced ecologist and involve the following:

- the demarcation of areas approved for clearing to reduce risk of accidental clearing
- habitat resources and habitat trees should be identified and marked (note: habitat trees are those containing hollows, cracks or fissures and spouts, active nests, dreys or other signs of recent fauna usage. Other habitat features to be identified include fallen timber/hollow logs, burrows and boulder piles)
- the potential presence of threatened flora and fauna species, endangered populations and TECs should be identified
- the identification of species or habitat features that are suitable for translocation or salvage
- the presence of weed species and vertebrate pest species should be assessed, if relevant and
- disturbance activities should be targeted for specific times of the year to minimise impacts to target species usage of habitat features for breeding and roosting, where practicable.

5.1.1.2 Clearance Supervision

Tree clearing will be completed as close to the completion of pre-clearance surveys as practicable to limit the potential for new issues to arise (such as new active nests being built). Tree felling supervision will be undertaken by an appropriately qualified and experienced ecologist after pre-clearance surveys have identified potential threatened species habitat. The supervising ecologist will be licensed by the relevant field survey and ethics authorities to allow for capture, housing, transport and possibly ethical euthanizing of injured fauna. The tree-felling procedure will include the following:

- Prior to clearing identified habitat trees, the felling of non-habitat trees will be completed as close to the felling of habitat trees as possible, with all surrounding habitat trees to be vigorously shaken with heavy machinery.
- On the day of habitat tree felling, the following is to be undertaken:
    - all habitat trees will be subject to a visual inspection to survey for threatened species
    - trees previously identified as containing fauna will be shaken and then felled, providing no threatened species are identified
    - all reasonable attempts will be made to reduce the impact of felling on all fauna species. This may include delaying felling trees with fauna present or felling in sections to reduce potential for injury
    - the lowering of hollow-bearing trees will be done as gently as possible with heavy machinery
    - if a threatened species is identified in a habitat tree on the day of felling, the supervising person is to advise the most appropriate method to minimise potential harm. This may include leaving the tree overnight, further shaking to encourage the animal to vacate the tree, gradual removal of branches to discourage ongoing use, soft-felling of the tree with the animal in the tree, or measures to capture and relocate the animal to secure habitats
    - uninjured animals should be released on the day of capture into nearby suitable secure habitat and should not be held for extended periods of time, and
    - injured animals will be taken to the nearest veterinary clinic or wildlife carer as soon as possible for assessment and treatment. If required, the supervising person may ethically euthanize fauna
- Following felling, habitat trees will be inspected for remaining or injured fauna species and to ensure that no hollows are blocked against the ground. This may require the tree to be rolled to ensure adequate access
- All felled habitat trees should remain in place for a least one night to allow any fauna still present to move on
- Habitat features identified for translocation or salvage operations should be extracted and stored appropriately, and
- Detailed records should be maintained regarding the type and number of habitat features cleared, the type and number of fauna encountered and their fate. This will assist in informing mitigation programs such as nest boxes and habitat augmentation programs.

5.1.2 Weed Control

Weed species could be inadvertently brought into the Study Area with imported materials, or could invade naturally through removal of native vegetation. The increased presence of weed species within the Study Area has the potential to decrease the value of extant vegetation to native species, particularly threatened species.

The following management measures will be undertaken to minimise the potential impacts and spread of weeds during the construction of the proposed rezoning:

- Any vehicles or equipment being brought onto the Study Area to be involved in ground disturbance activities and/or travelling around the site must be inspected and cleaned prior to commencing work to limit the spread of seeds and plant material between sites.
- The limits of ground disturbance will be clearly demarcated and no unnecessary disturbance will be undertaken outside of these areas.
- Regular inspections will be undertaken in the Study Area to monitor the spread of weed species.
- Training of environmental personnel on the identification of target weed species.

Any outbreak of noxious weeds will be controlled and eradicated as required under the *Noxious Weeds Act 1993*, and as required by the Local Land Services and other relevant authorities. Weed control and eradication techniques may include:

- spraying with herbicides
- physical removal e.g. chipping, or
- minimisation of area available for weed infestation, through prompt revegetation of bare areas.

5.1.3 Site Management for Flora and Fauna Protection

DHA has sought to avoid areas of higher quality fauna and flora habitat in the Study Area. The following management measures are proposed to minimise the impacts on the local flora and fauna as a result of the proposed rezoning:

- Traffic control measures including 40 km/h speed limits and speed bumps installed in suitable locations.
- Signage within the development to minimise fauna injury/road kills, as much as possible.
- Minimisation of fencing between properties to reduce impacts on wildlife movement through the development.
- Where fencing is required, fauna-friendly fencing is to be used to allow for dispersal and safe fauna movement throughout the Study Area.
- Dog and cat ownership policies, such as requiring on-lead dogs and inside cats.
- Restricted vehicle and controlled pedestrian access along frontal dune system.

5.1.4 Specific Management of Koalas

DHA has substantially reduced the proposed rezoning footprint, avoiding large areas of high quality koala habitat across the Study Area. A Preliminary Koala Plan of Management has been prepared (refer to **Appendix E**) to guide the implementation of impact mitigation and management measures specific to the koala. The following measures are proposed to minimise the impacts on the local koala population as a result of the re-zoning:

- Traffic control measures/20 km/h speed limits/signage within the site to minimise fauna injury/road kills, as much as possible.
- Fencing to be used along the perimeter of the site to restrict koala from developed areas of the site and funnel individuals to move through retained high quality koala habitat.
- Detailed pre-clearing surveys, including pre-clearing nocturnal spotlighting and call playback surveys to be completed to specifically assess potential presence of the koala at the site prior to clearing activities.
- Detailed tree-felling procedures, including the use of adequately qualified and experienced ecologists and on-call wildlife rescue group to assist with any injured koalas, to minimise potential impact on koalas.
- Dog management including provisions for suitability fenced yards, management of vegetation adjacent to fencing and dog ownership covenants.
- Targeted koala feed tree planting such as swamp mahogany (*Eucalyptus robusta*) and Earps red gum (*Eucalyptus parramattensis* subsp*. decadens*).

5.1.5 Conservation Area Protection Measures

The Study Area adjoins the Worimi Regional Park which is jointly managed by the Worimi LALC and NPWS. The '*Guidelines for developments on adjoining land and water managed by the Department of Climate Change and Water*' (DECCW 2010) has been prepared to help avoid and minimise any direct or indirect adverse impacts on the National Parks estate.

The following issues need to be considered for developments adjoining reserve land and, in particular, their impacts:

- erosion and sediment control
- stormwater runoff
- wastewater
- management implications relating to pests, weeds and edge effects
- fire and the location of asset protection zones
- boundary encroachments and access through OEH lands
- visual, odour, noise, vibration, air quality and amenity impacts
- threats to ecological connectivity and groundwater dependent ecosystems
- cultural heritage.

In order to address the issues that are relevant to the Project, a range of measures have been proposed including the:

- use of a minimum 20 metre buffer zone between Worimi Regional Park and the Study Area to minimise the potential for adverse impact to NPWS estate
- implementation of weed control protocols within the buffer zone to prevent weed species spreading into Worimi Regional Park
- implementation of appropriate sediment and erosion control measures to ensure that there are no off-site impacts associated with the proposed rezoning.

5.1.6 Vegetation and Dune Rehabilitation

The aim of the dune rehabilitation will be to remove current weed infestations to establish and improve native coastal vegetation communities and fauna habitats occurring in the Study Area. Rehabilitation biodiversity objectives will be used in future rehabilitation planning as appropriate according to coastal hazard recommendations and should:

- aim to create a sustainable and stabilising vegetation community on the fore dunes
- focus on the planting of endemic coastal flora species
- aim to provide fauna movement habitat between the northern and southern boundaries of the site
- encourage ecological stewardship by promoting community planting days and wildlife watching.

Dune rehabilitation should consist of stabilising and returning the fore dune landscape to a condition characteristic of the natural coastal environment. Dune rehabilitation and landscaping between the development footprints will be conducted progressively during the construction and establishment of the development to self-sustaining native and coastal vegetation communities in line with the proposed vision of the Master Plan. Rehabilitation works will use local provenance endemic species (for native communities), including the consideration of seed availability.

5.2 Biodiversity Offsets and Buffers

This report has identified the numerous measures that have been undertaken as part of the planning and design of the Master Plan to avoid, minimise and then mitigate/offset the potential impacts of the proposed rezoning on the ecologically significant features of the Study Area. The implementation of these measures has resulted in a Master Plan that is likely to result in minimal residual impact on important ecological features.

The Master Plan also indicates the retention and protection of approximately 80 hectares within the Study Area. It is proposed that this will be protected via a proposed rezoning to National Parks and Reserves (E1) under the Port Stephens LEP or through a Biodiversity Stewardship Site under the *Biodiversity Conservation Act 2016*. This vegetation comprises the highest quality habitats in the Study Area being Frontal Dune Blackbutt-Apple Forest in the north and south of the Study Area. This includes the protection of preferred and supplementary koala habitat, as well as providing buffer vegetation between impacted areas and adjacent conservation areas.

The merits of these approaches will be determined by DHA at the Development Application phase.

6.0 Recommendations

It is recommended that the following additional ecological investigations are undertaken for the future development application phase of the project:

- Detailed floristic surveys, including systematic plots and transects in order to:
    - confirmation with the Royal Botanic Gardens Sydney on the occurrence or otherwise of the likely Earps gum hybrid (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*) occurring within the Mahogany-Baloskion Swamp Forest
    - collect appropriate vegetation integrity data for inclusion in a Biodiversity Development Assessment Report (BDAR) under the Biodiversity Assessment Method (BAM), if applicable.
- Targeted species-credit species surveys as applicable under the BAM and/or
- If the BAM is not applicable at the time of preparing the development application, update the Seven Part Tests of Significance under the EP&A Act and Assessments of Significance under the EPBC Act following the finalisation of the Master Plan and impact boundaries.

This assessment concludes that the proposed rezoning and use of the land for residential purposes could facilitate an acceptable ecological outcome on the site, subject to future detailed design and approvals.

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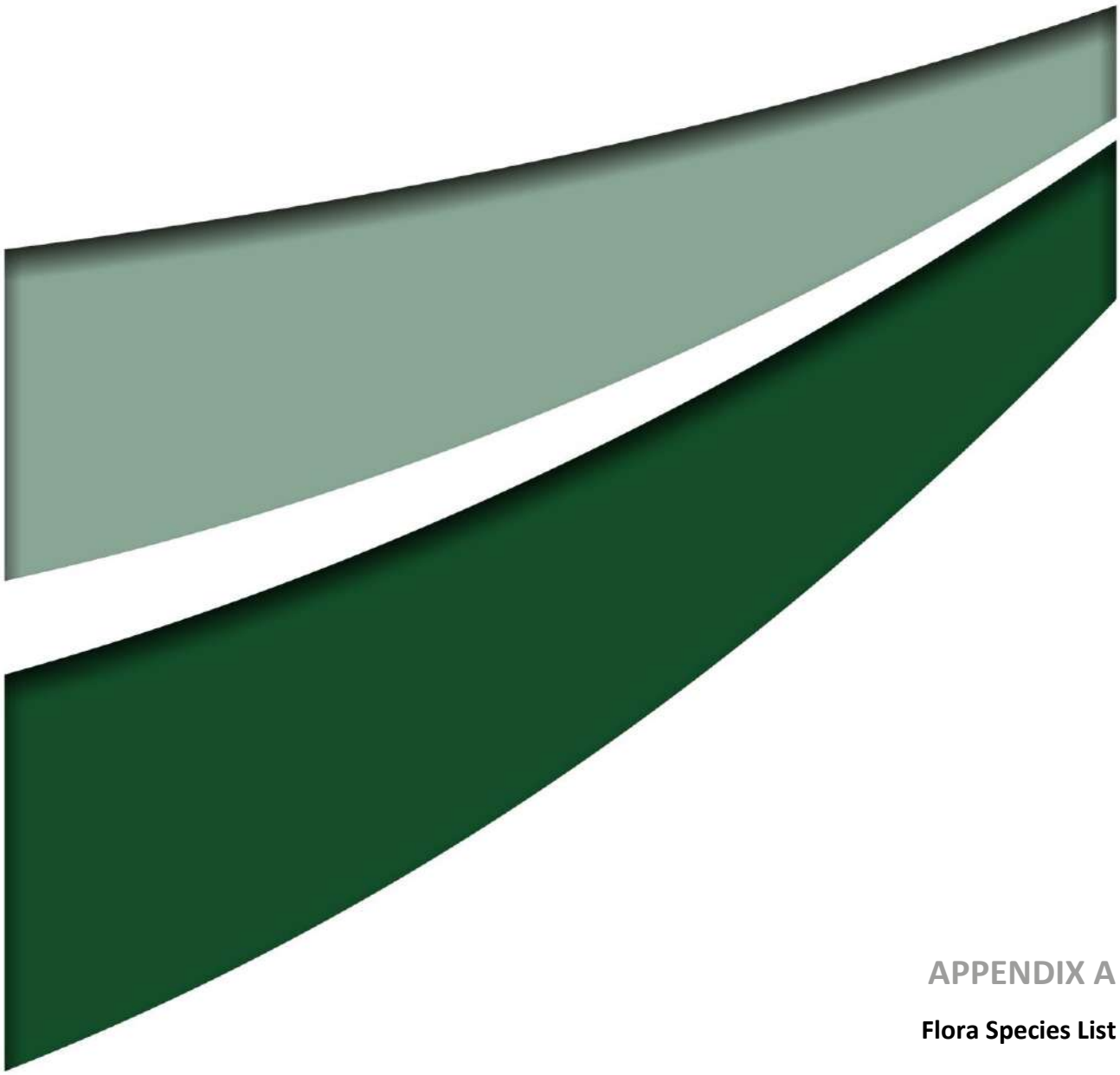


APPENDIX A

Flora Species List

Appendix A – Flora Species List

The following flora list was developed from surveys of the Study Area by SMEC (2008) Kleinfelder (2015) and Umwelt (2016). The list will not be comprehensive, because not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp. specimens that are identified to genus level only

The following abbreviations or symbols are used in the list:

asterisk (*) denotes species not native to the Study Area

subsp. subspecies

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002) and Wheeler *et al*. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2016), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Family	*Scientific Name*	Common Name	TSC Act Status	EPBC Act Status
FILICOPSIDA (FERNS)				
Blechnaceae	*Blechnum cartilagineum*	gristle fern	-	-
Blechnaceae	*Doodia aspera*	prickly rasp fern	-	-
Dennstaedtiaceae	*Pteridium esculentum*	bracken	-	-
MAGNOLIOPSIDA (FLOWERING PLANTS) – LILLIDAE (MONOCOTS)				
Arecaceae	*Livistona australis*	cabbage tree palm	-	-
Arecaceae	**Phoenix canariensis*	Canary Island date palm	-	-
Asparagaceae	**Asparagus aethiopicus*	asparagus fern	-	-
Commelinaceae	*Commelina cyanea*		-	-
Cyperaceae	*Carex pumila*	`	-	-
Cyperaceae	**Cyperus brevifolius*		-	-

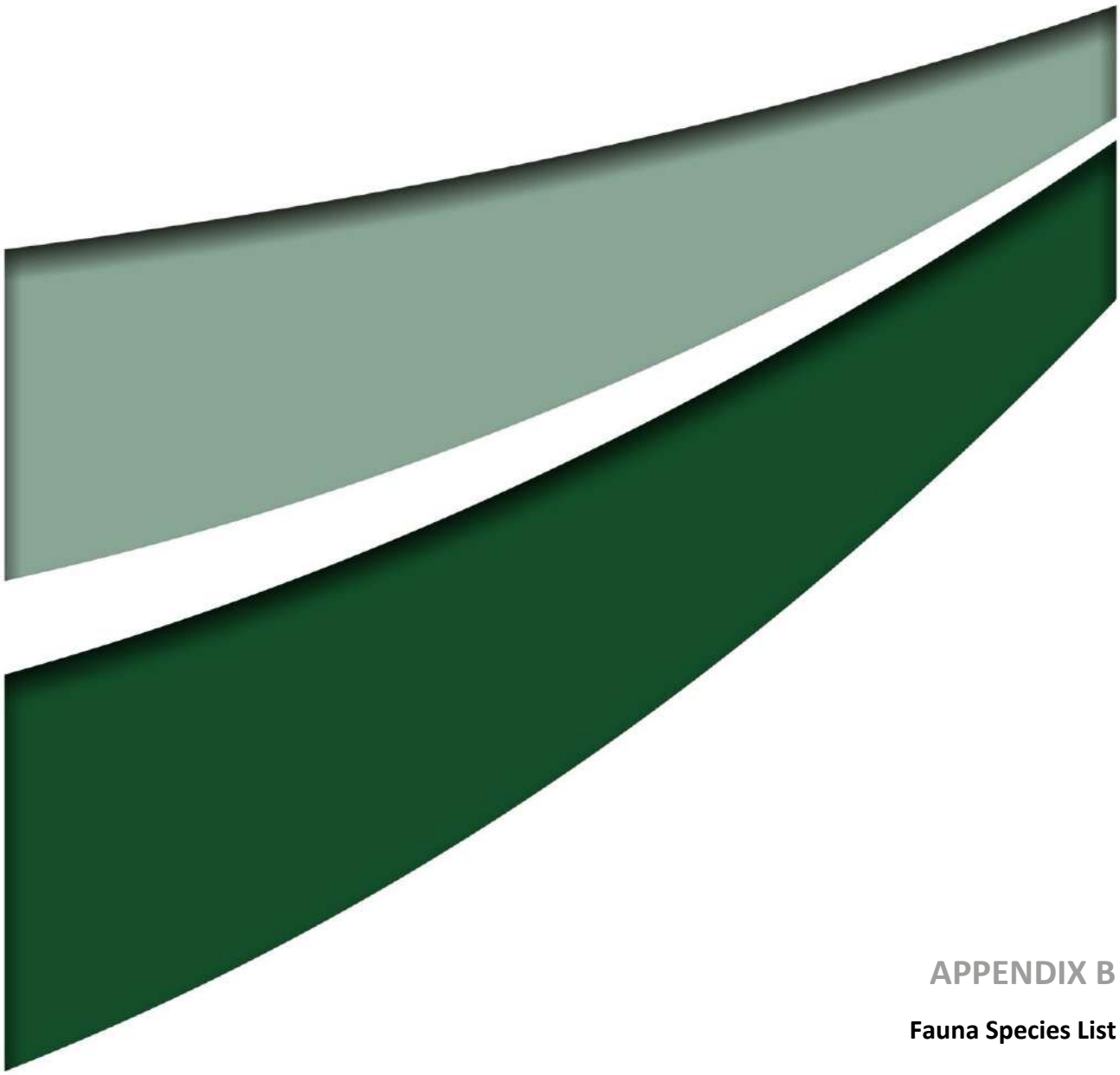
Family	*Scientific Name*	Common Name	TSC Act Status	EPBC Act Status
Cyperaceae	*Ficinia nodosa*	knobby club-rush	-	-
Cyperaceae	*Gahnia clarkei*	tall saw-sedge	-	-
Juncaceae	*Juncus pallidus*		-	-
Lomandraceae	*Lomandra filiformis*	wattle mat-rush	-	-
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush	-	-
Orchidaceae	*Microtis parviflora*	Slender onion orchid	-	-
Phormiaceae	Dianella *caerulea* var. *caerulea*	blue flax-lily	-	-
Phormiaceae	*Dianella caerulea* var. *producta*	blue flax-lily	-	-
Poaceae	**Briza minor*	shivery grass	-	-
Poaceae	*Dichelachne crinita*	longhair plumgrass	-	-
Poaceae	*Digitaria divaricatissima*	umbrella grass	-	-
Poaceae	**Ehrharta erecta*	panic veltgrass	-	-
Poaceae	*Enneapogon nigricans*	niggerheads	-	-
Poaceae	**Eragrostis curvula*	African lovegrass	-	-
Poaceae	*Eragrostis leptostachya*	paddock lovegrass	-	-
Poaceae	*Imperata cylindrica*	blady grass	-	-
Poaceae	**Melinis repens*	red natal grass	-	-
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass	-	-
Poaceae	*Panicum* sp.		-	-
Poaceae	**Pennisetum clandestinum*	kikuyu	-	-
Poaceae	*Rytidosperma fulvum*	wallaby grass	-	-
Poaceae	*Spinifex sericeus*	hairy spinifex	-	-
Poaceae	**Stenotaphrum secundatum*	buffalo grass	-	-
Poaceae	*Themeda triandra*	Kangaroo grass	-	-

Family	*Scientific Name*	Common Name	TSC Act Status	EPBC Act Status
MAGNOLIOPSIDA (FLOWERING PLANTS) – MAGNOLIIDAE (DICOTS)				
Aizoaceae	*Carpobrotus glaucescens*	pigface	-	-
Apiaceae	*Actinotus helianthi*	flannel flower	-	-
Apiaceae	**Aegopodium podagraria*	goutweed	-	-
Apiaceae	**Hydrocotyle bonariensis*		-	-
Apiaceae	*Platysace ericoides*		-	-
Asteraceae	**Chrysanthemoides monilifera*	bitou bush	-	-
Asteraceae	**Conyza sumatrensis*	tall fleabane	-	-
Asteraceae	*Euchiton sphaericus*		-	-
Asteraceae	**Senecio madagascariensis*	fire weed	-	-
Apocynaceae	**Gomphocarpus fruticosus*	cotton bush	-	-
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	wonga wonga vine	-	-
Boraginaceae	**Heliotropium amplexicaule*	blue heliotrope	-	-
Cactaceae	**Opuntia stricta*	common prickly pear	-	-
Campanulaceae	*Wahlenbergia* sp.		-	-
Convolvulaceae	*Dichondra repens*	kidney weed	-	-
Dilleniaceae	*Hibbertia obtusifolia*	hoary guinea flower	-	-
Dilleniaceae	*Hibbertia* sp.		-	-
Ericaceae	*Leucopogon ericoides*	pink beard-heath	-	-
Ericaceae	*Monotoca scoparia*	tree broom-heath	-	-
Euphorbiaceae	*Ricinocarpos pinifolius*	wedding bush	-	-
Fabaceae (Faboideae)	*Aotus ericoides*		-	-
Fabaceae (Faboideae)	*Bossiaea ensata*	sword bossiaea	-	-
Fabaceae (Faboideae)	*Bossiaea stephensonii*		-	-
Fabaceae (Faboideae)	*Daviesia ulicifolia*	gorse bitter-pea	-	-
Fabaceae (Faboideae)	*Glycine clandestina*		-	-

Family	*Scientific Name*	Common Name	TSC Act Status	EPBC Act Status
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	-	-
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *longifolia*	Sydney golden wattle	-	-
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *sophorae*	coastal wattle	-	-
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	prickly Moses	-	-
Goodeniaceae	*Scaevola calendulacea*	dune fan-flower	-	-
Haloragaceae	*Gonocarpus teucrioides*	germander raspwort	-	-
Lauraceae	*Cassytha glabella f. glabella*		-	-
Lauraceae	**Cinnamomum camphora*	camphor laurel	-	-
Loranthaceae	*Amyema congener* subsp. *congener*		-	-
Malvaceae	**Pavonia hastata*		-	-
Myrtaceae	*Angophora costata*	smooth-barked apple	-	-
Myrtaceae	*Angophora floribunda*	rough-barked apple	-	-
Myrtaceae	*Calytrix tetragona*			
Myrtaceae	*Eucalyptus parramattensis* x *robusta* subsp. *decadens*	Earp's gum	V^	V^
Myrtaceae	*Eucalyptus pilularis*	blackbutt	-	-
Myrtaceae	*Eucalyptus robusta*	swamp mahogany	-	-
Myrtaceae	*Leptospermum laevigatum*	coast teatree	-	-
Myrtaceae	*Leptospermum polygalifolium*	tantoon	-	-
Myrtaceae	*Leptospermum trinervium*	slender tea-tree	-	-
Myrtaceae	*Melaleuca nodosa*	prickly leaved paperbark	-	-
Pittosporaceae	*Billardiera scandens*	hairy apple berry	-	-
Plantaginaceae	**Plantago lanceolata*	lamb's tongue	-	-
Proteaceae	*Banksia integrifolia*	coast banksia	-	-
Proteaceae	*Banksia serrata*	old-man banksia	-	-

Family	*Scientific Name*	Common Name	TSC Act Status	EPBC Act Status
Proteaceae	*Persoonia laurina*	laurel geebung	-	-
Proteaceae	*Persoonia levis*	narrow leaved geebung	-	-
Rubiaceae	*Opercularia varia*	variable stinkweed	-	-
Sapindaceae	*Cupaniopsis anacardioides*	tuckeroo	-	-
Solanaceae	**Cestrum parqui*	green cestrum	-	-
Solanaceae	**Solanum chenopodioides*	whitetip nightshade	-	-
Verbenaceae	**Lantana camara*	lantana	-	-

^ Neither the OEH profile (OEH 2016) or the approved Commonwealth conservation advice (TSSC 2014) for Earp's gum discusses the inclusion of hybrids in the listed species, however in accordance with the precautionary principle, these individuals are being assessed as the threatened species.



APPENDIX B

Fauna Species List

Appendix B - Fauna Species List

The following fauna list was developed from surveys of the Study Area by SMEC (2008), Kleinfelder (2015) and Umwelt (2016).

The following abbreviations or symbols are used in the list:

asterisk (*)	Denotes species not indigenous to the Study Area
subsp.	Subspecies
MIG	Listed migratory species under the EPBC Act
V	Vulnerable under the TSC and/or EPBC Act
PD	Preliminary Determination

Birds recorded were identified using descriptions in Pizzey and Knight (2012) and the scientific and common name nomenclature of BirdLife International Taxonomic Checklist (2015) (formerly Birds Australia). Reptiles recorded were identified using keys and descriptions in Cogger (2000) and Wilson and Swan (2008) and the scientific and common name nomenclature of Cogger (2000).

Amphibians recorded were identified using keys and descriptions in Cogger (2000), Robinson (1998), Anstis (2002) and Barker et al. (1995) and the scientific and common name nomenclature of Cogger (2000). Mammals recorded were identified using keys and descriptions in Menkhorst and Knight (2010). Bat species recorded were identified using keys and descriptions in Churchill (1998) and ecological information was obtained from Churchill (2008).

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
AMPHIBIANS			
Hylidae			
Litoria fallax	eastern dwarf tree frog	-	-
Myobatrachidae			
Crinia signifera	brown froglet	-	-
REPTILES			
Scincidae			
Amphibolurus muricatus	jacky dragon	-	-
Ctenotus robustus	striped skink	-	-
BIRDS			
Phasianidae			
Coturnix ypsilophora	brown quail	-	-

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Columbidae			
*Streptopelia chinensis**	spotted dove	-	-
Ocyphaps lophotes	crested pigeon	-	-
Vanellus miles	masked lapwing	-	-
Accipitridae			
Haliaeetus leucogaster	white-bellied sea eagle	V	-
Laridae			
Chroicocephalus novaehollandiae	silver gull	-	-
Cacatuidae			
Cacatua roseicapillus	galah	-	-
Psittacidae			
Trichoglossus haematodus	rainbow lorikeet	-	-
Glossopsitta concinna	musk lorikeet	-	-
Cuculidae			
Cacomantis flabelliformis	fan-tailed cuckoo	-	-
Halcyonidae			
Dacelo novaeguineae	laughing kookaburra	-	-
Menuridae			
Menura novaehollandiae	superb lyrebird	-	-
Maluridae			
Malurus cyaneus	superb fairy-wren	-	-
Malurus lamberti	variegated fairy-wren	-	-
Acanthizidae			
Acanthiza chrysorrhoa	yellow-rumped thornbill	-	-
Acanthiza pusilla	brown thornbill	-	-
Meliphagidae			
Meliphaga lewinii	Lewin's honeyeater	-	-

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Lichenostomus chrysops	yellow-faced honeyeater	-	-
Lichenostomus penicillatus	white-plumed honeyeater	-	-
Manorina melanocephala	noisy miner	-	-
Anthochaera chrysoptera	little wattlebird	-	-
Anthochaera carunculata	red wattlebird	-	-
Phylidonyris niger	white-cheeked honeyeater	-	-
Eupetidae			
Psophodes olivaceus	eastern whipbird	-	-
Pachycephalidae			
Pachycephala pectoralis	golden whistler	-	-
Artamidae			
Cracticus torquatus	grey butcherbird	-	-
Gymnorhina tibicen	Australian magpie	-	-
Strepera graculina	pied currawong	-	-
Rhipiduridae			
Rhipidura albiscapa	grey fantail	-	-
Corvidae			
Corvus coronoides	Australian raven	-	-
Monarchidae			
Grallina cyanoleuca	magpie-lark	-	-
Zosterops lateralis	silvereye	-	-
Corcoracidae			
Corcorax melanorhamphos	white-winged chough	-	-
Pycnonotidae			
*Pyconotus jocosus**	red-whiskered bulbul	-	-

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Estrildidae			
Taeniopygia guttata	zebra finch	-	-
Neochmia temporalis	red-browed finch	-	-
Motacilidae			
Anthus novaeseelandiae	Australasian pipit	-	-
MAMMALS			
Tachyglossidae			
Tachyglossus aculeatus	short-beaked echidna	-	-
Macropodidae			
Macropus rufogriseus	red-necked wallaby	-	-
Pteropodidae			
Pteropus poliocephalus	grey-headed flying-fox	V	V
Molossidae			
Mormopterus norfolkensis	east coast freetail-bat	V	-
Vespertilionidae			
Miniopterus australis	little bentwing-bat	V	-
Miniopterus schreibersii oceanensis	eastern bentwing-bat	V	-
Vespadelus vulturnus	little forest bat	-	-
Felidae			
*Felis catus**	feral cat	-	-
Canidae			
*Vulpes vulpes**	red fox	-	-
Leporidae			
*Oryctolagus cuniculus**	European rabbit	-	-

APPENDIX C

Threatened Species Assessment

Appendix C - Threatened Species Assessment

Threatened and migratory species, endangered populations and threatened ecological communities (TECs) listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) having the potential to occur in the Study Area have been identified based on the results of the searches of the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database and Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Database and are outlined in **Table 1**.

Additionally, migratory species listed under international agreements being the Bonn Convention (Bonn), China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) or Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) with potential to occur in the Study Area have also been identified based on the results of the searches and are outlined in **Table 2**.

Purely marine and pelagic species have been omitted from **Table 1** and **Table 2** due to a lack of suitable habitat.

The likelihood of a community/species to occur in the Study Area is noted using the following definitions:

Recorded	Species/community has been recorded within the Study Area.
Likely	Suitable habitat is present for this species/community and/or records of the species are known to occur in the immediate locality
Potential	Suitable habitat is present for this species/community and/or however records of the species are not known to occur in the immediate locality
Unlikely	Species/community is considered unlikely to occur within the Study Area due to lack of local records and/or lack of suitable habitat.
Not present	Species/community was not recorded in the Study Area and is not expected to occur due to its distribution, habitat requirements or lack of local records.

Species/communities with a reasonable potential to be impacted by the proposed rezoning were subject to preliminary Seven Part Tests of Significance under the EP&A Act and/or Assessments of Significance under the EPBC Act. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

Abbreviations used within **Table 1** and **Table 2** include the following:

V	Vulnerable
E	Endangered
EEC	Endangered Ecological Community
EP	Endangered Population
CE	Critically Endangered
CEEC	Critically Endangered Ecological Community
VEC	Vulnerable Ecological Community
PD	Preliminary Determination
C	CAMBA
J	JAMBA
K	ROKAMBA
B	Bonn

Table 1 - Threatened Species and TECs Recorded or with Potential to Occur within 10 kilometres of the Study Area

Species Name		Status		Likelihood to Occur within the Study Area	Reasonable Potential to be Impacted by the Proposal
Common Name	***Scientific Name***	**TSC Act**	**EPBC Act**		
Threatened Ecological Communities					
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (TSC Act) *Subtropical and Temperate Coastal Saltmarsh* (EPBC Act)		EEC	VEC	Not present	No
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	-	Not present	No
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (TSC Act) *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia* (EPBC Act)		EEC	CEEC	Not present	No
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (TSC Act) *Lowland Rainforest of Subtropical Australia* (EPBC Act)		EEC	CEEC	Not present	No
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	-	Not present	No
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	-	Not present (refer to **Appendix D**)	No
Sydney Freshwater Wetlands in the Sydney Basin Bioregion		EEC	-	Likely	**Yes**
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions		EEC	-	Not present	No
Endangered Populations					
Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	*Dromaius novaehollandiae*	EP	-	Unlikely	No

Species Name		Status		Likelihood to Occur within the Study Area	Reasonable Potential to be Impacted by the Proposal
Common Name	***Scientific Name***	**TSC Act**	**EPBC Act**		
Threatened Flora Species					
dwarf kerrawang	*Commersonia prostrata*	E	E	Unlikely	No
leafless tongue orchid	*Cryptostylis hunteriana*	V	V	Unlikely	No
sand doubletail	*Diuris arenaria*	E	-	Likely	**Yes**
rough doubletail	*Diuris praecox*	V	V	Likely	**Yes**
Camfield's Stringybark	*Eucalyptus camfieldii*	V	V	Unlikely	No
Earp's gum	*Eucalyptus parramattensis subsp. decadens*	V	V	**Recorded** (likely hybrid)	**Yes**
small-flower grevillea	*Grevillea parviflora subsp. parviflora*	V	V	Unlikely	No
	Maundia triglochinoides	V	-	Unlikely	No
biconvex paperbark	*Melaleuca biconvexa*	V	V	Unlikely	No
tall knotweed	*Persicaria elatior*	V	V	Unlikely	No
lesser swamp-orchid	*Phaius australis*	E	E	Unlikely	No
heath wrinklewort	*Rutidosis heterogama*	V	V	Unlikely	No
coast groundsel	*Senecio spathulatus*	E	-	Likely	**Yes**
magenta lilly pilly	*Syzygium paniculatum*	E	V	Unlikely	No
black-eyed Susan	*Tetratheca juncea*	V	V	Unlikely	No
	Zannichellia palustris	E	-	Unlikely	No
Threatened Fauna Species					
Amphibians					
wallum froglet	*Crinia tinnula*	V	-	Likely	**Yes**
green and golden bell frog	*Litoria aurea*	E	V	Unlikely	No
little John's Tree Frog	*Litoria littlejohni*	E	V	Unlikely	No
Birds					
regent honeyeater	*Anthochaera phrygia*	CE	E	Potential	**Yes**

Species Name		Status		Likelihood to Occur within the Study Area	Reasonable Potential to be Impacted by the Proposal
Common Name	*Scientific Name*	TSC Act	EPBC Act		
painted honeyeater	*Grantiella picta*	V	V	Unlikely	No
dusky woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Potential	**Yes**
Australasian bittern	*Botaurus poiciloptilus*	E	E	Unlikely	No
bush stone-curlew	*Burhinus grallarius*	E	-	Unlikely	No
curlew sandpiper	*Calidris ferruginea*	E	CE	Unlikely	No
great knot	*Calidris tenuirostris*	V	CE	Unlikely	No
red knot	*Calidris canutus*	E	-	Unlikely	No
greater sand-plover	*Charadrius leschenaultii*	V	V	Unlikely	No
lesser sand-plover	*Charadrius mongolus*	V	E	Unlikely	No
white-fronted chat	*Epthianura albifrons*	V	-	Unlikely	No
sooty oystercatcher	*Haematopus fuliginosus*	V	-	Unlikely	No
pied oystercatcher	*Haematopus longirostris*	E	-	Unlikely	No
little eagle	*Hieraaetus morphnoides*	V	-	Potential	No
white-bellied sea eagle	*Haliaeetus leucogaster*	V	-	**Recorded**	**Yes**
swift parrot	*Lathamus discolor*	E	CE	Potential	**Yes**
broad-billed sandpiper	*Limicola falcinellus*	V	-	Unlikely	No
black-tailed godwit	*Limosa limosa*	V	-	Unlikely	No
bar-tailed godwit	*Limosa lapponica baueri*	-	V	Unlikely	No
northern Siberian bar-tailed godwit	*Limosa lapponica baueri*	-	CE	Unlikely	No
eastern bristlebird	*Dasyornis brachypterus*	E	E	Unlikely	No
turquoise parrot	*Neophema pulchella*	V	-	Potential	**Yes**
powerful owl	*Ninox strenua*	V	-	Likely	**Yes**
eastern curlew	*Numenius madagascariensis*	-	CE	Unlikely	No
eastern osprey	*Pandion cristatus*	V	-	Potential	**Yes**

Species Name		Status		Likelihood to Occur within the Study Area	Reasonable Potential to be Impacted by the Proposal
Common Name	*Scientific Name*	TSC Act	EPBC Act		
wompoo fruit-dove	*Ptilinopus magnificus*	V	-	Unlikely	No
Australian painted snipe	*Rostratula australis*	E	-	Unlikely	No
diamond firetail	*Stagonopleura guttata*	V	-	Unlikely	No
little tern	*Sternula albifrons*	E	-	Likely	**Yes**
eastern grass owl	*Tyto longimembris*	V	-	Unlikely	No
masked owl	*Tyto novaehollandiae*	V	-	Likely	**Yes**
terek sandpiper	*Xenus cinereus*	V	-	Unlikely	No
Mammals					
large-eared pied bat	*Chalinolobus dwyeri*	V	V	Unlikely	No
spotted-tailed quoll	*Dasyurus maculatus*	V	E	Potential	**Yes**
eastern false pipistrelle	*Falsistrellus tasmaniensis*	V	-	Potential	**Yes**
little bentwing-bat	*Miniopterus australis*	V	-	**Recorded**	**Yes**
eastern bentwing-bat	*Miniopterus schreibersii oceanensis*	V	-	**Recorded**	**Yes**
eastern freetail-bat	*Mormopterus norfolkensis*	V	-	**Recorded**	**Yes**
hoary wattled bat	*Chalinolobus nigrogriseus*	V	-	Potential	**Yes**
greater broad-nosed bat	*Scoteanax rueppellii*	V	-	Likely	**Yes**
yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	V	-	Potential	**Yes**
southern myotis	*Myotis macropus*	V	-	Likely	**Yes**
greater glider	*Petauroides volans*	-	V	Unlikely	No
squirrel glider	*Petaurus norfolcensis*	V	-	Likely	**Yes**
koala	*Phascolarctos cinereus*	V	-	Likely	**Yes**
long-nosed potoroo	*Potorous tridactylus*	V	V	Potential	**Yes**
New Holland mouse	*Pseudomys novaehollandiae*	-	V	Likely	**Yes**

Species Name		Status		Likelihood to Occur within the Study Area	Reasonable Potential to be Impacted by the Proposal
Common Name	*Scientific Name*	TSC Act	EPBC Act		
grey-headed flying-fox	*Pteropus poliocephalus*	V	V	**Recorded**	**Yes**
Fishes					
black rockcod	*Epinephelus daemelii*	-	V	Not present	No

Table 2 - Migratory Species Recorded or with Potential to Occur within 10km of the Study Area

Common Name	*Scientific Name*	International Convention	Likelihood to Occur within Study Area	Reasonable Potential to be Impacted by the Proposal
little tern	*Sternula albifrons*	B, C, J, K	Likely	**Yes**
crested tern	*Thalasseus bergii*	J	Likely	**Yes**
common sandpiper	*Actitis hypoleucos*	B, C, J, K	Unlikely	No
ruddy turnstone	*Arenaria interpres*	B, C, J, K	Unlikely	No
sharp-tailed sandpiper	*Calidris acuminata*	B, C, J, K	Unlikely	No
red knot	*Calidris canutus*	B, C, J, K	Unlikely	No
curlew sandpiper	*Calidris ferruginea*	B, C, J, K	Unlikely	No
pectoral sandpiper	*Calidris melanotos*	B, C, K	Unlikely	No
red-necked stint	*Calidris ruficollis*	B, C, J, K	Unlikely	No
great knot	*Calidris tenuirostris*	B, C, J, K	Unlikely	No
double-banded plover	*Charadrius bicinctus*	B	Unlikely	No
greater sand-plover	*Charadrius leschenaultia*	B, C, J, K	Unlikely	No
lesser sand-plover	*Charadrius mongolus*	B, C, J, K	Unlikely	No
oriental cuckoo	*Cuculus optatus*	C, J, K	Unlikely	No
Latham's snipe	*Gallinago hardwickii*	B, J, K	Unlikely	No
Swinhoe's snipe	*Gallinago megala*	B, C, J, K	Unlikely	No
pin-tailed snipe	*Gallinago stenura*	B, C, J, K	Unlikely	No

Common Name	*Scientific Name*	International Convention	Likelihood to Occur within Study Area	Reasonable Potential to be Impacted by the Proposal
white-throated needletail	*Hirundapus caudacutus*	C, J, K	Likely	**Yes**
fork-tailed swift	*Apus pacificus*	C, J, K	Likely	**Yes**
eastern osprey	*Pandion cristatus*	B	Potential	**Yes**
broad-billed sandpiper	*Limicola falcinellus*	B, C, J, K	Unlikely	No
bar-tailed godwit	*Limosa lapponica*	B, C, J, K	Unlikely	No
black-tailed godwit	*Limosa limosa*	B, C, J, K	Unlikely	No
black-faced monarch	*Monarcha melanopsis*	B	Unlikely	No
spectacled monarch	*Monarcha trivirgatus*	B	Unlikely	No
eastern yellow wagtail	*Motacilla tschutschensis*	C, K, J	Unlikely	No
satin flycatcher	*Myiagra cyanoleuca*	B	Unlikely	No
eastern curlew	*Numenius madagascariensis*	B, C, J, K	Unlikely	No
little curlew	*Numenius minutus*	B, C, J, K	Unlikely	No
whimbrel	*Numenius phaeopus*	B, C, J, K	Unlikely	No
ruff	*Philomachus pugnax*	B, C, J, K	Unlikely	No
Pacific golden plover	*Pluvialis fulva*	B, C, J, K	Unlikely	No
grey plover	*Pluvialis squatarola*	B, C, J, K	Unlikely	No
rufous fantail	*Rhipidura rufifrons*	B	Unlikely	No
grey-tailed tattler	*Tringa brevipes*	B, C, J, K	Unlikely	No
common greenshank	*Tringa nebularia*	B, C, J, K	Unlikely	No
terek sandpiper	*Xenus cinereus*	B, C, J, K	Unlikely	No

Preliminary Seven Part Tests under the *Environmental Planning and Assessment Act 1979*

Threatened species and TECs known to occur or considered to have reasonable likelihood to occur within the Study Area (based on known distribution and habitat requirements) and with reasonable potential to be impacted by the proposed rezoning are addressed in the following preliminary Seven Part Tests of Significance. These assessments have been conducted in accordance with Section 5A of the EP&A Act, based on the current Master Plan. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

It is acknowledged that the *Biodiversity Conservation Act 2016* was implemented on 25 August 2017, repealing the TSC Act. The assessments in this report have not been updated to reflect the minor changes in relation to the replacement of the TSC Act by the BC Act. It is understood that threatened entities previously listed under the TSC Act were automatically transferred to be listed under the BC Act and the amended Assessment of Significance Test (now outlined in Section 7.3 of the BC Act) does not materially change the assessment outcome. Consideration of the BC Act and its implications on the Project will be addressed at the DA phase of the project, as required.

The following threatened species have been recorded in the Study Area, or are likely to occur and therefore have the potential to be impacted by the proposed rezoning:

Threatened Ecological Communities

- *Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC*

Threatened Flora Species

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)
- rough doubletail (*Diuris praecox*)
- sand doubletail (*Diuris arenaria*)
- coast groundsel (*Senecio spathulatus*)

Threatened Fauna Species

- wallum froglet (*Crinia tinnula*)
- little tern (*Sternula albifrons*)
- regent honeyeater (*Anthochaera phrygia*)
- swift parrot (*Lathamus discolor*)
- turquoise parrot (*Neophema pulchella*)
- dusky woodswallow (*Artamus cyanopterus cyanopterus*)
- white-bellied sea eagle (*Haliaeetus leucogaster*)

- eastern osprey (*Pandion cristatus*)
- powerful owl (*Ninox strenua*)
- masked owl (*Tyto novaehollandiae*)
- koala (*Phascolarctos cinereus*)
- squirrel glider (*Petaurus norfolcensis*)
- long-nosed potoroo (*Potorous tridactylus*)
- grey-headed flying-fox (*Pteropus poliocephalus*)
- eastern false pipistrelle (*Falsistrellus tasmaniensis*)
- little bentwing-bat (*Miniopterus australis*)
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*)
- east coast freetail-bat (*Mormopterus norfolkensis*)
- hoary wattled bat (*Chalinolobus nigrogriseus*)
- greater broad-nosed bat (*Scoteanax rueppellii*)
- yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*)
- southern myotis (*Myotis macropus*).

All assessments are undertaken without any consideration of impact mitigation or offsetting and are based on the current indicative Master Plan. Any changes to the indicative Master Plan following this assessment may require a revised Seven Part Test assessment under the EP&A Act.

Species descriptions are referenced from the Office of Environment and Heritage (OEH 2016) and Department of the Environment and Energy (2016) online species profiles, unless otherwise noted.

Threatened Ecological Communities

The following threatened ecological community is considered in this assessment:

- Sydney Freshwater Wetlands in the Sydney Basin Bioregion

The beach wetland vegetation community is considered likely to conform to the NSW Scientific Committee determination to list Sydney Freshwater Wetlands in the Sydney Basin Bioregion as an EEC (NSWSC 2000). The community covers approximately 3.2 hectares of the Study Area and is dominated by the constituent canopy species *Carex pumila or Ficinia nodosa*.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;

Not applicable.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction;

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; and

The proposed rezoning is unlikely to result in the removal or disturbance of *Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC*. No development is proposed in this area, however the proposed rezoning may result in increased human access to the sand dunes. The proposed rezoning is not likely to have an adverse effect on the extent of the community such that its local occurrence would be placed at the risk of extinction.

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;

No development is proposed in the area containing *Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC*, however the proposed rezoning may result in increased human access to the sand dunes. Furthermore, disturbed remnants are considered to form part of the EEC where the natural soil and associated seedbank is partially intact. The proposed rezoning is unlikely to disturb the natural soil and associated seedbank in the sand dunes. The proposed rezoning is unlikely to result in the loss of species diversity that would adversely modify the composition of the community such that its local occurrence may be placed at risk of extinction.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

The current Master Plan indicates no disturbance of this community.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

Fragmentation of remnants of the community within the Study Area is unlikely to increase as a result of the proposed rezoning due to the location of the *Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC* on the sand dunes. This community largely occurs as small remnants across Stockton beach and is unlikely to be further fragmented or isolated from other areas of habitat as a result of the proposed rezoning.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;

The habitat for this community within the Study Area is not likely to be important to its long-term survival in the locality.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);

The Study Area is not located in proximity to any areas of declared or recommended critical habitat. The proposed rezoning will not have an adverse effect on any critical habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and

A recovery plan has not been prepared for this community. There are no threat abatement plans of relevance to the proposed rezoning.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed rezoning will not contribute to the operation of any key threatening processes listed under the TSC Act relevant to the EEC.

Conclusion

Based on the information provided above, and considering the application of the precautionary principle, the proposed rezoning is unlikely to result in a significant impact on the *Sydney Freshwater Wetlands in the Sydney Basin Bioregion EEC* due to the small area of the community and the unlikely impacts associated with the rezoning.

This assessment has been undertaken based on the current Master Plan. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

Threatened Flora Species

The following threatened flora species are considered in this assessment:

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)
- rough doubletail (*Diuris praecox*)
- sand doubletail (*Diuris arenaria*)
- coast groundsel (*Senecio spathulatus*)

An atypical eucalypt was recorded within the Study Area that may be Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*). This species is known to hybridise with *Eucalyptus robusta* in the Worimi Regional Park just north of the Study Area (Bell and Driscoll 2010). Most specimens appear closest to *Eucalyptus robusta*, and this parent seems to be the more dominant, resulting in a hybrid swarm of specimens very difficult to identify to species level (Bell and Driscoll 2010). Neither the OEH profile (OEH 2016) or the approved Commonwealth conservation advice (TSSC 2014) discusses the inclusion of hybrids in the listed species, however in accordance with the precautionary principle, these individuals are being assessed as the threatened species.

Rough doubletail (*Diuris praecox*) and sand doubletail (*Diuris arenaria*) were subject to targeted surveys on 8 September 2016 during the known flowering period for the species. These species were not recorded within the Study Area, despite other known populations flowering in the locality, however suitable habitat is known to occur within the Study Area.

Coast groundsel (*Senecio spathulatus*) has not been recorded within the Study Area, but has been previously recorded on the Stockton sand dunes approximately 10km northeast of the Study Area (Bell and Driscoll 2010).

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;

Two likely Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*) have been recorded in the Study Area within the Mahogany-Baloskion Swamp Forest in the northeast of the site. The species generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. The proposed rezoning currently disturbs the two individuals recorded at the site. This area of disturbance is primarily associated with the APZ which will selectively retain important canopy species such as the Earp's gum hybrids.

Rough doubletail and sand doubletail have not been recorded within the Study Area however suitable habitat occurs on the margins and disturbed tracks associated with the Frontal Dune Blackbutt-Apple Forest. The proposed rezoning currently excludes this habitat from direct development disturbances. These species are known to occur on coastal heath and dry grassy eucalypt forest on sandy flats and have been primarily recorded along the Tomaree Peninsula.

Coast groundsel has not been recorded in the Study Area however suitable habitat occurs on the frontal sand dunes on the far eastern portion of the Study Area. This species has been previously recorded on the Stockton sand dunes (Bell and Driscoll 2010). No development is proposed in this area, however the proposed rezoning may result in increased human access to the sand dunes.

The proposed rezoning may result in the loss of a small area of likely Earp's gum hybrids and minor indirect disturbances to areas of suitable habitat for rough doubletail, sand doubletail and coast groundsel. It is not considered that the loss of this habitat may result in an adverse effect on the life cycle of these species such that a viable local population of these species will be likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction;

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;

Not applicable.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

The proposed rezoning may result in the loss of two likely Earp's gum hybrids and minor indirect impacts to suitable habitat for rough doubletail, sand doubletail and coast groundsel. Given the availability of other higher quality habitat in the adjacent Worimi Conservation Lands, it is unlikely that these species depend on the habitats within the Study Area.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The proposed rezoning would result in the loss of two likely Earp's gum hybrids and minor indirect impacts to suitable habitat for rough doubletail, sand doubletail and coast groundsel. Consequently the level of fragmentation and isolation will increase for these species where these impacts occur.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;

The proposed rezoning would result in the loss of two likely Earp's gum hybrids and minor indirect impacts to suitable habitat for rough doubletail, sand doubletail and coast groundsel. The Study Area occurs and the southernmost extent of high quality continuous habitat within the Worimi Conservation Lands occurring between Nelson Bay and Fern Bay. The Study Area has been previously disturbed as part of the activities on the Rifle Range and the habitats for these species are generally weed infested and fragmented.

It is unlikely that the habitat to be disturbed as part of the proposed rezoning would be considered important to the long-term survival of these species in the locality and the region.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);

The Study Area is not located in proximity to any areas of declared or recommended critical habitat. The proposed rezoning will not have an adverse effect on any critical habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and

No recovery plans have been prepared for rough doubletail, sand doubletail or coast groundsel. A draft National Recovery Plan has been prepared for Earp's gum (OEH 2011). The Recovery Plan includes a specific objective to provide appropriate protection to the potentially distinct population (i.e. hybrid form) of Earp's gum around Fern Bay. Any impacts to the likely hybrids of Earp's gum in the Study Area would contravene this objective. Samples of these potential hybrids have been sent to Royal Botanic Gardens Sydney for formal identification.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed rezoning will contribute to the operation of the following key threatening processes listed under the TSC Act relevant to these species:

- Clearing of native vegetation.
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by *Chrysanthemoides monilifera*.

Conclusion

Based on the information provided above, and considering the application of the precautionary principle, the proposed rezoning is unlikely to result in a significant impact on rough doubletail, sand doubletail or coast groundsel due to the minor and indirect impacts on potential habitat and no impact on known individuals. Further investigations into the likely Earp's gum hybrid occurring within the Study Area is required to determine the conservation status and importance of the Earp's gum hybrid population occurring within the Study Area.

This assessment has been undertaken based on the current Master Plan. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

Threatened Fauna Species

The following threatened fauna species are considered in this assessment:

- wallum froglet (*Crinia tinnula*)
- little tern (*Sternula albifrons*)
- regent honeyeater (*Anthochaera phrygia*)
- swift parrot (*Lathamus discolor*)
- turquoise parrot (*Neophema pulchella*)
- dusky woodswallow (*Artamus cyanopterus cyanopterus*)
- white-bellied sea eagle (*Haliaeetus leucogaster*)
- eastern osprey (*Pandion cristatus*)
- powerful owl (*Ninox strenua*)
- masked owl (*Tyto novaehollandiae*)
- koala (*Phascolarctos cinereus*)
- squirrel glider (*Petaurus norfolcensis*)
- long-nosed potoroo (*Potorous tridactylus*)
- grey-headed flying-fox (*Pteropus poliocephalus*)
- eastern false pipistrelle (*Falsistrellus tasmaniensis*)
- little bentwing-bat (*Miniopterus australis*)
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*)
- east coast freetail-bat (*Mormopterus norfolkensis*)
- hoary wattled bat (*Chalinolobus nigrogriseus*)
- greater broad-nosed bat (*Scoteanax rueppellii*)
- yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*)
- southern myotis (*Myotis macropus*)

Potential habitat occurs within the Study Area for the wallum froglet; woodland birds such as regent honeyeater, dusky woodswallow, swift parrot, turquoise parrot; large forest owls including powerful owl, masked owl, coastal birds such as eastern osprey, little tern; and threatened mammal species being spotted-tailed quoll, squirrel glider, koala, long-nosed potoroo; and micro-bat species being eastern false pipistrelle, hoary wattled bat, greater broad-nosed bat, yellow-bellied sheathtail bat and southern myotis.

Grey-headed flying-fox, east coast freetail-bat, eastern bentwing-bat and little bentwing-bat have been recorded utilising the habitats of the Study Area.

White-bellied sea eagle was also recorded flying over the habitats of the Study Area. This species was recently listed as vulnerable under the TSC Act (NSWSC 2016) and should also be considered in any future development applications for the project.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;

Grey-headed flying-fox, east coast freetail-bat, eastern bentwing-bat and little bentwing-bat have been recorded utilising the habitats of the Study Area. Up to five grey-headed flying-foxes were observed foraging in the forested habitats of the Study Area in April 2007. No flying-fox camps have been recorded in the Study Area and east coast freetail-bat, eastern bentwing-bat and little bentwing-bat were detected using Anabat recorders in May 2016. The forested areas of the Study Area are likely to provide suitable foraging habitat for these species and potential hollow resources for little bentwing-bat and east coast freetail-bat. One white-bellied sea eagle was recorded flying over the habitats of the Study Area.

No other threatened species are known to occur in the Study Area. Two preferred koala feed trees, being swamp mahogany (*Eucalyptus robusta*) and likely Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*) occur within the Mahogany-Baloskion Swamp Forest. The koala has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park. Furthermore, the squirrel glider has been recorded in adjacent similar habitat in Fern Bay. *Banksia serrata* in the forest understorey provides suitable foraging habitat for the species. Powerful owl and masked owl have also been recorded in the habitats of the Worimi Conservation Lands and may utilise the Study Area for foraging resources. Little tern has been previously recorded nesting in mined dunes along the south-western edge of the Worimi Conservation Lands and may also use the similar habitats of the Study Area.

Potential habitat also occurs for wallum froglet, regent honeyeater, dusky woodswallow, swift parrot, turquoise parrot, eastern osprey, spotted-tailed quoll, long-nosed potoroo and micro-bat species being eastern false pipistrelle, hoary wattled bat, greater broad-nosed bat, yellow-bellied sheathtail bat and southern myotis. These species have not been recorded in the Study Area.

The proposed rezoning may result in the loss of approximately 2.1 hectares of potential and likely forest foraging habitat for a range of threatened species in the forested areas of the site. However it is noted that hollow resources in the Study Area occur in low densities in these habitats. The Study Area contains preferred and supplementary koala habitat as per Lunney *et al.* (1998) with up to 1.6 hectares of buffer around preferred habitat potentially impacted by the proposed rezoning. 2.1 hectares of known foraging habitat for grey-headed flying-fox, east coast freetail-bat, eastern bentwing-bat and little bentwing-bat may be impacted.

It is not considered that the loss of this habitat may result in an adverse effect on the life cycle of these species such that a viable local population of these species will be likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction;

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;

Not applicable.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

The proposed rezoning may result in the loss of approximately 2.1 hectares of forest habitat that includes preferred feed trees for the koala and likely foraging habitat for a range of threatened species. Given the availability of other higher quality habitat in the adjacent Worimi Conservation Lands, it is unlikely that these species depend on the habitats within the Study Area.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The proposed rezoning would result in the loss approximately 2.1 hectares of forest habitat that includes preferred feed trees for the koala and likely foraging habitat for a range of threatened species. The proposed rezoning may introduce significant barriers for some of these species such that it will prevent movement of individuals between proximate areas of habitat. Highly mobile species such as grey-headed flying-fox, micro-bats and birds are unlikely to be substantially affected. The Study Area contains intact vegetation primarily along its northern boundaries. While this allows some east to west fauna movement from the coastal dune area to the Hunter River estuary, the value of this is limited due to residential areas and Nelson Bay Road to the west of the Study Area. Connectivity from the south of the site to Stockton is currently highly fragmented as a result of previous residential and urban development.

As some forest habitat will be removed as part of the Project, the level of fragmentation and isolation within the Study Area will increase for these species.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;

The proposed rezoning would result in the loss approximately 2.1 hectares of forest habitat that contains likely foraging habitat for a range of threatened species. Hollow-bearing tree resources for roosting habitat occur in low densities in the Study Area.

While the Study Area is known to contain small areas of preferred koala feed trees and preferred and supplementary koala habitat as per Lunney *et al.* (1998), the site has been previously disturbed as part of the activities on the Rifle Range and the habitats for these species are generally weed infested and fragmented. Sand dune habitat in relation to the little tern, which has been recorded nesting in mined dunes along the south-western edge of the Worimi Conservation Lands, is not expected to be impacted by the proposed rezoning, however the proposed rezoning may result in increased human access to the sand dunes. Key foraging trees being swamp mahogany (*Eucalyptus robusta*) for species such as grey-headed flying-fox (DECCW 2009), regent honeyeater (DoE 2016) and swift parrot (Saunders 2011) occur in small discrete areas of the Study Area.

The Study Area occurs and the southernmost extent of high quality continuous habitat within the Worimi Conservation Lands occurring between Nelson Bay and Fern Bay. It is unlikely that the habitat to be disturbed as part of the proposed rezoning would be considered important to the long-term survival of these species in the locality and the region.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);

No critical habitat has been listed within or adjacent to the Study Area for this threatened species. The Project will not have an adverse effect on any critical habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and

The following recovery plans have been prepared:

- National recovery plan for the wallum sedge frog and other wallum-dependent frog species (Meyer *et al.* 2006)
- Little tern (*Sterna albifrons*) Recovery Plan (NPWS 2003)
- National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (DoE 2016)
- National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (Saunders 2011)
- Approved Recovery Plan for the Large Forest Owls (DEC 2006)
- Recovery Plan for the Koala (*Phascolarctos cinereus*) (DECC 2008)
- National Recovery Plan for the Spotted-tailed Quoll (*Dasyurus maculatus*) (DELWP 2016)
- Draft Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*) (DECCW 2009)

Any impacts to known habitat for these species in the Study Area are likely to contravene the objectives of these recovery plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed rezoning may contribute to the operation of the following key threatening processes listed under the TSC Act relevant to these species:

- Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*).
- Clearing of native vegetation.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by *Chrysanthemoides monilifera*.
- Removal of dead wood and dead trees.

Conclusion

Based on the information provided above, and considering the application of the precautionary principle, the proposed rezoning is unlikely to result in a significant impact on wallum froglet, regent honeyeater, dusky woodswallow, swift parrot, turquoise parrot, powerful owl, masked owl, eastern osprey, little tern, spotted-tailed quoll, squirrel glider, long-nosed potoroo, eastern false pipistrelle, hoary wattled bat, greater broad-nosed bat, yellow-bellied sheathtail bat and southern myotis due to the minor and indirect impacts on potential habitat and no impact on known individuals.

Furthermore, due to the highly mobile nature of these species and the availability of higher quality habitats in the locality, the proposed rezoning is unlikely to result in a significant impact on white-bellied sea eagle, grey-headed flying-fox, east coast freetail-bat, eastern bentwing-bat and little bentwing-bat, which have been recorded utilising the habitats of the Study Area. While the Study Area contains preferred koala feed trees and preferred and supplementary koala habitat, this area is minimal, fragmented and the species has not been recorded at this southern extremity of the potential extent of the Port Stephens koala population. Based on the current Master Plan, the proposed rezoning is unlikely to result in a significant impact on the koala.

This assessment has been undertaken based on the current Master Plan. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

Preliminary Assessment of Significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires an Assessment of Significance relating to the potential impacts of a Project on listed matters of national environmental significance (MNES). These assessments have been conducted in accordance with the Significant Impact Guidelines 1.1 (DoE 2013), based on the current Master Plan. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

Under the EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on MNES. These matters are:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Great Barrier Reef Marine Park
- nuclear actions
- a water resource, in relation to coal seam gas development and large coal mining development.

A search of the Department of Environment and Energy Protected Matters Search Tool in September 2016 and collated information from literature reviews identified three threatened ecological communities, 32 threatened species and 35 terrestrial migratory species listed under the EPBC Act that are known to occur, or considered to have the potential to occur on the basis of habitat modeling within the Study Area. Each of these has been included in **Tables 1** and **2** (note that purely marine or pelagic species were excluded due to lack of habitat), together with an indication of those species that warrant further assessment by way of an Assessment of Significance.

As outlined in **Tables 1** and **2**, the following EPBC Act listed species and communities are considered to have the potential to occur or be impacted by the Project and are subject to an Assessment of Significance below:

Critically Endangered and Endangered Species

- swift parrot (*Lathamus discolor*)
- regent honeyeater (*Anthochaera phrygia*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) SE mainland population

Vulnerable Species

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)
- rough doubletail (*Diuris praecox*)
- long-nosed potoroo (*Potorous tridactylus*)
- koala (*Phascolarctos cinereus*) combined populations of Qld, NSW and the ACT
- New Holland mouse (*Pseudomys novaehollandiae*)
- grey-headed flying-fox (*Pteropus poliocephalus*)

Migratory Species Listed under International Conventions

- little tern (*Sternula albifrons*)
- crested tern (*Thalasseus bergii*)
- white-throated needletail (*Hirundapus caudacutus*)
- fork-tailed swift (*Apus pacificus*)
- eastern osprey (*Pandion cristatus*)

Critically Endangered and Endangered Species

The following critically endangered and endangered species are considered in this assessment:

- swift parrot (*Lathamus discolor*)
- regent honeyeater (*Anthochaera phrygia*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) SE mainland population

Species descriptions, in the Assessments of Significance below, are referenced from the Office of Environment and Heritage (OEH 2016) and Department of the Environment and Energy (2016) online species profiles, unless otherwise noted.

In this case, a *population* means:

- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

The swift parrot occurs as a single population that migrates annually from breeding grounds in Tasmania to the winter foraging grounds on the coastal plains and slope woodlands of mainland eastern Australia (Saunders 2011). Approximately 200 mature birds (10 per cent of the total estimated population) are known to over-winter in the Lower Hunter Region of New South Wales (Saunders 2002). The swift parrot has not been recorded within the Study Area however it has been recorded approximately 8 km north of the Study Area near Williamtown feeding on swamp mahogany.

Although there appears to be minor behavioural differences between regent honeyeaters in the three main areas inhabited by the species (the Bundarra-Barraba area in NSW, the Capertee Valley in NSW, and north-eastern Victoria), the direction and extent of movements, including evidence of movement between breeding sites, and a lack of discernable genetic differences between the sites suggest that the regent honeyeater occurs as a single, contiguous population (Garnett and Crowley 2000). The regent honeyeater has not been recorded within the Study Area however it has been recorded approximately 15 km north of the Study Area near Medowie.

There is very little research-based literature that allows confident definition of population size or population boundaries of the spotted-tailed quoll. There are few recent records of this species occurring from the Port Stephens local area and no important southeast mainland populations around Port Stephens are listed in the National Recovery Plan (DELWP 2016). It is considered likely that any individuals of this species around the Study Area would be part of a broad regional population that included the Tomaree Peninsula and the Karuah – Raymond Terrace area.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population; or**

No *populations* of the swift parrot, regent honeyeater or spotted-tailed quoll have been recorded within the Study Area. The proposed rezoning may result in the loss of a small area of key feed tree individuals for swift parrot and regent honeyeater and up to 2.1 hectares of forested foraging habitat for the spotted-tailed quoll. The Study Area is not known as a historical or important foraging site for these species.

It is considered unlikely that the proposed rezoning will lead to a decrease in the size of a *population* of the swift parrot, regent honeyeater or spotted-tailed quoll.

- **reduce the area of occupancy of the species; or**

The swift parrot, regent honeyeater and spotted-tailed quoll have not been recorded within the Study Area. The proposed rezoning may result in the loss of a small area of key feed tree individuals for these species. While the proposed rezoning will remove potential habitat for these species, it is not likely to lead to a significant reduction in known habitat in the region. Substantial areas of similar habitats for these species are protected in proximity to the Study Area, including the Worimi Conservation Lands.

The proposed rezoning may result in a reduction of the potential area of occupancy for the swift parrot, regent honeyeater and spotted-tailed quoll, however this is unlikely to substantially reduce the area of known occupancy in the locality or region.

- **fragment an existing *population* into two or more populations; or**

The swift parrot, regent honeyeater and spotted-tailed quoll have not been recorded within the Study Area. The swift parrot and regent honeyeater are highly dispersive and it is unlikely that the proposed rezoning would create a significant change to the species' dispersal capacity or create a significant barrier the movement of the species. The spotted-tailed quoll occupies home ranges of several hundred to several thousand hectares in size (DELWP 2016). Connectivity from the south of the site to Stockton is currently highly fragmented as a result of previous residential and urban development and the proposed rezoning is unlikely to fragment an existing *population* of spotted-tailed quoll.

It is unlikely that the Project may result in the fragmentation of an existing *population* into two or more *populations*.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the swift parrot includes those areas of priority habitat for which the species has a level of site fidelity or possess phenological characteristics likely to be of importance to the swift parrot (Saunders 2011). The Study Area contains 2.3 hectares dominated by swamp mahogany (*Eucalyptus robusta*) being a key feed tree species for the swift parrot. The proposed rezoning is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

Habitat critical to the survival of the regent honeyeater includes any breeding or foraging areas where the species is likely to occur and any newly discovered breeding for foraging locations (DoE 2016). The Study Area contains 2.3 hectares dominated by swamp mahogany (*Eucalyptus robusta*) being a key feed tree species for the regent honeyeater. The proposed rezoning is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

Habitat that is critical to the survival of the spotted-tailed quoll includes large patches of forest with adequate denning resources and relatively high densities of medium-sized mammalian prey (DELWP 2016). This habitat is likely to occur in the adjacent Worimi Conservation Lands and the adjoining forested habitats in the north of the Study Area. The proposed rezoning is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of a population; or**

The swift parrot breeds and nests exclusively in Tasmania and migrates to mainland Australia during the non-breeding season. There is no potential for breeding habitat to occur in the Study Area.

The regent honeyeater mainly breeds in three key sites from the Bundarra-Barraba area NSW, the Capertee Valley in NSW, and north-eastern Victoria. Breeding has also been recorded within the Hunter Valley, with the species recorded breeding in open forest close to Kurri Kurri in 2007. Nests are usually placed in the canopy of mature trees with rough bark, e.g. ironbarks, sheoaks (*Casuarina*) and rough-barked apple (*Angophora floribunda*).The regent honeyeater has not been previously recorded in the Study Area and it is unlikely to contain breeding habitat for the species.

The spotted-tailed quoll generally dens in rock shelters, small caves, hollow logs or tree hollows and utilises numerous dens within its home range. Potential den sites were not recorded in the Study Area. The spotted-tailed quoll has not been previously recorded in the Study Area and it is unlikely to contain breeding habitat for the species.

The proposed rezoning is not expected to disrupt the breeding cycle of *populations* of the swift parrot, regent honeyeater or the spotted-tailed quoll.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The proposed rezoning will involve the removal of a small area of key feed tree individuals for swift parrot and regent honeyeater and 2.1 hectares of potential forested foraging habitat for spotted-tailed quoll. The Lower Hunter and Port Stephens area supports other areas of habitat that contain suitable woodland and forest vegetation that would also provide potential habitat for these species.

It is considered unlikely that the proposed rezoning will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the swift parrot, regent honeyeater and spotted-tailed quoll decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The proposed rezoning is not expected to result in invasive species that are harmful to the swift parrot, regent honeyeater or spotted-tailed quoll becoming established in the species' habitat.

- **introduce disease that may cause the species to decline; or**

Relevant for the swift parrot, psittacine beak and feather disease is a common and potentially deadly disease of parrots caused by a circovirus named beak and feather disease virus. The disease appears to have originated in Australia and is widespread and continuously present in wild populations of Australian parrots. Beak and feather disease affecting endangered psittacine species (parrots and related species) was listed in April 2001 as a key threatening process under the EPBC Act.

It is considered unlikely that the proposed rezoning will introduce beak and feather disease or any other disease that may cause the swift parrot, regent honeyeater or spotted-tailed quoll to decline.

- **interfere with the recovery of the species.**

The following recovery plans have been prepared:

- National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (Saunders 2011)
- National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (DoE 2016)
- National Recovery Plan for the Spotted-tailed Quoll (*Dasyurus maculatus*) (DELWP 2016).

Any impacts to known habitat for these species in the Study Area are likely to contravene the objectives of these recovery plans. The swift parrot, regent honeyeater and spotted-tailed quoll have not been recorded within the Study Area, however potential foraging habitat has been identified. It is considered unlikely that the proposed rezoning will interfere with the recovery of the swift parrot, regent honeyeater or spotted-tailed quoll throughout Australia.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on the populations of the swift parrot, regent honeyeater or spotted-tailed quoll. Although the Study Area provides potential foraging habitat for these species, they have not been recorded utilising the potential habitat within the Study Area or in the immediate surrounds.

This assessment has been undertaken based on the current Master Plan. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

Vulnerable Species

The following vulnerable species are considered in this assessment:

- Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*)
- rough doubletail (*Diuris praecox*)
- long-nosed potoroo (*Potorous tridactylus*)
- koala (*Phascolarctos cinereus*) combined populations of Qld, NSW and the ACT
- New Holland mouse (*Pseudomys novaehollandiae*)
- grey-headed flying-fox (*Pteropus poliocephalus*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

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

An atypical eucalypt was recorded within the Study Area that may be Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*). This species is known to hybridise with *Eucalyptus robusta* in the Worimi Regional Park just north of the Study Area (Bell and Driscoll 2010). Most specimens appear closest to *Eucalyptus robusta*, and this parent seems to be the more dominant, resulting in a hybrid swarm of specimens very difficult to identify to species level (Bell and Driscoll 2010). Neither the OEH profile (OEH 2016) or the approved Commonwealth conservation advice (TSSC 2014) for the species discusses the inclusion of hybrids in the listed species, however in accordance with the precautionary principle, these individuals are being assessed as the threatened species. The Recovery Plan for Earp's gum (OEH 2011) outlines the importance of the potentially distinct population (i.e. hybrid form) of Earp's gum around Fern Bay. The likely Earp's gum hybrids in the Study Area may constitute an *important population*.

Rough doubletail (*Diuris praecox*) was subject to targeted surveys on 8 September 2016 during the known flowering period for the species. This species were not recorded within the Study Area, despite other known populations flowering in the locality, however suitable habitat is known to occur within the Study Area. It is unlikely an *important population* of rough doubletail occurs within the Study Area.

Records of the long-nosed potoroo are scarce within the Port Stephens LGA. The species is known to occur in greater densities in the Barrington Top National Park to the north and the Watagans National Park to the west of the Study Area. It is not considered that an *important population* of long-nosed potoroo occurs in the Study Area as it has not been identified as containing a key source population either for breeding or dispersal; populations that are necessary for maintaining genetic diversity, and/or populations that are near the limit of the species' range.

Koala (*Phascolarctos cinereus*) is known to occur in eucalypt woodlands and forests from the north-eastern Queensland, along the eastern coast of NSW, to the south-east corner of South Australia. The koala has not been recorded within the Study Area, however it has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park. Koalas occurring within the Port Stephens LGA are likely to comprise an *important population*, in accordance with the criteria listed above.

The Study Area is unlikely to be core habitat for the Port Stephens koala population, however individuals may occur infrequently as they move through the landscape around Fern Bay.

Genetic evidence indicates that the New Holland mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement (Breed and Ford, 2007). In NSW, the New Holland mouse is known from: Royal National Park (NP) and the Kangaroo Valley; Kuringai Chase NP; and Port Stephens to Evans Head near the Queensland border (DoE 2015). While the species has not been recorded in the Study Area, coastal dune vegetation occurring in the Port Stephens LGA is likely to comprise an *important population* of the species.

Grey-headed flying-fox (*Pteropus poliocephalus*) has been recorded within the Study Area. Up to five individuals were observed foraging in the forested habitats of the Study Area in April 2007. No flying-fox camps have been recorded in the Study Area. The closest active camp is located approximately 5 km to the southwest of the Study Area near Carrington (DoEE 2016). From these camps, the species can travel up to 50 km in one night in search of food where they feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. It is likely that the species utilises the Project Area as foraging habitat. The Study Area is likely to provide suitable foraging habitat for a local population the species.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

No *important populations* of the rough doubletail, long-nosed potoroo or New Holland mouse have been recorded within the Study Area. Known habitat for likely Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens*), koala and grey-headed flying-fox have been recorded in the Study Area, however the Study Area is unlikely to be important for an important population of these species.

The proposed rezoning may result in the loss of approximately two key feed tree individuals for koala, two Earp's gum hybrids, 2.1 hectares of foraging habitat for grey-headed flying-fox and up to 17.9 hectares of forest and shrubland foraging habitat for long-nosed potoroo and New Holland mouse. The Study Area is unlikely to be frequently utilised by the Port Stephens koala population or be depended on by local grey-headed flying-fox colonies.

It is considered unlikely that the proposed rezoning will lead to a decrease in the size of an important population of the rough doubletail, long-nosed potoroo, New Holland mouse, koala and grey-headed flying-fox. The proposed rezoning may result in a short-term decrease in the local distinct population of Earp's gum hybrids. It is likely this species can be selectively retained and replanted in the post-construction landscape.

- **reduce the area of occupancy of an important population, or;**

No *important populations* of the rough doubletail, long-nosed potoroo or New Holland mouse have been recorded within the Study Area.

The proposed rezoning may result in the loss of approximately two key feed trees for koala, two Earp's gum hybrids and 2.1 hectares of foraging habitat for grey-headed flying-fox. Due to the small area of impact, retention of forested vegetation and existing fragmentation within the Study Area, the proposed rezoning is unlikely to reduce the area of the important population of koala or a local population of grey-headed-flying-fox.

The proposed rezoning may result in a reduction in the area of occupancy for the locally occurring Earp's gum hybrid population in the Study Area and the locality.

- **fragment an existing important population into two or more populations, or;**

No *important populations* of the rough doubletail, long-nosed potoroo or New Holland mouse have been recorded within the Study Area.

The grey-headed flying fox is highly dispersive and it is unlikely that the proposed rezoning would create a significant change to the species' dispersal capacity or create a significant barrier the movement of the species. The spotted-tailed quoll occupies home ranges of several hundred to several thousand hectares in size (DELWP 2016). Connectivity from the south of the site to Stockton is currently highly fragmented as a result of previous residential and urban development and the proposed rezoning is unlikely to fragment an existing population of koala.

It is unlikely that the proposed rezoning may result in the fragmentation of an existing *important population* into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

No habitat critical to the survival for rough doubletail, long-nosed potoroo or New Holland mouse have been recorded within the Study Area.

The Draft National Recovery Plan for Earp's gum (OEH 2011) does not identify habitat critical to the survival of the species, noting that all habitat where the species occurs contributes to the long-term conservation of the species. Given that the Study Area contains a small area of likely hybrid Earp's gum separate to the known populations of Earp's gum in the Tomago sandbeds, it is unlikely that this area would be habitat critical to the survival of the species.

The Study Area contains preferred and supplementary koala habitat as per Lunney *et al.* (1998) with up to 2.3 hectares of preferred habitat, 3.6 hectares of buffer habitat and 15.9 hectares of supplementary koala habitat. According to the EPBC Act Referral Guidelines for the Vulnerable Koala (DoE 2014), koala habitat is defined as forest or woodland containing species that are known koala food trees or shrubland with emerging food trees. According to the Koala Habitat Assessment Tool in the EPBC Act Referral Guidelines, the preferred habitats within the Study Area score 7 out of 10 and are therefore considered to contain habitat critical to the survival of the species (DoE 2014). The proposed rezoning may result in the loss of 1.6 hectares of buffer around preferred habitat. The current Master Plan has sought to avoid impacts in the area containing preferred koala habitat.

According to the draft National Recovery Plan for the grey-headed flying-fox (DECC 2009), foraging habitat is considered critical to the survival of the species if it is productive during winter and spring and productive during the final weeks of gestation, and during the weeks of birth, lactation and conception. Swamp mahogany (*Eucalyptus robusta*) dominated forest communities in the Study Area are productive during winter, during which food bottlenecks have been identified. The Study Area is considered to comprise an area of foraging habitat for this species but is unlikely to contain significant breeding and roosting habitat.

- **disrupt the breeding cycle of an important population, or;**

No *important populations* of the rough doubletail, long-nosed potoroo or New Holland mouse have been recorded within the Study Area.

The proposed rezoning may result in the loss of two likely Earp's gum hybrids in the Study Area. It is likely that the population within the Study Area is part of the Fern Bay *important population* of a distinct hybrid

type of the species. The reduction of size of this population may result in the disruption of the breeding cycle of the hybrid type of this species.

While koala breeding has not been recorded in the Study Area, suitable foraging habitat was recorded. The retention of preferred and supplementary habitat on the site will enable the species to utilise optimal habitats and breeding is not considered likely to be adversely impacted. The proposed rezoning is not expected to disrupt the breeding cycle of an *important population* of this species.

No grey-headed flying-fox breeding populations or camps have been identified in the Study Area. The proposed rezoning is not expected to disrupt the breeding cycle of an *important population* of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposed rezoning may result in the loss of approximately two key feed trees for koala, two Earp's gum hybrids, 2.1 hectares of foraging habitat for grey-headed flying-fox and up to 17.9 hectares of forest and shrubland habitat for long-nosed potoroo and New Holland mouse. The Study Area is unlikely to be frequently utilised by the Port Stephens koala population or be depended on by local grey-headed flying-fox colonies.

It is considered unlikely that the proposed rezoning will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the rough doubletail, long-nosed potoroo, New Holland mouse, koala and grey-headed flying-fox would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

There are not any invasive species that are likely to become established as a result of the proposed rezoning that may impact upon any habitat relevant to the koala, grey-headed flying-fox, long-nosed potoroo or New Holland mouse.

Weed invasion by common coastal exotic species such as bitou bush (*Chrysanthemoides monilifera*) and lantana (*Lantana camara*) would threaten the establishment of vulnerable flora species such as rough doubletail and Earp's gum. It is expected that this threat would be managed within the construction and post-construction phases of the proposed rezoning.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause rough doubletail, grey-headed flying-fox, long-nosed potoroo or New Holland mouse to decline are likely to be introduced as a result of the proposed rezoning that may impact upon any habitat relevant to the

Key biological pathogens that have the most risk of impacting Earp's gum include the disease-causing rusts to plants of the Myrtaceae family (particularly myrtle rust (*Uredo rangelii*)) and the soil pathogen causing root-rot (*Phytophthora cinnamomi*). The presence of these pathogens has not been specifically identified within the Study Area, however both are known to occur throughout NSW. The proposed rezoning is not expected to introduce or exacerbate any diseases that may cause Earp's gum to decline.

The koala is known to contract strains of *Chlamydia* and the koala retrovirus. Chlamydia infections are known to cause reduced female fertility and are expected to reduce the reproductive potential of koala populations. It has been predicted that up to half of the koalas in south-east Queensland have reproductive disease likely to result in infertility (TSSC 2012).

The koala retrovirus can cause a range of conditions including leukaemia and immunodeficiency syndrome. It is estimated that up to 100 per cent of koala populations in Queensland and New South Wales have the koala retrovirus (TSSC 2012).

The proposed rezoning does not involve any processes that are likely to introduce a disease for the koala or Earp's gum that may cause these species to decline.

- **interfere substantially with the recovery of the species.**

The following recovery plans have been prepared:

- Draft National Recovery Plan for Earp's Dirty Gum *Eucalyptus parramattensis* subsp. *decadens* (OEH 2011)
- Recovery Plan for the Koala (*Phascolarctos cinereus*) (DECC 2008)
- Draft Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*) (DECCW 2009)

Any impacts to known habitat for these species in the Study Area are likely to contravene the objectives of these recovery plans. Rough doubletail, koala, long-nosed potoroo or New Holland mouse have not been recorded within the Study Area, however potential foraging habitat has been identified. It is considered unlikely that the proposed rezoning will interfere with the recovery of the Rough doubletail, Earp's gum, koala, long-nosed potoroo, New Holland mouse or grey-headed flying-fox throughout Australia.

Conclusion

The proposed rezoning is unlikely to result in a significant impact on the populations of the rough doubletail, long-nosed potoroo or New Holland mouse. Although the Study Area provides potential foraging habitat for these species, they have not been recorded utilising the potential habitat within the Study Area or in the immediate surrounds.

While the Study Area contains preferred koala feed trees and preferred and supplementary koala habitat, this area is minimal, fragmented and the species has not been recorded at this southern extremity of the potential extent of the Port Stephens koala population. Based on the current Master Plan, the proposed rezoning is unlikely to result in a significant impact on the koala.

While, the proposed rezoning is unlikely to result in a significant impact on Earp's gum, further investigations into the likely hybrid occurring within the Study Area is required to determine the conservation status and importance of the potential population occurring within the Study Area.

This assessment has been undertaken based on the current Master Plan. It is expected that these assessments will be reviewed and revised following the finalisation of the Master Plan and impact boundaries as part of the future development application.

Migratory Species under International Conventions

The following migratory species are considered in this assessment:

- little tern (*Sternula albifrons*)
- crested tern (*Thalasseus bergii*)
- white-throated needletail (*Hirundapus caudacutus*)
- fork-tailed swift (*Apus pacificus*)
- eastern osprey (*Pandion cristatus*)

None of the migratory species above have been recorded within the Study Area, however the little tern has been previously recorded nesting in mined dunes along the south-western edge of the Worimi Conservation Lands. Likely habitat for the species occurs in the sandy dune habitats of the Study for little tern and crested tern. Potential habitat has been identified for white-throated needletail, fork-tailed swift and eastern osprey.

An area of important habitat is:

- **habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or**
- **habitat utilised by a migratory species which is at the limit of the species range; or**
- **habitat within an area where the species is declining.**

The habitats within the Study Area for migratory species listed under international conventions is not considered to meet the criteria listed above, and important habitat is not likely to occur.

The Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015) defines important habitat for the white-throated needletail, fork-tailed swift and eastern osprey. Important habitat for white-throated needletail includes tree hollows in tall trees on ridge tops (DoE 2015). Otherwise the species is almost entirely aerial (DoE 2015). Important habitat for fork-tailed swift includes open plains to woodland areas, however the species is almost entirely aerial (DoE 2015). Important habitat for the eastern osprey includes Bays, estuaries, along tidal stretches of large coastal rivers, mangrove swamps, coral and rock reefs, terrestrial wetlands and coastal lands of tropical and temperate Australia and off shore islands (DoE 2015).

No guidelines are available for little tern or crested tern. Little terns and crested terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches (DoE 2016). The Study Area contains suitable sand dune habitat to the east of the site. Little tern has been previously recorded nesting in mined dunes along the south-western edge of the Worimi Conservation Lands, however this has not been recorded within the Study Area.While this is not expected to be impacted by the proposed rezoning, the proposed rezoning may result in increased human access to the sand dunes.

The habitats within the Study Area for migratory species listed under international conventions is not considered to meet the criteria listed above, and *important habitat is* not likely to occur.

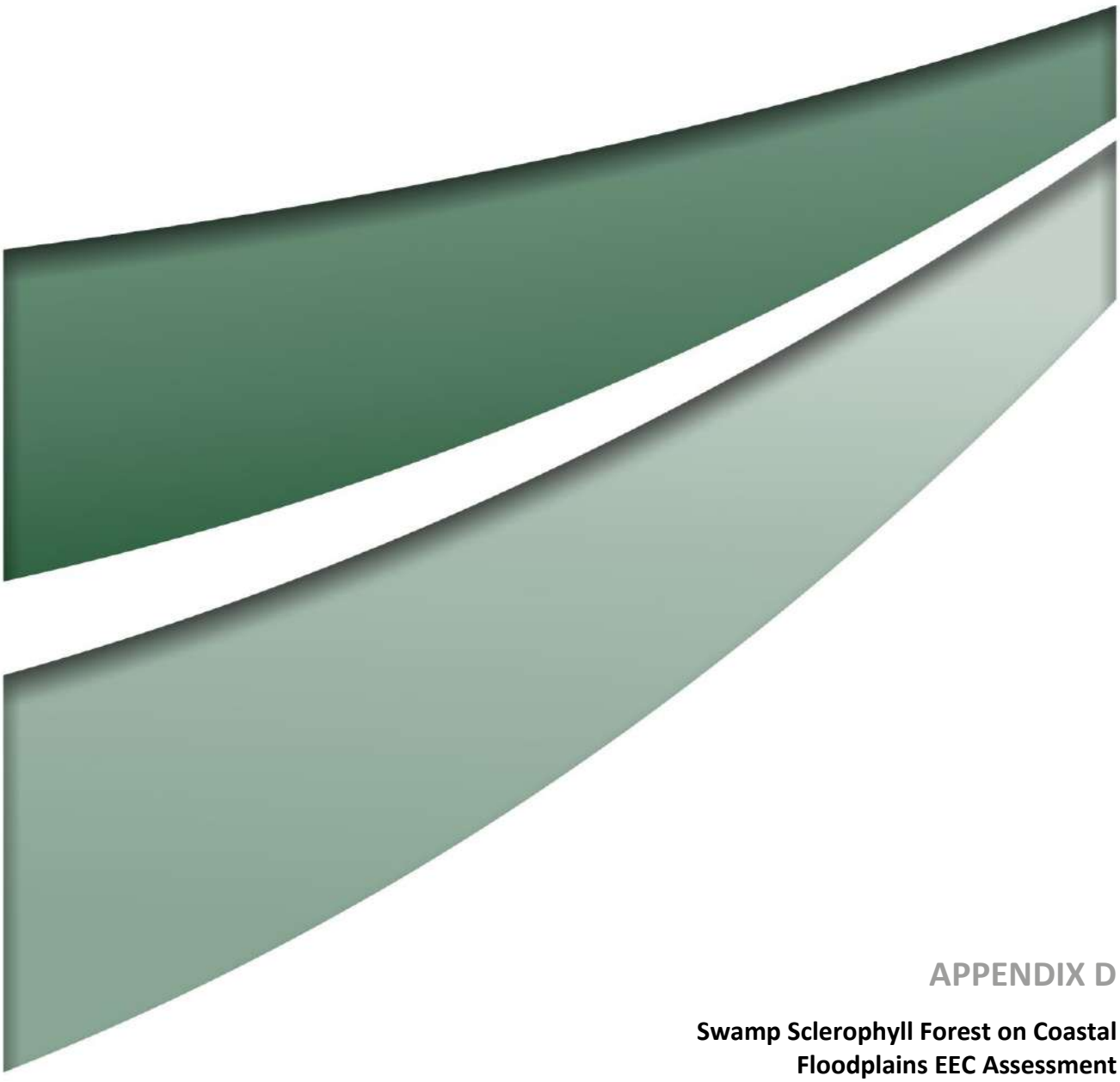
The proposed rezoning is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

- ***substantially modify and/or destroy an area of important habitat for a migratory species;***
- ***seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species; and/or***
- ***result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.***

The Study Area is not considered to comprise *important habitat* for any of the identified migratory species listed above, and therefore the proposed rezoning is not likely to substantially modify or destroy important migratory species habitat. Similarly, the proposed rezoning will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species; or result in an invasive species that is harmful to migratory species becoming established within the Study Area.

Conclusion

The proposed rezoning is not likely to result in a significant impact on any migratory species listed under the EPBC Act or international conventions.



APPENDIX D

Swamp Sclerophyll Forest on Coastal Floodplains EEC Assessment

Swamp Sclerophyll Forest on Coastal Floodplains EEC under the TSC Act Assessment

The potential presence of *Swamp Sclerophyll Forest on Coastal Floodplains EEC* under the TSC Act within the Mahogany-Baloskion Swamp Forest in the Study Area was highlighted in the constraints assessment. Although this EEC is usually associated with alluvial flats and coastal floodplains and does not typically occur within the coastal sand plains, the EEC has been identified along Nelson Bay Road approximately 2km north of the Study Area and previous judgements (such as Motorplex v Port Stephens Council NSW LEC 74) have indicated that the EEC may occur on sand plains that have hydrological, geographical or floristic associations with coastal floodplains.

As a result of the uncertainty, further investigations into the potential presence of the community were undertaken. Vegetation was sampled within this vegetation community at the Study Area by two ecologists on 1 November 2016 within one 400 square metre plot and along a walking transect. An assessment of the community was then undertaken against the Final Determination for the EEC (NSWSC 2004).

In order for the vegetation community Mahogany – Baloskion Swamp Forest to be the *Swamp Sclerophyll Forest on Coastal Floodplains EEC*, it must satisfy the description of the EEC provided in the final determination of the NSW Scientific Committee (2004). This description includes the main components of:

- Edaphic (soils), topographic/locational and
- Floristic structure and composition.

The Mahogany – Baloskion Swamp Forest in the Study Area does not meet the NSW Scientific Committee's description for most of these components.

Edaphic (soils), Topographical and Locational

The Final Determination for *Swamp Sclerophyll Forest on Coastal Floodplains EEC* states the community:

> *"generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions".*

The NSW Scientific Committee also states that this EEC is:

> *"associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with the coastal floodplains".*

Although Mahogany – Baloskion Swamp Forest in the Study Area does occur below 20m ASL, it does not occur on or in association with the floodplain. A floodplain landform is defined by the Scientific Committee as a:

> *"level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less"*

The Study Area does not occur on the floodplain nor is it associated with alluvial floodplains: it occurs on ancient sand-dunes behind Stockton Beach. Furthermore, it is not alluvial in nature: the sandy soils in the Study Area have formed from beach sand deposits, and stream formation (exhibiting channelised flow) is

weak. Furthermore, soil in the Study Area was recorded during field work as coarse sand with minor loam; sandy loams or humic clay loams were not recorded.

Floristic Composition and Structure

The Final Determination for *Swamp Sclerophyll Forest on Coastal Floodplains EEC* states the community:

> *"is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. Typically these forests, scrubs, fernlands, reedlands and sedgelands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water"*

Vegetation mapped as Mahogany – Baloskion Swamp Forest in the Study Area does form an open forest with areas that are low and dense that has a scrub structure. However, apart from dense patches of bracken fern (*Pteridium esculentum*), which are likely associate with past disturbance and bushfire, there are no areas of fernland, reedland or sedgeland in this community. The understorey is typically dry and sclerophyllous in nature, which is more typical of dry, open forest, including coast teatree (*Leptospermum laevigatum*), tantoon (*L. polygalifolium* subsp. *cismontanum*), common fringe-myrtle (*Calytrix tetragona*) and tree broom-heath (*Monotoca elliptica*) dominant.

The ground cover is also more typical of dry, coastal, sclerophyllous forest, including pomax (*Pomax umbellata*), spiny-headed mat rush (*Lomandra longifolia*) and bracken (*Pteridium esculentum*). Presence also are species that are non-typical of Swamp Sclerophyll EEC, including pigface (*Carpobrotus glaucescens*) and old-man banksias (*Banksia serrata*), which are common on sandy, coastal soils.

Furthermore, there were no areas of semi-permanent standing water, except in areas immediately downslope and adjacent to residential areas where water is most likely running off from gardens and drainage from impermeable surfaces such as roads and driveways.

The Final Determination for *Swamp Sclerophyll Forest on Coastal Floodplains EEC* provides a list of 59 characteristic plant species. A total of 24 native species were recorded in the Mahogany – Baloskion Swamp Forest community within the Study Area. Of these 24 species, only six occur on the EEC's list of characteristic plant species. This is represented by the following ratios:

- 10% of the EEC list of characteristic plant species were recorded in the Study Area; and
- 24% of the species recorded in the Study Area are on the EEC list of characteristic plant species.

The Scientific Committee does state that:

> *"the total species list of the community is considerably larger than that given...with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance".*

However, the proportion of EEC characteristic plant species recorded in the Mahogany – Baloskion Swamp Forest is low. Additionally, the number of the most widespread and abundant plant species in the EEC that are present in the Study Area is low, with swamp mahogany (*Eucalyptus robusta*) the only dominant tree recorded.

Conclusion

Given the above information, the Mahogany – Baloskion Swamp Forest in the Study Area does not conform to the description of the *Swamp Sclerophyll Forest on Coastal Floodplains EEC*.

APPENDIX E

Preliminary Koala Plan of Management

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DHA

PRELIMINARY KOALA PLAN OF MANAGEMENT

Rifle Range
Defence Housing Project

May 2018

PRELIMINARY KOALA PLAN OF MANAGEMENT

Rifle Range
Defence Housing Project

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Defence Housing Australia

Project Director:	Rebecca Vere
Project Manager:	Kate Connolly
Report No.	3764/R03/Final
Date:	May 2018

Newcastle

75 York Street
Teralba NSW 2284

Ph. 02 4950 5322

www.umwelt.com.au

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	**Date**	**Name**	**Date**
Final	Rebecca Vere	29/05/2018	Rebecca Vere	29/05/2018

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Appendices

Appendix 1 Application of the Koala Habitat Assessment Tool (DoE 2014)

1.0 Introduction

Defence Housing Australia (DHA) proposes to rezone the former Rifle Range at Fern Bay (refer to **Figure 1.1**) from the current Environmental Conservation (E2) to Low Density Residential (R2) and National Parks and Reserve (E1) under the Port Stephens Local Environmental Plan (LEP) 2013 to allow for a residential subdivision and conservation.

The site has been subject to ongoing investigations (including ecological survey) as a potential development site since 2008. The ecological features identified as part of such investigations (including current and previous field survey) have been used to guide the design of an appropriate Master Plan for the proposed development, with the aim of providing a development approach which balances the economic potential of the Study Area with appropriate biodiversity conservation outcomes for the broader Stockton area.

This Preliminary Koala Plan of Management (KPoM) has been prepared in recognition of the presence of preferred koala habitat, including suitable koala feed trees, on or within the vicinity of the site and as required by Port Stephens Council and in consideration of State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44).

1.1 Project Description

DHA has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle-based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. In response to this, DHA have recently purchased two sites: Fort Wallace, Stockton, NSW and the Rifle Range, Fern Bay, NSW. DHA intends to obtain the necessary planning approvals to develop these sites for residential use with a mix of housing suitable for both Australian Defence Force (ADF) personnel and the private market.

The proposed Master Plan for the Rifle Range site includes a mix of residential typologies primarily placed within the former Rifle Range footprint (refer to **Figure 1.2**). The Master Plan has sought to retain the Rifle Range landscape and focus development within the previously disturbed areas of the site.

1.2 Objectives

The objectives of this KPoM are to:

- identify the location and characteristics of the core koala habitat identified within the Study Area
- identify the potential impacts of the Project to core koala habitat identified within the Study Area
- provide management measures to minimise the potential impacts on core koala habitat associated with the re-zoning project.

Image Source: Nearmap (May2016)
Data Source: LPI NSW (2009)

0 1.0 2.0 2.5km
1:50 000

Legend

- Site Boundary
- National Park
- State Conservation Area
- Regional Park
- Hunter Estuary Wetlands Ramsar Site

FIGURE 1.1

Locality Map

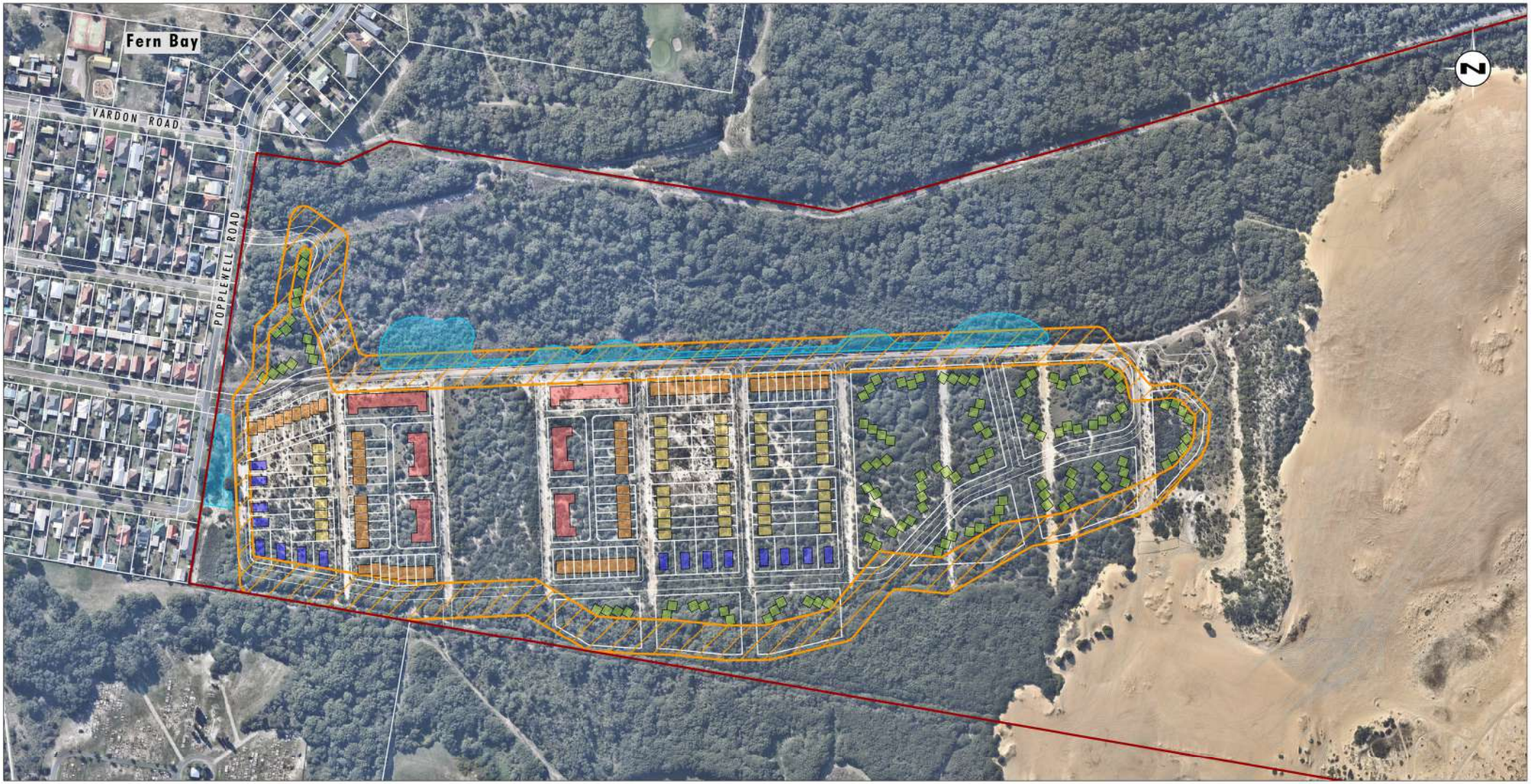

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2009), Architectus (2018)

0 100 200 250m
1:5000

Legend

- Site Boundary
- Asset Protection Zone
- Stormwater Detention Basin (Subject to design resolution)
- Dune Apartment
- Townhouse
- Courtyard Home
- Cluster Home
- Single Eco Home

FIGURE 1.2

Proposed Master Plan

File Name (A4): R03/3764_012.dgn
20180524 16.08

1.3 Legislative Requirements

The *Environmental Planning and Assessment Act 1979* (EP&A Act) makes provision for a range of environmental planning instruments, which additionally provide for protection of koala habitat, including State Environmental Planning Policies and Local Environmental Plans. The main provisions of the state and local planning instruments are provided below.

1.3.1 Port Stephens Council Comprehensive Koala Plan of Management

The Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) was prepared by Port Stephens Council and the Australia Koala Foundation to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline in the Port Stephens LGA.

The report provides guidelines for koala habitat assessments, habitat conservation measures and performance criteria to facilitate targeted koala conservation and management across the Port Stephens koala population. Broad-scale mapping of preferred, supplementary and marginal koala habitat is outlined for the Port Stephens LGA. According to this habitat mapping, the Study Area contains preferred and supplementary habitat as well as buffer vegetation for the koala.

This site specific KPoM was prepared in response to the presence of primary koala habitat in accordance with the Port Stephens CKPoM and the high level of historic usage of the site by koalas indicating the presence of 'core' koala habitat in accordance with SEPP 44.

1.3.2 SEPP 44 – Koala Habitat Protection

State Environmental Planning Policy 44 – Koala Habitat Protection is a policy made under EP&A Act. SEPP 44 is currently under review. The proposed amendment will update the controls to better protect koala habitat. The update will bring the SEPP into line with the current planning system and support councils to prepare comprehensive plans of management. The amendments will also improve the application of the SEPP by recognising the extent of tree species important to koalas. Explanation of Intended Effect was on public exhibition from 18 November 2016 through 3 March 2017. Submissions are now being reviewed. As such, any reference to SEPP 44 in this report relates to the current SEPP 44 as at 28 May 2018.

SEPP 44 aims to encourage the appropriate conservation and management of areas of natural vegetation that provide habitat for koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline. Any development application in an identified local government area, affecting land of one hectare or greater, including adjoining lands on the same holding, must be assessed under SEPP 44.

Assessment under SEPP 44 is based on an initial determination of whether the subject land constitutes potential koala habitat. This is determined by assessing whether the eucalypt species listed in Schedule 2 constitute 15 per cent or more of the total number of trees in the upper or lower strata of the tree component of the subject land. If potential koala habitat is present, the area must be further assessed to determine if the land is core koala habitat. This is primarily determined by completing field surveys and literature searches to determine if a population of koalas is present within the subject land.

The proposed Project is not subject to assessment under SEPP 44 as it lies in the Port Stephens local government area which has prepared a Comprehensive Koala Plan of Management, however the key components of the SEPP have been considered in the preparation of this Plan.

1.3.3 NSW *Biodiversity Conservation Act 2016*

The NSW *Biodiversity Conservation Act 1995* (BC Act) provides protection for threatened plants and animals native to NSW. Species listed under Schedule 1 of the BC Act are considered to be threatened in NSW. The koala (*Phascolarctos cinereus*) is listed as a Vulnerable species within Schedule 1 of the BC Act. The koala has additionally been listed as an Endangered Population in Pittwater LGA, the Hawks Nest/Tea Gardens LGA and between the Tweed River and Brunswick River east of the Pacific Highway in northern NSW, which are not relevant to this KPoM.

Protection of the koala (including its habitat) is provided by integrating the conservation of the species into the development control process under the EP&A Act (which includes SEPP 44).

1.3.3.1 Approved Recovery Plan for the Koala (*Phascolarctos cinereus*) (DECC 2008)

A Recovery Plan for the Koala has been prepared by OEH (DECC 2008) under the requirements of the now repealed *Threatened Species Conservation Act 1995*.

This recovery plan is the formal recovery plan for the koala in NSW and considers the conservation requirements of the species across its known range in NSW. It identifies the actions needed and parties responsible for undertaking the identified actions. It also provides a framework for localised recovery efforts throughout NSW, including the management issues relevant to the koala.

Although this document is primarily aimed at actions to be undertaken by government authorities many of the issues presented are applicable, and the recovery objectives and proposed recovery actions have been considered in the development of this KPoM.

1.3.4 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides the legislation to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places (also known as matters of national environmental significance).

The combined populations of the koala in Queensland, New South Wales and the Australian Capital Territory were listed as Vulnerable under the EPBC Act in May of 2012. The koala was listed as Vulnerable due to a substantial decline over three generations (TSSC 2012).

A recovery plan for the koala was recommended as part of the listing advice and is due to be prepared following the expiration of the National Koala Conservation and Management Strategy 2009–2014.

1.3.4.1 National Koala Conservation and Management Strategy 2009-2014

This Management Strategy was prepared by the Natural Resource Management Ministerial Council (NRMMC 2009) to provide a national coordinating framework for the numerous koala plans and actions that have been developed and are being undertaken by various state and local governments across Australia. Being a policy document, this Management Strategy does not provide any legislative powers or obligations. Importantly, the Management Strategy provides overarching policies and directions for action for the integration of national and state koala policies in order to work towards the goal of conserving koalas and their habitat. This Management Strategy has been considered in the development of this KPoM.

1.3.4.2 EPBC Act Referral Guidelines for the Vulnerable Koala (DoE 2014)

These koala referral guidelines (the guidelines) aim to address this complexity and provide guidance that can be applied consistently across the entire listed distribution of the koala. The guidelines break down the significant impact decision and guide proponents on important requirements, particularly on information expectations, survey planning, standards for mitigating impacts and guidance on significant impact.

In accordance with the Referral Guidelines, the habitat assessment tool was applied to the Study Area which determined that the extent of vegetation that contains at least one known koala food tree corresponds to a range of forest and woodland communities occurring in the Study Area. This includes:

- Mahogany-Baloskion Swamp Forest.

As the assessment of koala habitats resulted in a score greater than five using the Referral Guidelines habitat assessment tool (refer to **Appendix 1**), the Study Area is considered to contain habitat critical to the survival of the species (DoE 2014).

2.0 Ecology of Koalas

2.1 General Information

The koala (*Phascolarctos cinereus*) is an arboreal marsupial with fur ranging from grey to brown above, and is generally white below. It has large furry ears, a prominent black nose and no tail. It spends most of its time in trees and has long, sharp claws, adapted for climbing. Adult males weigh 6–12 kg and adult females weigh 5–8 kg. During breeding, males advertise with loud snarling coughing and bellowing (OEH 2016).

This species has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, and it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands (OEH 2016). Under the IUCN red list of threatened species the koala is listed as being in the category of least concern.

Koalas inhabit eucalypt woodlands and forests, and feed on the foliage of at least 70 known eucalypt species and 30 non-eucalypt species, selecting preferred browse species in various regions. This species is generally inactive for most of the day, feeding and moving mostly at night. Koalas spend most of their time in trees, but will descend and traverse open ground to move between trees, when required. Home range size varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size. This species is generally solitary, however has complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year (OEH 2016).

The breeding season for koalas peak between September and February and animals are most active during this period (DECC 2008). The gestation period for the koala is 35 days. Following birth, the young remains in the pouch for approximately 6 months, and on leaving the pouch, remains dependent on its mother and is carried on her back. Young reach independence at about 12 months old, although they can remain in the mother's home range for a further two to three years (Mitchell and Martin 1990). After this time, young animals of both sexes disperse to establish their own home range areas (Ramsay 1999). Dispersal distances range from one to 11 km although movements in excess of 50 km have been recorded (DECC 2008).

2.2 Habitat Quality

The quality of forest and woodland communities as habitat for koalas is influenced by a range of factors, including:

- **Species and size of trees present**: the most important factor influencing koala occurrences is the suite of tree species available. Koalas rely exclusively on regionally specific primary and/or secondary food tree species (DECC, 2008). Adequate floristic diversity is also important. The quality of habitat is also influenced by the presence of suitable shelter trees.

- **Structural diversity of the vegetation**: it has been found that koala activity is greater in structurally diverse forest with the majority of trees 50–80 cm DBH (DECC, 2008). Some groundcover vegetation and other features, such as hollow logs, are useful in providing shelter while on the ground and refuge in extreme weather conditions.

- **Soil nutrients**: in general, vegetation on more fertile soils provides the most suitable habitat for koalas due to the greater availability of nutrients within leaves (Cork *et al.* 1990).

- **Climate and rainfall**: koalas rely primarily on the moisture within their food to meet their water requirements.

- **Size and disturbance history of the habitat patch**: small, fragmented or highly disturbed habitats are less likely to be able to support koalas in the long term due to edge effects, limited resource availability and increased predation (DECC 2008). Vegetation corridors are important to support continued koala movements where dispersal and recruitment are impeded by barriers such as large areas of open ground and roads.

2.3 Preferred Koala Feed Tree Species

Koalas feed on the foliage of eucalypt tree species and in some areas exhibit extremely strong preferences for particular eucalypt species. SEPP 44 lists preferred koala feed trees in Schedule 2 of the SEPP. These species are listed in **Table 2.1** below.

Table 2.1 Preferred Koala Feed Trees listing under Schedule 2 of SEPP 44

Scientific Name	Common Name
Eucalyptus tereticornis	forest red gum
Eucalyptus microcorys	tallowwood
Eucalyptus punctata	grey gum
Eucalyptus viminalis	ribbon or manna gum
Eucalyptus camaldulensis	river red gum
Eucalyptus haemastoma	broad leaved scribbly gum
Eucalyptus signata	scribbly gum
Eucalyptus albens	white box
Eucalyptus populnea	bimble box or poplar box
Eucalyptus robusta	swamp mahogany

The Recovery Plan for the Koala (DECC 2008) documents the preferred feed trees in each of seven management areas identified in the Recovery Plan. The Study Area occurs within the North Coast Management Area, and **Table 2.2** outlines the primary, secondary and supplementary species that have been identified in that Management Area.

Table 2.2 Preferred Koala Feed Trees in the North Coast Management Area

Scientific Name	Common Name
Primary Food Tree Species	
Eucalyptus microcorys	tallowwood
Eucalyptus tereticornis	forest red gum
Eucalyptus robusta	swamp mahogany
Eucalyptus parramattensis	Parramatta red gum
Eucalyptus amplifolia	cabbage gum
Secondary Food Tree Species	
Eucalyptus seeana	narrow-leaved red gum
Eucalyptus glaucina	slaty red gum
Eucalyptus propinqua	small-fruited grey gum
Eucalyptus resinifera	red mahogany
Eucalyptus notabilis	mountain mahogany
Eucalyptus moluccana	grey box
Eucalyptus melliodora	yellow box
Eucalyptus largeana	craven grey box
Eucalyptus biturbinata	grey gum
Eucalyptus canaliculata	large-fruited grey gum
Eucalyptus rummeryi	steel box
Eucalyptus rudderi	Rudder's box
Eucalyptus quadrangulata	white-topped box
Stringybarks/Supplementary Species	
Eucalyptus tindaliae	stringybark
Eucalyptus eugeniodes	thin-leaved stringybark
Eucalyptus globoidea	white stringybark
Eucalyptus agglomerata	blue-leaved stringybark
Eucalyptus cameronii	diehard stringybark

The Port Stephens Comprehensive Koala Plan of Management (PSC 2002) documents three tree species known to be feed trees for koalas in the Port Stephens LGA. **Table 2.3** outlines these species.

Table 2.3 Feed Tree Species for Koala in the Port Stephens Local Government Area

Scientific Name	Common Name
Eucalyptus robusta	swamp mahogany
Eucalyptus parramattensis	Parramatta red gum
Eucalyptus tereticornis	forest red gum

3.0 Regional and Local Koala Habitat Populations

3.1 Koala Habitat

3.1.1 Regional Koala Habitat

In New South Wales, koalas inhabit a range of forest and woodland communities, including coastal forests, woodlands on the tablelands and western slopes, and woodland communities along watercourses in the western plains in areas dominated by the genus *Eucalyptus*. On the NSW North Coast important koala population centres are at Port Stephens, Port Macquarie, Coffs Harbour, Ballina, Lismore and Tweed (DECC 2008).

The Australian Koala Foundation's Port Stephens Koala Habitat Atlas (Phillips *et al.* 1996), confirmed the following tree species as being preferentially utilised by koalas within the Port Stephens LGA: swamp mahogany (*Eucalyptus robusta*) and Parramatta red gum (*E. parramattensis*) on all substrates where they occur; and forest red gum (*Eucalyptus tereticornis*) where it occurs on soils derived from Quaternary alluvials and volcanics.

Koala habitat in the Port Stephens area has been mapped and presented in the Port Stephens Council Koala Plan of Management (PSC 2002). Koala habitat identification was undertaken by Lunney *et al.* (1998) and incorporated into the CKPoM which identified the following habitat types for koalas in the Port Stephens area:

- Preferred koala habitat
- Supplementary koala habitat
- Marginal koala habitat
- Habitat buffers
- Habitat linking areas.

Preferred habitat on the coastal strip of Port Stephens generally occurs in the intact Swamp Sclerophyll Forest community and supplementary habitat includes areas where the Swamp Sclerophyll Forest intergrades with the Smooth-barked Apple Blackbutt Forest vegetation community. Lunney *et al.* (1998) identified approximately 7,366 hectares of preferred habitat, 9,778 hectares of supplementary and 22,781 hectares of marginal koala habitat in the Port Stephens LGA.

3.1.2 Local Koala Habitat

The koala has not been recorded within the Study Area, however it has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park. Koalas occurring within the Port Stephens LGA are likely to comprise an important population in the region. The Study Area is unlikely to be core habitat for the Port Stephens koala population, however individuals may occur infrequently as they move through the landscape around Fern Bay.

Preferred habitat on the coastal strip of Port Stephens generally occurs in the intact Swamp Sclerophyll Forest community and supplementary habitat includes areas where the Swamp Sclerophyll Forest intergrades with the Smooth-barked Apple Blackbutt Forest vegetation community. The Port Stephens Koala Habitat Planning Map (PSC 2007) maps the Study Area as 'mainly cleared' with edges of 'supplementary habitat' occurring to the north of the site in association with the Frontal Dune Blackbutt-Apple Forest and the Worimi Conservation Lands.

However, based on the habitat categories by Lunney *et al.* (1998), it is likely that the Mahogany-Baloskion Swamp Forest would meet the definition of Category B vegetation detailed by Lunney *et al.* (1998) and therefore would be considered preferred koala habitat in the Port Stephens LGA. The Frontal Dune Blackbutt-Apple Forest is likely to confirm to Category C vegetation and would be considered supplementary koala habitat. The remaining vegetation in the Study Area is classified as 'other vegetation'. Koala habitat within the Study Area, mapped by Umwelt in consideration of Lunney *et al.* (1998), is shown in **Figure 3.1**.

The koala was targeted during surveys undertaken in May 2016 including SAT, call playback and spotlighting surveys. No evidence (scats, scratches, etc) of koala occupation was recorded in the Study Area. While the koala has not been specifically recorded within the Study Area, the species has been recorded as recently as 2015 in habitats associated with Fern Bay approximately 1.5km north of the Study Area.

A map of the extent and quality of the habitat in the Study Area for the koala is provided as **Figure 3.1**. This map has been prepared in accordance with the Port Stephens CKPoM and Lunney *et al*. (1998) and defines the area of preferred, supplementary and marginal habitat, and also the relevant buffer and linking areas.

Table 3.1 below outlines the area of each koala habitat type mapped in the Study Area according to the Port Stephens CKPoM with a justification of the koala habitat categories as per Lunney *et al.* (1998). 2.3 hectares of preferred koala habitat has been identified in the Study Area, as shown in **Table 3.1**. **Table 3.1** outlines the broad habitat types and allocation to koala habitat categories as per Lunney et al. (1998) within the Study Area.

Table 3.1 Extent of Koala Habitat Identified in the Study Area

Vegetation Community	Dominant Overstorey Species	Habitat Category (as per Lunney *et al.* 1998)	Justification (as per Lunney *et al.* 1998)	Area (ha) in Study Area
Frontal Dune Blackbutt-Apple Forest	*Angophora costata* *Eucalyptus pilularis*	Supplementary	Meets category C vegetation	17.5
Mahogany-Baloskion Swamp Forest	*Eucalyptus robusta* *Eucalyptus parramattensis* subsp. *decadens* x *robusta*	Preferred	Meets category B vegetation	2.3
Coastal Tea-tree – Banksia Scrub	N/A	Other vegetation	Considered to be excluded vegetation	20.5
Foredune Spinifex	N/A	Other vegetation	Considered to be excluded vegetation	1.4

Vegetation Community	Dominant Overstorey Species	Habitat Category (as per Lunney *et al.* 1998)	Justification (as per Lunney *et al.* 1998)	Area (ha) in Study Area
Beach Wetlands	N/A	Other vegetation	Considered to be excluded vegetation	3.2
Cleared land/sand dunes	N/A	Other vegetation	Considered to be excluded vegetation	66.7
Total Preferred Koala Habitat				**2.3**
Total Supplementary Habitat				**15.9**
Total Buffer Around Preferred Habitat				**3.6**
TOTAL				**21.8**

Koalas feed on the foliage of eucalypt tree species and in some areas exhibit extremely strong preferences for particular eucalypt species. As outlined in **Section 2.3**, the SEPP 44 lists preferred koala feed trees as does the CKPoM (PSC 2002) and the Approved Recovery Plan for the Koala (DECC 2008). These species are outlined in **Table 3.2** below as well as counts of preferred feed tree species in the Study Area as a result of the koala habitat tree survey. **Figure 3.2** shows the location of koala feed trees across the Study Area.

Table 3.2 Preferred/Primary Koala Feed Trees

Preferred/Primary Koala Feed Tree Species	SEPP 44	Port Stephens Comprehensive Koala Plan of Management	Approved Recovery Plan for the Koala^	Number Recorded in the Study Area
swamp mahogany *Eucalyptus robusta*	✓	✓	✓	148
Parramatta red gum *Eucalyptus parramattensis*	-	✓	✓	2 (likely hybrid with *E. robusta*)
forest red gum *Eucalyptus tereticornis*	✓	✓	✓	-
tallowwood *Eucalyptus microcorys*	✓	-	✓	-
grey gum *Eucalyptus punctata*	✓	-	-	-
ribbon or manna gum *Eucalyptus viminalis*	✓	-	-	-

Preferred/Primary Koala Feed Tree Species	SEPP 44	Port Stephens Comprehensive Koala Plan of Management	Approved Recovery Plan for the Koala^	Number Recorded in the Study Area
river red gum *Eucalyptus camaldulensis*	✓	-	-	-
broad-leaved scribbly gum *Eucalyptus haemastoma*	✓	-	-	-
scribbly gum *Eucalyptus signata*	✓	-	-	-
white box *Eucalyptus albens*	✓	-	-	-
bimble box or poplar box *Eucalyptus populnea*	✓	-	-	-
cabbage gum *Eucalyptus amplifolia*	-	-	✓	-
Total				**150**

^Appendix 2 – North Coast Koala Management Area

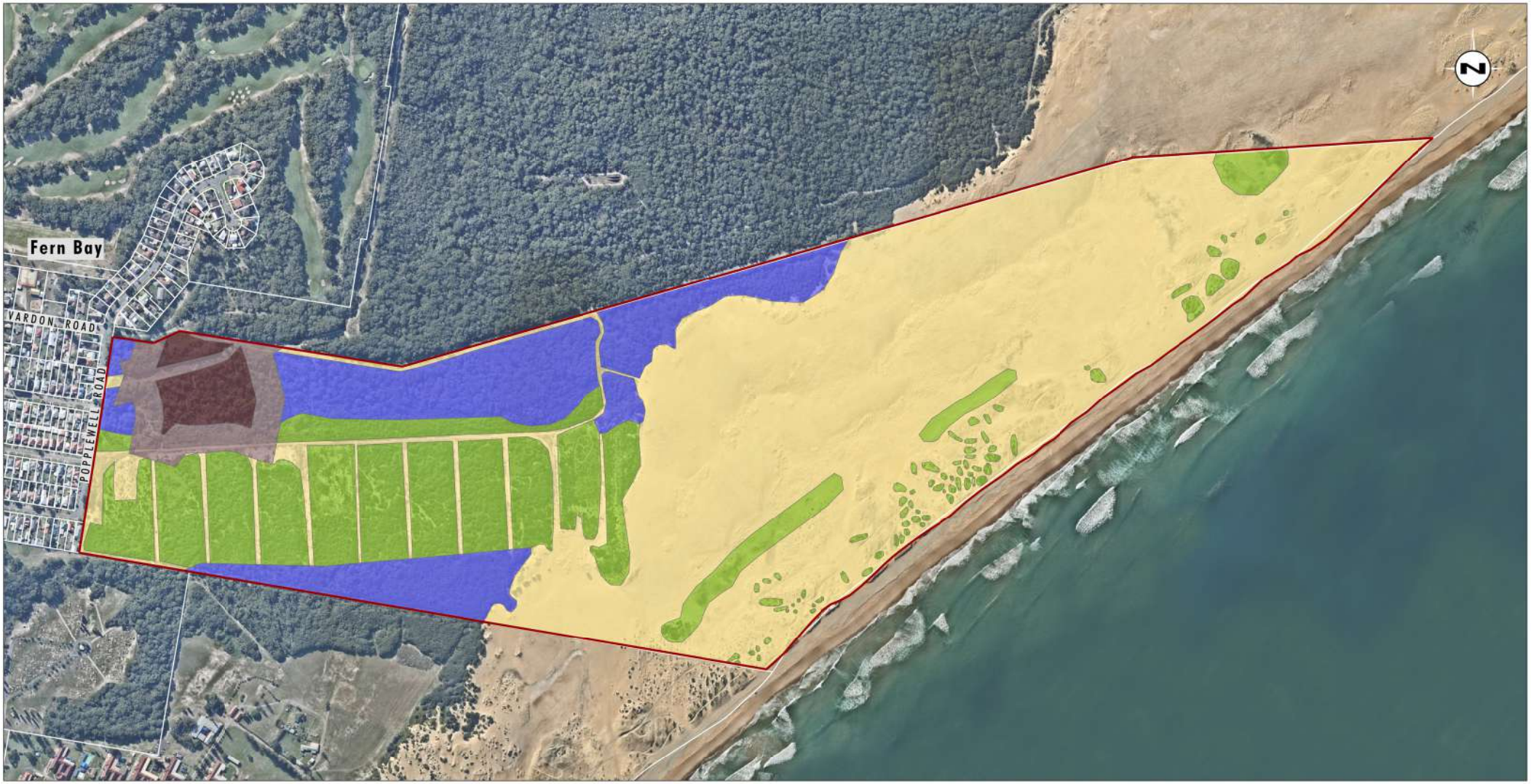

Image Source: Nearmap (May2016)
Data Source: LPI NSW (2009), Atlas (2016)

0 100 250 500m
1:10 000

Legend

- Site Boundary
- Koala Habitat Entities:
  - Preferred Koala Habitat
  - 50m Buffer around Preferred Koala Habitat
  - Supplementary Koala Habitat
- Other Vegetation
- Mainly Cleared

FIGURE 3.1

Koala Habitat in the Study Area
(Mapped by Umwelt)

Image Source: Nearmap (May2016)
Data Source: LPI NSW (2009), Atlas (2016)

0 100 250 500m
1:10 000

Legend

- Site Boundary
- *Eucalyptus parramattensis* subsp. *decadens* x *robusta*
- *Eucalyptus robusta*

FIGURE 3.2

Koala Feed Trees in the Study Area

3.1.3 Availability of Alternative Koala Habitat and Corridor Function

Figure 3.1 identifies the vegetation communities likely to comprise koala habitat within the Study Area. This koala habitat has been determined by refining the broad koala habitat mapping outlined in the Port Stephens Council Comprehensive Koala Plan of Management (PSC 2002).

The majority of this habitat occurs in large, relatively continuous patches in the northern parts of the Study Area (refer to **Figure 3.1**). Review and analysis of regional vegetation mapping data indicates that those communities that were recorded during vegetation surveys within the Study Area occur extensively in the local area and region.

The Study Area occurs on the southern edge of extensive areas of forested habitat within the Worimi Conservation Lands and adjacent vegetated areas along the Port Stephens coast that provide connectivity and movement corridors for a wide range of flora and fauna species from Fern Bay to Nelson Bay. The protection of landscape connections is important to ensure the exchange of genetic material and ensure adequate feeding area, breeding grounds and allow for migration for koalas.

The rezoning may result in the loss of up to 3.2 hectares of preferred, buffer and supplementary koala habitat south of Worimi Conservation Lands which will result in the loss of a small area of the southern extent of continuous habitat between Fern Bay and Nelson Bay. It is considered unlikely that the residential development as a result of the rezoning will restrict ecological vectors from moving from one habitat to another throughout the wider area or have substantial adverse impacts on the movement corridors and connectivity for species. The Worimi Conservation Lands include substantial areas of likely koala habitat on the basis of suitable vegetation communities.

3.2 Koala Populations

3.2.1 Regional Populations

The Study Area falls within Koala Management Area 1: North Coast (DECC 2008). On the NSW North Coast important koala population centres are at Port Stephens, Port Macquarie, Coffs Harbour, Ballina, Lismore and Tweed. In addition to these population centres, numerous small koala populations occur along the coast but many are separated as a result of urban and rural development, roads and other forms of fragmentation.

The Koala Recovery Plan (DECC 2008) has identified the Hawks Nest and Tea Gardens as comprising an important endangered koala population. This area is the closest regionally important population of the koala, occurring approximately 20 km to the northeast of the Study Area. It is unlikely that the individuals recorded within the Study Area would substantially interact with this population.

3.2.2 Local Population

Some population estimates have been derived for the Port Stephens LGA, with Phillips *et al.* (1996) concluding that historical estimates of population size suggest well below 1,000 individuals distributed over the entire Port Stephens LGA area and likely between 350-500 animals in total. Later population viability analysis modelling by Lunney *et al.* (2007) utilised a starting population within their study area of 7,000 hectares of the Tomago sandbeds of 800 individuals in 1998.

The koala has not been recorded within the Study Area, however it has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park. An Atlas of NSW Wildlife point buffer search identified 145 koala records within a 10 km radius of the Study Area. The Study Area contains two preferred koala feed trees, being swamp mahogany (*Eucalyptus robusta*) and likely Earps gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*) occurring in the northwest of the site in the Mahogany-Baloskion Swamp Forest.

4.0 Potential Impacts from the Proposal

Approximately 21.8 hectares of preferred, buffer and supplementary koala habitat have been identified in the Study Area, with 3.2 hectares to be potentially impacted by the rezoning proposal. Due to the records of the species on the locality and the known occurrence of koala feed trees on the site, it is considered likely that the Study Area provides a small area of core koala habitat as described by SEPP 44. The potential impacts of the rezoning proposal are discussed below.

4.1 Increased Traffic

The proposed residential development as a result of the rezoning proposal will result in an increase in local traffic flows to and from the residential areas during construction and operation of the site. This will be primarily due to increased vehicle movements associated with residents accessing housing areas.

4.2 Lighting and Dust

Operational impacts that may impact upon the normal behaviour patterns of the koala include fugitive lighting impacts. Research into the impacts of altered lighting indicates that it can trigger behavioural and physiological responses including changes in foraging behaviour, disruptions of seasonal day length trigger cues for critical behaviour, disorientation and temporary blindness and interference with predator prey relationships.

The generation of dust during construction has the potential to impact on habitat through the deposition of dust on plant surfaces and the subsequent influence this can have on physiological processes. This can result in decreased plant health and in extreme cases plant death, as well as increased susceptibility to pathogens and other disturbances. The potential impacts of dust on koala includes degraded air or water quality and through impacts on food and habitat sources.

Impacts from these elements as a result of the rezoning proposal are expected to be minor and the koala is expected to continue to occupy the habitats in the wider locality in co-existence with the proposed residential development. Lighting and dust impacts will be mitigated through the application of mitigation measures to minimise lighting and dust impacts in the locality.

4.3 Noise and Vibration

The potential noise and vibration sources from the rezoning proposal include operational noise, construction noise and road traffic noise. Noise and vibration impacts can affect fauna physiology and behaviour, particularly by causing disruption to communication including mating calls, territorial calls and alarm calls. In additional to physiological impacts, this can also result in habitat loss through avoidance.

The proposed equipment being used during construction are not anticipated to create any noticeable vibration impacts due to the nature of the equipment being used and the considerable separation distances to adjoining receivers. Impacts are expected to be minor and the koala is expected to continue to occupy the habitats in the wider locality in co-existence with the proposed residential development.

4.4 Clearance of Vegetation/Loss of Habitat

The clearing of native vegetation (particularly of koala feed trees) is a major threat facing the koala across its range and the clearing of vegetation may reduce the extent of koala habitat by up to approximately two koala feed tree individuals, which represents approximately 1.3 per cent of the extent of the koala feed trees in the Study Area.

The proposed rezoning may result in adverse impacts on the koala through the removal and disturbance of known koala habitat and koala feed trees. Mitigation measures to minimise these impacts are outlined in **Section 6.0**.

4.5 Increased Competition for Resources

The removal of approximately 3.2 hectares of preferred, buffer and supplementary koala habitat may reduce the area of occupancy of the koala in the Study Area. A reduction in koala habitat may have minor adverse impacts to locally-occurring koala individuals through increased competition for resources, including consideration of the ongoing availability of suitable territories and home ranges, mates and other habitat features such as specific feed species and foraging resources within the Study Area. However, the species has not been recorded utilising the resources within the Study Area.

Increased resource competition is expected to have minor impacts on the known population of the koala in the Port Stephens locality.

5.0 Threatening Processes

Koalas are known to be susceptible to a number of identified threatening processes. These are recognised within the Koala Recovery Plan (DECC 2008) as being (in order of general importance):

- habitat loss and fragmentation
- habitat degradation
- road kills
- dog attacks
- fire
- logging
- disease
- severe weather conditions
- swimming pools
- overbrowsing.

There are currently 38 key threatening processes listed under the BC Act. Of these, the following have the koala specifically listed as being potentially affected:

- forest eucalypt dieback associated with over-abundant psyllids and bell miners
- clearing of native vegetation
- invasion, establishment and spread of *Lantana camara*
- predation and hybridisation of feral dogs (*Canis lupus familiaris*)
- anthropogenic climate change
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- infection of native plants by *Phytophthora cinnamomi*
- predation by the European red fox (*Vulpes vulpes*)
- predation by the feral cat (*Felis catus*)
- removal of dead wood and dead trees.

The proposed rezoning is expected to have a minor impact on the exposure of the koala to the key threatening process of clearing of native vegetation. It is not expected that the proposal will exacerbate any of the other threatening processes that are known to adversely affect the koala.

6.0 Management Strategies

6.1 Impact Avoidance

DHA undertook a detailed constraints study to guide the design of the Master Plan. Through this process, different building locations were considered and DHA has sought to minimise the biodiversity impacts associated with the proposed development. Key factors in selecting the location of the disturbance footprints included the likely impacts on important ecological features, including threatened species, TECs and/or their habitats.

Ecological site inspections were undertaken in May 2016 within the Study Area to provide information on the early design phase of the Master Plan. In November, targeted surveys of the koala feed trees were undertaken to determine the extent of food resources for the koala within the Study Area. The final layout of the Master Plan was determined in consideration of the biodiversity values of the Study Area. It was found that the area north of the Study Area contained higher value vegetation and fauna habitat in structured woodland areas than the lower quality scattered woodland trees and exotic groundcovers dominating the central portion of the Study Area and therefore the disturbance area for the development was focused in the areas of lower ecological value.

In addition to avoiding areas of high conservation value, the proposed development includes provision for large lots with minimal building envelopes and strategic Asset Protection Zones (APZs) to retain as much vegetation surrounding and within the residential buildings as possible. This should allow continued connectivity in a north/south direction across the site following the completion of construction. This was considered to provide an important mechanism particularly for the movement of the koala, and also allows for the targeted selected retention of important habitat features such as hollow-bearing trees.

6.2 Pre-clearance Surveys and Clearance Supervision

A robust tree felling procedure will be implemented to minimise the potential for impacts on native fauna specie, including the koala. Tree felling supervision will be undertaken by an appropriately qualified and experienced ecologist after pre-clearance surveys have identified potential threatened species habitat. The supervising ecologist will be licensed by the relevant field survey and ethics authorities to allow for capture, housing, transport and possibly ethical euthanizing of injured fauna.

The pre-clearance survey will include the following:

- the demarcation of areas approved for clearing to reduce risk of accidental clearing
- habitat resources and habitat trees should be identified and marked (note: habitat trees are those containing hollows, cracks or fissures and spouts, active nests, dreys or other signs of recent fauna usage. Other habitat features to be identified include fallen timber/hollow logs, burrows and boulder piles)
- the potential presence of threatened flora and fauna species, endangered populations and TECs should be identified. Surveys will include detailed searches for koalas
- visual canopy inspection of all trees to be removed by suitably experienced and licensed ecologist to ensure that the koala is not injured during tree felling operations. Should a koala be identified during these surveys, works will avoid this area until the individual has moved on into surrounding remnant vegetation.

On the day of habitat tree felling, the following is to be undertaken:

- all habitat trees will be subject to a visual inspection to survey for threatened species
- trees previously identified as containing fauna will be shaken and then felled, providing no threatened species are identified
- all reasonable attempts will be made to reduce the impact of felling on all fauna species. This may include delaying felling trees with fauna present or felling in sections to reduce potential for injury
- the lowering of hollow-bearing trees will be done as gently as possible with heavy machinery
- if a threatened species is identified in a habitat tree on the day of felling, the supervising person is to advise the most appropriate method to minimise potential harm. This may include leaving the tree overnight, further shaking to encourage the animal to vacate the tree, gradual removal of branches to discourage ongoing use, soft-felling of the tree with the animal in the tree, or measures to capture and relocate the animal to secure habitats
- uninjured animals should be released on the day of capture into nearby suitable secure habitat and should not be held for extended periods of time, and
- injured animals will be taken to the nearest veterinary clinic or wildlife carer as soon as possible for assessment and treatment. If required, the supervising person may ethically euthanize fauna.

All personnel who will capture/handle/house and/or transport native fauna species (injured or uninjured) will be appropriately licensed under the requirements of the NSW Animal Ethics Committee.

6.3 Traffic and Vehicle Strike Mitigation

To reduce potential impacts as a result of increased traffic levels it is recommended that 'Koala Warning' signs and 'Injured Native Wildlife' signs be installed in appropriate locations as a reminder to take care when driving on site. This should also be enhanced by an enforced on-site speed limit of 40 km/h to ensure adequate reaction time for drivers of vehicles in the event that a koala is encountered.

Furthermore, koala exclusion fencing should be investigated as a way of excluding the koala from the active areas of the proposed residential development. Exclusion fencing can also be used to guide koalas towards koala-safe crossing points. The Study Area occurs on the southern edge of extensive areas of forested habitat within the Worimi Conservation Lands that provide connectivity and movement corridors for fauna species to the north. The Study Area contains intact vegetation primarily along its northern boundaries. Connectivity from the south of the site to Stockton is currently highly fragmented as a result of previous residential and urban development. The value for koala movement to the southern portion of the Study Area and towards Stockton is very low, with no koala records known to occur south of the Stockton Centre to the suburb of Stockton. The use of koala exclusion fencing is unlikely to result in a loss of connectivity and movement to quality habitats to the south of the site for koala or other threatened species.

Suitable fencing designs may include (Gleeson and Gleeson 2012):

- Floppy-top fences – chainmesh fence with curved mesh at the top of the fence
- Top hat fences - chainmesh fence with a formed curve attached to the top of the fence
- Metal-sheeted mesh fences - chainmesh fence fitted with a metal sheet on the top portion of the fence.

6.4 Dog Management

Domestic dog and koala encounters can be minimised though the confinement of dogs to the house or in an appropriately fenced part of the yard. Koalas are most vulnerable to dog attack at night, however, koalas may travel through backyards during daylight hours at any time of the year. The following measures should be considered for the proposed residential development:

- Use koala exclusion fencing around the dog's enclosures/yards
- Management of vegetation adjacent to fencing to ensure koala exclusion fencing effectiveness, or
- Designate a development dog-free by using a covenant (as part of a condition of approval) to prohibit dogs being kept on the property in perpetuity.

6.5 Swimming Pool Mitigation

Koala mortality as a result of drowning in swimming pools can be mitigated by requiring one or more of the following measures:

- Trailing a length of stout rope (minim diameter of 50mm) secured to a stable poolside fixture
- Pool design to allow for an easy escape (e.g. shallow steps)
- Exclusion fencing around pools.

6.6 Targeted Koala Feed Tree Planting

The Master Plan for the proposed residential development will focus on planting endemic species in the unbuilt areas of the site and target vegetation communities and habitats of the Study Area. This can include preferred koala feed trees for the locality such as swamp mahogany (*Eucalyptus robusta*) and Earps gum (*Eucalyptus parramattensis* subsp*. decadens*).

7.0 Conclusions

The Study Area contains approximately 2.3 hectares of preferred habitat for the koala, which has been identified as core koala habitat as defined under SEPP 44 and Lunney *et al.* (1998). This was identified as core koala habitat due to the presence of SEPP 44 preferred koala feed trees, however the species has not been recorded the Study Area.

Up to 3.2 hectares of preferred, buffer and supplementary habitat for the koala may be removed as a result of the proposed residential development and the Project may have minor adverse impacts on the local koala population. Mitigation measures are identified in **Section 6.0** of this KPoM have been developed to reduce the level of impact on this species.

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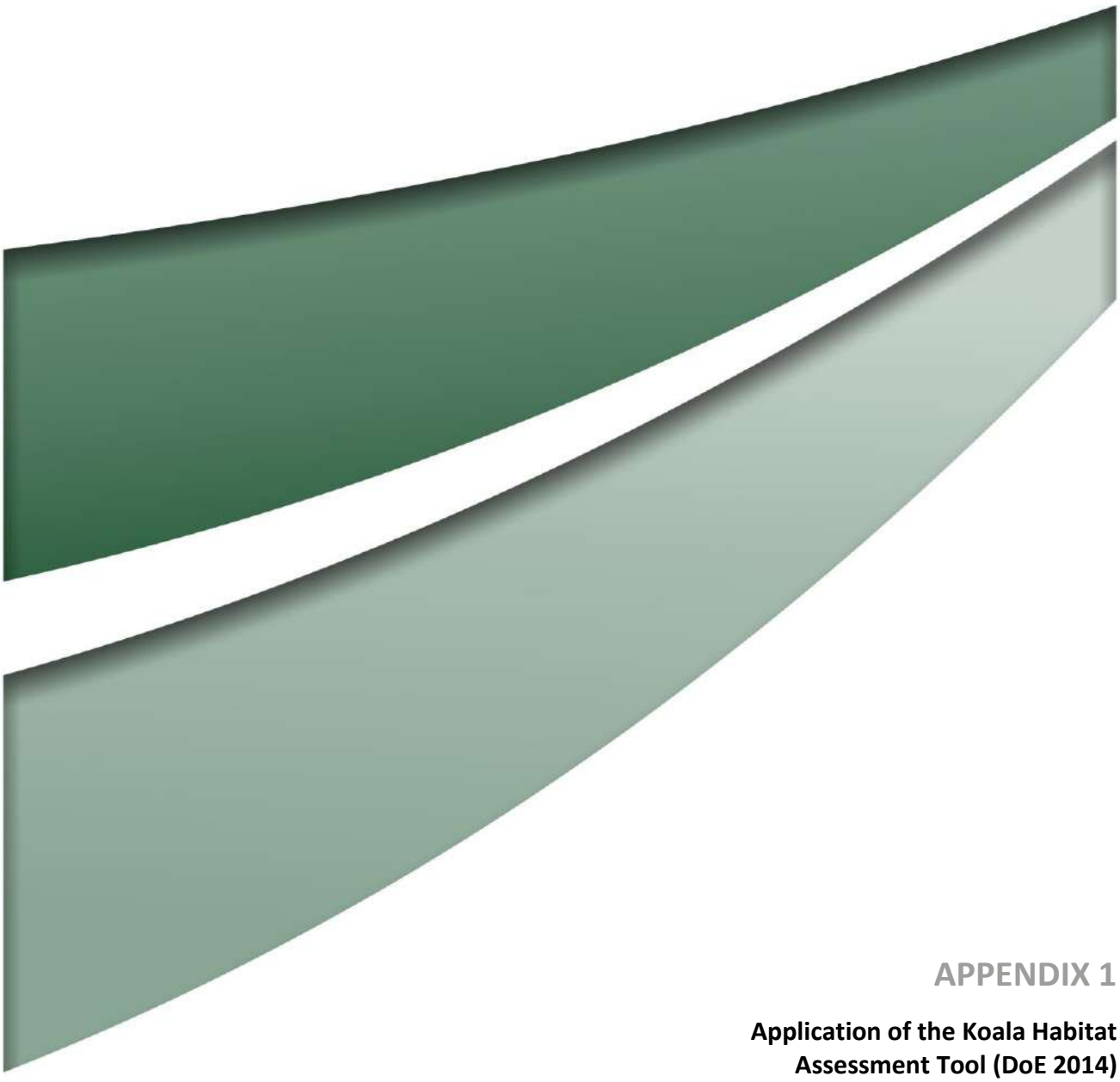

APPENDIX 1

Application of the Koala Habitat Assessment Tool (DoE 2014)

Koala Habitat Assessment Tool (Table 4 from DoE 2014)			Study Area Assessment	
Attribute	**Score**	**Coastal**	**Allocated Score**	**Score Justification**
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 2 years.	**1**	**Desktop:** • EPBC PMST report identified the koala or koala habitat as 'known to occur' in the Study Area. • Atlas of NSW Wildlife point buffer search identified 0 koala records within the Study Area and 145 records within a 10 km radius of the Study Area. **On-ground:** • The koala has not been recorded on the site. • This species has been recorded in adjacent habitats associated with Fern Bay and the Worimi Regional Park.
	+1 (medium)	Evidence of one or more koalas within 5 km of the edge of the impact area within the last 5 years.		
	0 (low)	None of the above.		
Vegetation composition	+2 (high)	Has forest or woodland with 2 or more known koala food tree species in the canopy. **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	**2**	**Desktop:** The Port Stephens Council CKPoM maps the site as mainly cleared. **On-ground:** This Study Area contains two known koala feed trees being swamp mahogany (*Eucalyptus robusta*) and likely Earp's gum hybrids (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*) listed as important for koalas in the Port Stephens LGA (PSC 2002) and SEPP 44 feed species.
	+1 (medium)	Has forest or woodland with only 1 species of known koala food tree present in the canopy.		
	0 (low)	None of the above.		
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 500 ha.	**2**	The Study Area borders the Worimi Regional Park and Worimi Conservation Lands that extend along the Stockton Bight to the north in Nelson Bay. Land to the south and east is fragmented.
	+1 (medium)	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.		
	0 (low)	None of the above.		
Key existing threats	+2 (low)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.	**1**	**Desktop:** A desktop search has failed to locate any reports on koala mortality from vehicle strike or dog attack within the local area. **On-ground:** It is expected that the local koala population is adversely affected by vehicle strike associated with Nelson Bay and by dogs
	+1 (medium)	Evidence of infrequent or irregular koala mortality		

Koala Habitat Assessment Tool (Table 4 from DoE 2014)			Study Area Assessment	
Attribute	**Score**	**Coastal**	**Allocated Score**	**Score Justification**
		from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.		occurring in the local rural residential area.
	0 (high)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, or Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.		
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	**1**	**Desktop:** Table 1 of the Referral Guidelines (DoE 2014) prescribes, that for coastal areas, the interim recovery objective(s) are to: "Protect and conserve large, connected areas of koala habitat, particularly large, connected areas that support koalas that are: of sufficient size to be genetically robust/operate as a viable sub-population OR free of disease or have a low incidence of disease OR breeding and to maintain corridors and connective habitat that allow movement of koalas between large areas of habitat." and "Maintain corridors and connective habitat that allow movement of koalas between large areas of habitat." Despite the small size of the koala habitat within the Study Area, surrounding connected habitats are likely to be important for the local koala population. The habitat present for the koala in the study area is consistent with this description. **On-ground:** No clearing of preferred koala habitat is proposed. Disturbance of buffer and supplementary habitat will not result in fragmentation of retained habitats and is not likely to influence the recovery objectives.
	+1 (medium)	Uncertainty exists as to whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		
TOTAL SCORE			**7**	**≥ 5 indicates habitat critical for the survival of the koala.**

HERITAGE IMPACT STATEMENT

STOCKTON RIFLE RANGE

URBIS

PREPARED FOR DEFENCE HOUSING AUSTRALIA

URBIS STAFF RESPONSIBLE FOR THIS REPORT WERE:

Director	Stephen Davies, B Arts Dip. Ed., Dip. T&CP, Dip. Cons. Studies
Senior Consultant	Alexandria Barnier, B Des (Architecture), Grad. Cert. Heritage Conservation
	1 – Draft report issued 10.10.2016
	2 – Draft report issued 31.01.2017
	3 – Draft report issued 28.06.2017
	4 – Final report issued 30.06.2017
Report Number	5 – Revised report issued 06.12.2018

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EXECUTIVE SUMMARY

Urbis has been engaged by Defence Housing Australia (hereafter DHA) to prepare the following Heritage Impact Statement to accompany a Planning Proposal for Stockton Rifle Range

The site has no associated heritage listings. However, it does comprise two items with some heritage significance, being the Links Anti-Aircraft Battery (hereafter Links Battery) which is located near the northern boundary of the site and the remnants of the 1000yd Firing Range which constitutes semi cleared tracks extending south from the central track at 100yd intervals, now largely overgrown. The subject site is also located in the general vicinity of the Stockton Beach Dune System (item 34) as identified in the Port Stephens Local Environmental Plan 2013.

As part of a consultant team appointed to develop a master plan for the subject site, Urbis has been engaged to prepare this Heritage Impact Statement to assess the heritage impact of the planning proposal on the identified heritage values associated with the site.

The planning proposal presents an opportunity to invigorate a presently underutilised site. The area to be rezoned is resultant of extensive and concurrent site investigations which have identified the significant values associated with the site. These values relate to built heritage, Indigenous archaeology and ecology among others. The investigations into sensitive areas comprising these values have facilitated the identification of the most appropriate area for redevelopment on the site. This area constitutes the western portion of the site, not including the area along the northern boundary. It is within this area that rezoning is proposed.

The land use and maximum height of building rezoning would facilitate future development of the area currently occupied by the remnants of the 1000-yard firing range. There is no built fabric remnant from this element (such as the original target mantlets and stop butts) which now presents as a series of semi cleared tracks at 100yd intervals. The element has been identified as having little conservation value (GML 2008) and is in a constantly deteriorating condition as the tracks become more overgrown. It is considered that heritage interpretation in the context of future residential development in this area would be more effective in communicating the sites former use than the retention of the element in its current condition.

It is appreciated that the planning proposal does not facilitate any future development in the area occupied by the Links Battery in addition to that which is permissible under the existing planning controls. As the Links Battery constitutes the only remnant built fabric with a connection to the sites historic use, it is considered that the planning proposal would be sympathetic to the most significant and intact fabric comprised in the site in terms of built heritage.

It is considered that the application of the new zoning across the site and the proposed maximum building heights would be appropriate in ensuring that the new development does not visually dominate or detract from the remnant fabric of the Links Battery. A full assessment of visual impact would be undertaken as part of a future application for the development of the rezoned land.

In accordance with the above and the observations set out in this report, the Planning Proposal is supported from a heritage perspective.

The indicative Master Plan addressed herein has been developed to illustrate a potential product of the planning proposal. It is considered that the indicative Master Plan conserves the heritage significance of the site which is largely vested in the remnant Links Battery and allows for the interpretation of the original firing range markers. Further development of the indicative Master Plan is supported.

RECOMMENDATIONS

The following recommendations have been set down to guide the next stages of the process including the design development of a proposed master plan:

- Note that at the time of inspection (May 2016) the Links Battery was severely overgrown and essentially inaccessible. The areas accessed indicate that it is in poor condition. Subsequent development applications and works on the site should ensure future repair and maintenance of the Links Battery. Specifically, the item should be stabilised, repaired where necessary and appropriately conserved. Clearing the vegetation will allow for the identification of opportunities to heritage list the item in the future and/or incorporate the item into an Interpretation Plan for the site; and

- An Interpretation Strategy should be prepared in conjunction with the master planning for the site. The site of the battery could be considered for the location of interpretative devices which communicate the historic values associated with the site.

1. INTRODUCTION

1.1. BACKGROUND

Urbis has been engaged by Defence Housing Australia (hereafter DHA) to prepare the following Heritage Impact Statement to accompany a planning proposal for Stockton Rifle Range which is located on Popplewell Road, Fern Bay.

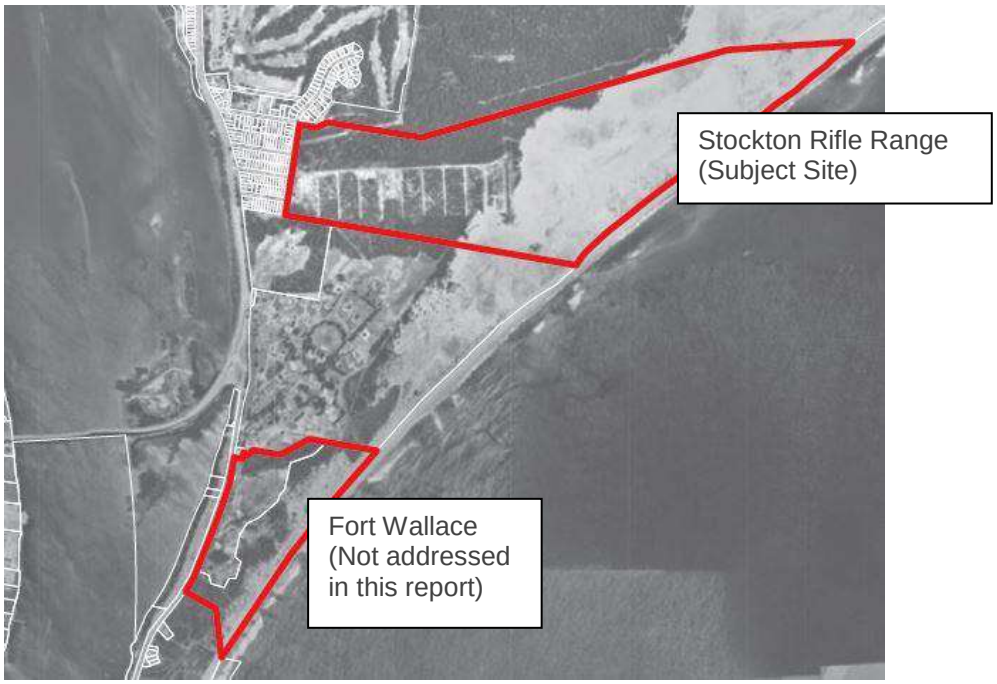
As part of a consultant team appointed to develop a master plan for the subject site, Urbis has been engaged to prepare this Heritage Impact Statement to assess the heritage impact of the planning proposal on the intrinsic heritage values associated with the site.

The site has no associated heritage listings. However, it does comprise two items with some heritage significance, being the Links Anti-Aircraft Battery (hereafter Links Battery) which is located near the northern boundary of the site and the remnants of the 1000yd Firing Range which constitutes semi cleared tracks extending south from the central road at 100yd intervals, now largely overgrown. The subject site is also located in the general vicinity of the Stockton Beach Dune System (item 34) as identified in the Port Stephens Local Environmental Plan 2013.

1.2. SITE LOCATION

The entire site which is located on Popplewell Road, Fern Bay (Figure 1) borders Stockton Beach to the east. The site is legally known as Lot 5, DP233358. Stockton Rifle Range is located to the north of Fort Wallace which is also planned for rezoning. Fort Wallace will be assessed in a separate document. For the purposes of this report the "subject site" refers only to Stockton Rifle Range.

Figure 1 – Map indicating the location of the subject site (Stockton Rifle Range) and Fort Wallace to the south.



Source – Architectus Draft Masterplan Report

1.3. METHODOLOGY

This Heritage Impact Statement has been prepared in accordance with the NSW Heritage Branch guideline 'Assessing Heritage Significance' (2001) and the Commonwealth Heritage Criteria. The philosophy and process adopted is that guided by the *Australia ICOMOS Burra Charter* 1999 (revised 2013).

The planning proposal has been discussed herein with reference to the identified significance of the remnant elements on site.

The indicative master plan has been briefly assessed with reference to the obligations arising from heritage significance set down by Urbis in June 2016. This is a preliminary assessment only to demonstrate how the application of development facilitated by the planning proposal could be sympathetic to the heritage significance of the place.

Stockton Rifle Range is located to the north of Fort Wallace which is also planned for redevelopment. Fort Wallace will be addressed in a separate assessment. For the purposes of this report the "subject site" refers only to the Rifle Range.

1.4. LIMITATIONS

The Heritage Assessment prepared for the Rifle Range site by GML Heritage in January 2008 identified a total of 9 built heritage items. However, during Urbis' site visit on 22 May 2016 the only items identified as extant at the Rifle Range site were the Links Battery and the 1000yd Firing Range; none of the other nine items were able to be located on site. It appears that all other elements have been removed, have become ruinous and/or have been buried under sand/vegetation.

As such Urbis has recommended that an historical archaeologist is engaged to assess the potential for remnants of these items to be present on site, verify their presence or absence, and develop an appropriate methodology for their management and/or treatment with regards to their identified heritage significance.

In accordance with the above this report addresses only potential heritage impacts on the Links Battery and the remnants of the 1000yd Firing Range. No Indigenous or historic archaeology has been considered in the preparation of this report.

Note that at the time of inspection (May 2016) the Links Battery was severely overgrown and essentially inaccessible. The areas accessed indicate that it is in poor condition. Subsequent development applications and works on the site should ensure future repair and maintenance of the Links Battery. Specifically, the item should be stabilised, repaired where necessary and appropriately conserved. Clearing the vegetation will allow for the identification of opportunities to heritage list the item in the future and/or incorporate the item into an Interpretation Plan for the site.

The 1000yd Firing Range is also severely overgrown and not easily apparent from ground level as it essentially constitutes cleared tracks extending south from the central track. The layout of the range is most easily apparent in aerial imagery.

1.5. AUTHOR IDENTIFICATION

The following report has been prepared by Alexandria Barnier (Senior Consultant – Heritage).

Unless otherwise stated, all drawings, illustrations and photographs are the work of Urbis.

The following document has been referenced in the preparation of this document:

- Stockton Rifle Range prepared by Godden Mackay Logan in January 2008.

1.6. THE PROPOSAL

This report provides an assessment of the heritage impact of the planning proposal for the land known as the Rifle Range located on Popplewell Road, Fern Bay. The application proposes to amend the existing land use zoning and maximum height of buildings controls that relate to the site.

The north eastern portion of the site and the area along the northern boundary including the area occupied by the Links Battery is proposed to retain the existing zoning E2 – Environmental Conservation. The zoning of part of the south western portion would be zoned R3 – Medium Density Residential.

The proposed maximum building height in the south western portion of the site varies from 9m to 15m.

The application also proposes to amend the minimum lot sizes in the north east portion of the site to AB3 – 40ha and the minimum lot sizes in the south west portion of the site to I – 500sqm.

The intended outcomes of the planning proposal have been set out in the Planning Proposal Report prepared by Architectus, received by Urbis June 2017. The intended outcomes are as follows:

1. Maintain the area of high ecological value to uphold the intent of the existing E2 Environmental Conservation Zone;
2. Facilitate the renewal of a currently underutilised site in disturbed area;
3. Deliver a diversity of housing through a mixture of densities and housing typologies on the site, including townhouses, single dwellings, and multi-dwelling housing;
4. Open the site to the community through the delivery of public open space and landscaping; and
5. Ensure orderly development and the clear delineation in the ownership and ongoing management of the site.

This report has been written in reference to the Planning Proposal Report prepared by Architectus on behalf of Defence Housing Australia (received by Urbis 15.06.2017).

Concept Master Plan

An indicative Master Plan dated 18.06.2017 has been assessed briefly herein. Although there are no works proposed under this application, this master plan constitutes an illustration of one way that the site could be redeveloped for residential and community use. The preliminary assessment is included only to demonstrate how the application of development facilitated by the Planning Proposal could be sympathetic to the heritage significance of the place.

Figure 2 – Indicative Master Plan.

Source: Architectus

2. SITE DESCRIPTION

Stockton Rifle Range is located on the Stockton Peninsula, 6 kilometres northeast of the Newcastle CBD and 4 kilometres north of the Stockton Township. It is located within Port Stephens Local Government Area. The site occupies 111 hectares in area and is bounded by Fullerton Road to the west and Stockton Bight to the east. The site is generally flat but is higher to the east. The sand dunes to the east of the site vary in stability in accordance with the level of ground cover.

The site extends from Stockton Beach in the east to Popplewell Road in the west. The topography of the land has been much altered as a result of the construction of the range, WWII weapons testing, post war remediation and sandmining.

The subject site is generally in poor condition and largely void of any built features. It is dominated by sandy tracks, grasses and shrubs. The north and south boundaries of the site have more dense vegetation including trees. There is a clear track down the centre of the site which is now used for access and south from this extends firing markers at 100 yard intervals which were originally part of the 1000yd firing range. These firing markers are not identifiable by anything other than the absence of vegetation which is more obvious in aerial view than from the ground. It is noted that vegetation is beginning to reclaim these clear areas after which the Firing Range will not be visible from the ground or in aerial view.

Figure 3 – General images of the Rifle Range.

Picture 1 – View east from the front gate to Popplewell Road.

Picture 2 – View west across the Rifle Range from the beach.

Picture 3 – View along the eastern boundary of the site.

Figure 4 – General images of the Rifle Range.

Picture 4 – View down one of the overgrown markers associated with the 1000 yard Firing Range.

Built evidence of only one of the nine site elements recorded in 2008 by the GML report appears to remain on site. It appears that all other elements have been removed, have become ruinous and/or have been buried under sand/vegetation. In particular, the GML 2008 report shows that the 20mm Accuracy Range observation hut was largely obscured by sand by that time, it is now completely covered by sand if not removed. The only remnant evidence of occupation identifiable on the site constitutes the Links Anti-Aircraft Battery and the semi clear areas of land which served as the markers for the 1000 yard Firing Range.

Aerial imagery indicates that the remnant Links Battery consists of four concrete gun emplacements and a central command post in a standard layout. The Links Battery is accessed by a now overgrown small ancillary track running north from the central spine. The Links Battery is in a ruinous condition and is surrounding by metal fencing.

The 1000 yard Firing Range is identifiable in aerial imagery. No built remnants of the range were located during the site visit. The range presents as 10 semi clear, partly raised, arms of land which extend from the central road from Popplewell Road to the dune system. The range been progressively overgrown over time.

Figure 5 – Visible part of the Links Anti-Aircraft Battery.

Picture 5 – View towards part of the Anti-Aircraft Battery.

Picture 6 – View towards part of the Anti-Aircraft Battery.

Picture 7 – View towards part of the Anti-Aircraft Battery (image curtesy of client).

Picture 8 – View towards part of the Anti-Aircraft Battery (image curtesy of client).

Figure 6 – 2010 aerial imagery showing the location of the Links Battery and the firing markers of the 1000 yard Rifle Range extending from the central track.

Source – nearmaps.com.au

3. HISTORICAL OVERVIEW

The below history of Stockton Rifle Range has been summarised from the Stockton Rifle Range Heritage Assessment prepared by Godden Mackay Logan January 2008. Refer to that document for a comprehensive history. Where relevant to the proposed master plan this history has been variously augmented.

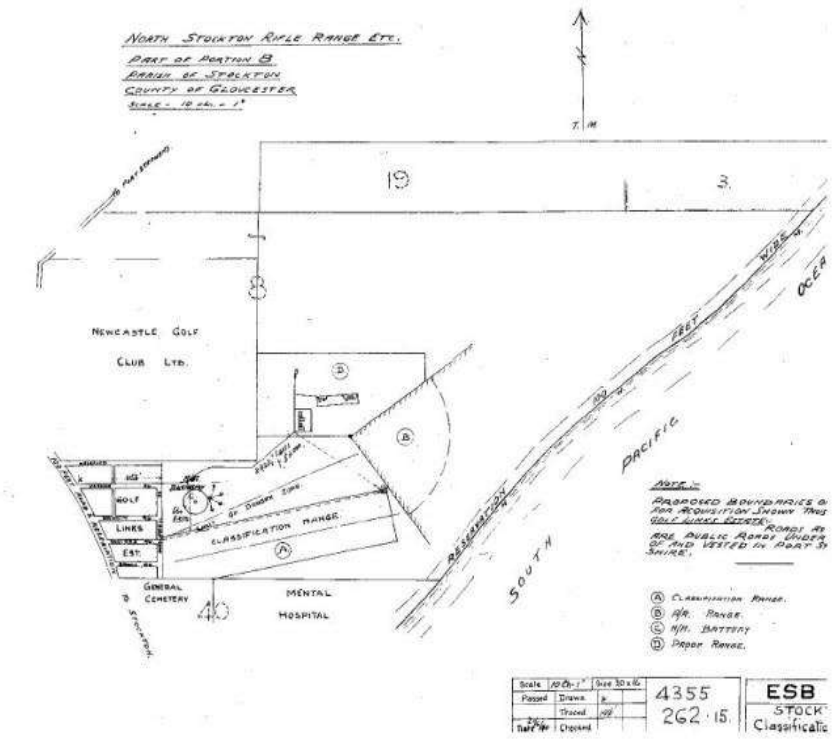
3.1. SITE HISTORY

The Rifle Range is sited on land which was part of James Mitchell's purchase from the Crown in 1837. Mitchell was a local businessman., buying up much of Stockton and the land south of Newcastle CBD. Mitchell established various business in the region including a saltworks and a foundry however the Rifle Range remained undeveloped until it was acquired by the Commonwealth.

The Commonwealth acquired the site in 1942 for the purpose of constructing facilities for a classification range due to the demand for rifle shooting that the Adamstown Rifle Range could not meet. The topography of the site was heavily altered as it was not considered suitable for shooting however it did offer an adequate 'free danger zone' through the sand dunes. The site was used variously by military personal throughout WWII.

The range was constructed as a classification range of 50 targets in a concrete gallery, firing mound at 900 yards, a telephone service, wind flags, storage facilities and workshop. Construction began two years before the site was formally acquired and the range was opened for use in 1941. However by April 1941 funds for continued construction on the site ran out and several buildings were left incomplete. Construction began in 1942 again under the Unemployment Relief Works Program.

A series of upgrades were undertaken from 1942 as a result of the arrival of two new types of fighter planes from Britain which were ordered to oppose the Japanese over Darwin. These planes utilised 20mm Hispano Cannons. New firing ranges were required to test these weapons and in response the Stockton range was equipped with a 20mm Accuracy Range.



Picture 9 – Plan showing WWII uses of the site (Source National Archives of Australia GML Heritage Assessment)

The remnant Links Battery was establish on the site to the north of the classification range. It comprised four Vickers 3.7 inch anti-aircraft guns and was completed around 1940. The name was drawn from its proximity to the Golf Links. It consisted of four gun emplacements and a central command post in a standard layout. The battery contributed to the Newcastle Fortress coastal defence system against air bombardment and particularly to protect Fort Wallace. A report by Gibson Nominees noting practice shoots (1942 and 1943) indicates that the battery was constructed by 1942.

Both Stockton and Adamstown remain in use after the war. However, the practicality of Adamstown was still questionable and attempts were made to close it down. Post War remediation works at Stockton were complete in 1953 and in the same year Adamstown was finally closed. From 1953 the range was used by military personal, the police force, the RAAF and civilian rifle clubs.

The site continued as a working rifle range until it became unoccupied in 1997 as it was no longer required by the military.

The site was acquired by Defence Housing Australia in 2015 when it was purchased from the Department of Defence.

4. HERITAGE SIGNIFICANCE

4.1. WHAT IS HERITAGE SIGNIFICANCE?

Before making decisions to change a heritage item, an item within a heritage conservation area, or an item located in proximity to a heritage listed item, it is important to understand its values and the values of its context. This leads to decisions that will retain these values in the future. Statements of heritage significance summarise a place's heritage values – why it is important, why a statutory listing was made to protect these values.

4.2. COMMONWEALTH AND NSW HERITAGE CRITERIA

The Commonwealth Heritage Criteria of the EPBC Regulations and their correlating NSW criteria have been set out below. The following assessments of heritage significance set out below in this section have been prepared with reference to the Commonwealth Heritage Criteria or the Heritage Brand Criteria where relevant.

Commonwealth Heritage Criteria	Equivalent NSW Heritage Branch Criteria
A: The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history	**A – Historical Significance** *An item is important in the course or pattern of the local area's cultural or natural history.*
B: The place has significant heritage value because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history	**F – Rarity** *An item possesses uncommon, rare or endangered aspects of the local area's cultural or natural history.*
C: The place has significant heritage value because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history	**E – Research Potential** *An item has potential to yield information that will contribute to an understanding of the local area's cultural or natural history.*
D: The place has significant heritage value because of the place's importance in demonstrating the principal characteristics of: -a class of Australia's natural or cultural places; or -a class of Australia's natural or cultural environments;	**G – Representative** *An item is important in demonstrating the principal characteristics of a class of NSWs (or the local area's):* *cultural or natural places; or* *cultural or natural environments.*
E: The place has significant heritage value because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group	**C – Aesthetic Significance** *An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area.*

Commonwealth Heritage Criteria	Equivalent NSW Heritage Branch Criteria
F: The place has significant heritage value because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period	**C – Aesthetic Significance** *An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area.*
G: The place has significant heritage value because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons	**D – Social Significance** *An item has strong or special association with a particular community or cultural group in the local area for social, cultural or spiritual reasons.*
H: The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history	**B – Associative Significance** *An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area's cultural or natural history.*
I: The place has significant heritage value because of the place's importance as part of Indigenous tradition	Covered by the NPW Act.

4.3. ASSESSMENT OF HERITAGE SIGNIFICANCE – COMMONWEALTH VALUES

The below assessment of significance has been partly sourced from the GML Heritage Assessment of the Rifle Range and has been variously altered as necessary.

Criteria	Significance Assessment
A – Processes	The Rifle Range is historically associated with Australia's WWII effort. The previous structures which are now not visible/present on the site were reminders of the training facilities and the opposition of the Japanese on home soil. However, there is little remnant built evidence of this except the Links Battery located near the northern boundary and the 1000yd Firing Range discussed below. These elements are minimally visible and appear to be in poor condition. As such, the historic use of the site as a Rifle Range is no longer easily apparent. While the Links Battery itself is part of a network of related weapons along the east coast built to protect the Newcastle area against attack it is not known to be associated with any particular significant historical event. The 1000yd Firing Range constitutes evidence of the history of rifle shooting on the site and in Newcastle generally. The layout of the Firing Range is evident in aerial imagery however minimally

Criteria	Significance Assessment
	identifiable on ground level given it constitutes lengths of previously cleared land which are now becoming overgrown. Its contribution to an understanding of the site is therefore diminished and it is considered to have little conservation value. Attributes The remains of the Links Anti-Aircraft Battery and the 1000 yard range.
B – Rarity	It is understood that the Firing Range was the only 50 target range of that size by the time it closed in 1996. However, there are ranges known to be of a similar size extant in NSW and Australia today. The range is also not considered to be a good example of the type as there is no apparent associated built fabric remnant (including targets) and the firing markers are badly overgrown in places obscuring the layout of the range. Attributes The remains of the 1000 yard range.
D – Representativeness	The Links Battery and the 1000 yard Firing Range constitute the last visible evidence of the WWII activities on the site and do have some potential to demonstrate its role in the history of the defence of Newcastle. Notwithstanding as they appear to be in poor condition their representative value is diminished. Attributes The remains of the Links Anti-Aircraft Battery and 1000 yard Firing Range.

4.4. STATEMENT OF SIGNIFICANCE

It is considered that the subject site does not reach the threshold for Commonwealth listing on built heritage grounds.

The Links Battery constitutes the only significant built element remnant on the site and has a historic association with Australia's WWII effort. Further it is part of a network of defence installation along the coast constructed for the purpose of protecting Newcastle from air attacks. Notwithstanding, the fabric appears to be in very poor condition, likely requiring a range of remediation works and it is understood that the gun emplacements have largely been demolished. Further, the item is not known to be associated with any significant historical event and is one of a number of similar facilities constructed in Newcastle and NSW generally.

The 1000yd Firing Range has some significance as it is associated with the historic use of the site. However, no associated built fabric was identified on site (such as the original target mantlets and stop butts) and the firing markers are badly overgrown in many places obscuring the layout of the range from the ground plane. Accordingly, it is not considered to make a notable contribution to an understanding of the site and does not reach the requisite level of significance for local listing.

4.5. CONCLUSION

As above, it is not considered that the item meets the requisite threshold of significance for Commonwealth Heritage listing.

Further, given the very poor condition of the 1000yd Firing Range it is not considered that it reaches the threshold of significance for local listing. It is possible that the Links Battery meets the threshold for local listing. However, it is recommended that the vegetation is completely cleared from the site such that the condition and significance of the site can be properly assessed, and the site can be recommended for local listing in the future if appropriate.

5. IMPACT ASSESSMENT

5.1. HERITAGE LISTING

Stockton Rifle Range has no heritage listings relevant to built heritage on a local, state or Commonwealth level. As such, there are no pertinent legislative requirements to assess the impact of the proposal against in this report in terms of built heritage.

However, the site comprises two items (Links Battery and remnants of 1000yd Firing Range) which are identified as having some heritage significance given their association with the historic use of the site. Therefore, the planning proposal has been discussed in the section below in relation to any potential heritage impacts on the significance of these items.

The section of the dune system comprised within the subject site is not listed on the Port Stephens Local Environmental Plan 2013 however the subject site is located in the general vicinity of the area defined as the Stockton Beach Dune System (item 34) which is located north of the site.

Figure 7 – Heritage map indicating the approximate boundaries of the subject site (blue).

Source: Ports Stephens LEP 2013 Heritage Map sheet 004A

5.2. HERITAGE IMPACT ASSESSMENT

The following observations have been set down in regards to the potential heritage impact of the planning proposal on the values associated with the remnant elements on the site.

Land Use Rezoning

The entire site is currently zoned E2 – Environmental Conservation. However, the subject site presents an opportunity for redevelopment given it is underutilised and comprises only one built heritage feature. The south and west sections of the site are therefore proposed to be zoned R3 – Medium Density Residential.

The land use rezoning would facilitate future development of the area currently occupied by the remnants of the 1000-yard firing range. It should be noted that this element does not comprise any built elements, it essentially constitutes ten sandy tracks extending from the central road that are becoming overgrown and are increasingly indiscernible from the ground plane. All associated fabric such as the original targets appear to have been removed. Therefore, although there is some historic significance associated with the use of the site as a rifle range, the remnants of the Firing Range does little to contribute to an understanding of this historic use. The element has been identified as having little conservation value (GML 2008) and is only easily appreciable in aerial imagery. It is considered that heritage interpretation in the context of new residential development would be more effective in communicating the sites former use than the retention of the element in its current condition.

Further to the above, in addition to the built heritage values comprised within the site, it is appreciated that there is also a number of highly significant ecological and Indigenous values. All elements of environmental significance comprised within the site have been concurrently considered in the preparation of the planning proposal and master plan. It is understood that as the area occupied by the firing range is previously disturbed it has the least potential for comprising highly significant ecological or archaeological fabric. The subject area is therefore presented by the respective consultants as the most opportune area for sympathetic development on the site. Given the low integrity of the Firing Range and the comparatively high values identified by other consultants across the remainder of the site it is appreciated that the nominated area is the most appropriate area for redevelopment such that the holistic environmental significance of the place retained. The rezoning of the proposed area for medium density residential is therefore supported from a heritage perspective.

The significance of the Links Battery has not been categorically stated in Section 4 of this report as it was not accessible or easily visible during the site inspection and appears to be in poor condition. However, as the last remnant built fabric on the site with an association with the significant historic use, it has the most conservation value. Cognisant of the conservation value of the battery it is proposed to retain the existing land use zoning (E2 – Environmental Conservation) in the area it occupies. This would ensure that the areas of value (heritage and ecological) remain undisturbed.

Residential development to the south and west of the Links Battery which would be facilitated by the proposed residential zoning would be appropriately set back as the E2 zoning extends past the identifiable curtilage of the Links Battery. This would retain a curtilage around the item, ensure legibility of its original setting and encourage appreciation of it.

The residential development facilitated by this planning proposal would not notably alter the character of the setting of the heritage listed section of the Stockton Dune system to the north as there is a substantial separation between the subject site and the latter, and it is anticipated that the development would be largely screened by dense mature vegetation and the dunes along the eastern boundary of the subject site. Further, the residential development would be confined to the western part of the subject site and therefore is unlikely to notably alter the form of the Dune System along the eastern boundary of the subject site which contributes to the setting of the listed item to the north.

Maximum Height

Under the current LEP, the subject site is not affected by a maximum height of buildings control. However, given the proposed residential zoning it is considered appropriate that the height of future development is managed such that it does not unduly dominate the remnant early fabric on the site.

There is a part 9-metre, part 15-metre maximum height proposed to the west and south of the remnant Links Battery. This zoning would facilitate 2-5 storey development. It is considered that this maximum height is appropriate in the context of the early fabric as it is modest and given the separation from the early fabric maintained by the land use zoning, it would not visually dominate the fabric.

The proposed maximum height zoning will facilitate development which would alter the existing density on the site and the original character of the setting of the early fabric. However, it is acknowledged that without ongoing use the site is likely to remain is vacant, underutilised state and there will be no opportunity for the public to appreciate the Links Battery. The increase in density on parts of the site, with a buffer established by the appropriate application of a residential zoning and sympathetic design development of dwellings, is the preferred option in comparison to the retention of the site in its existing state.

There are no significant views to the Links Battery at present given the amount of surrounding vegetation. However, as the areas to the east and to the immediate south of the battery would remain unzoned in terms of height, the fabric item, if cleared of vegetation may be appreciable from a wide area including from the main central circulation corridor.

Lot Size

The site is currently affected by a minimum lot size of AB3 which restricts any lot to a minimum of 40 hectares in area.

It is proposed to retain the minimum lot size across the majority of the site such that the existing density in the vicinity of the Links Battery and the listed Stockton Dunes to the north is retained and their settings are respected.

It is proposed to reduce the minimum lot size in the south west corner of the site to 500sqm with a small area of 200sqm. As discussed above, while this would facilitate a change in the character of the setting of the early fabric remnant on the site it is appreciated that a separation would be maintained as a result of the application of the residential zoning and considered that increased density on the site is preferable to its continued disuse.

It is not considered that the increased density on the subject site as facilitated by the planning proposal would have any negative impacts on the heritage listed section of the Stockton dunes as there is a significant distance between the developable part of the subject site and the item. Further, the increased density would not impact on the ability of the dunes along the eastern boundary of the subject site to contribute to the setting of the listed item.

The proposed changes to the minimum lot size are therefore supported from a heritage perspective.

The following observations have been set down in regards to the potential heritage impact of the indicative Master Plan:

- There are no works proposed in the vicinity of the Links Battery. This would ensure that the historic associations of the site are maintained. It is recommended that a schedule of conservation works be completed as part of any master planning process to ensure the integrity of the item and facilitate identification of options for adaptive reuse;
- It is appreciated that the circulation has been designed such that the original axis' of some of the firing markers associated with the 1000yd Firing Range have been interpreted. It is considered that this could be supplemented by interpretation devices to communicate the values associated with the site; and

6. CONCLUSION AND RECOMMENDATIONS

The planning proposal presents an opportunity to invigorate a presently underutilised site. The area to be rezoned is resultant of extensive and concurrent site investigations which have identified the significant values associated with the site. These values relate to built heritage, Indigenous archaeology and ecology among others. The investigations into sensitive areas comprising these values have facilitated the identification of the most appropriate area for redevelopment on the site. This area constitutes the western portion of the site, not including the area along the northern boundary. It is within this area that rezoning is proposed.

The land use and maximum height of building rezoning would facilitate future development of the area currently occupied by the remnants of the 1000-yard firing range. There is no built fabric remnant from this element (such as the original target mantlets and stop butts) which now presents as a series of semi cleared tracks at 100yd intervals. The element has been identified as having little conservation value (GML 2008) and is in a constantly deteriorating condition as the tracks become more overgrown. It is considered that heritage interpretation in the context of future residential development in this area would be more effective in communicating the sites former use than the retention of the element in its current condition.

It is appreciated that the planning proposal does not facilitate any future development in the area occupied by the Links Battery in addition to that which is permissible under the existing planning controls. As the Links Battery constitutes the only remnant built fabric with a connection to the sites historic use, it is considered that the planning proposal would be sympathetic to the most significant and intact fabric comprised in the site in terms of built heritage.

It is considered that the application of the new zoning across the site and the proposed maximum building heights would be appropriate in ensuring that the new development does not visually dominate or detract from the remnant fabric of the Links Battery.

In accordance with the above and the observations set out in this report, the Planning Proposal is supported from a heritage perspective.

The indicative Master Plan addressed herein has been developed to illustrate a potential product of the planning proposal. It is considered that the indicative Master Plan conserves the heritage significance of the site which is largely vested in the remnant Links Battery and allows for the interpretation of the original firing range markers. Further development of the indicative Master Plan is supported.

RECOMMENDATIONS

The following recommendations have been set down to guide the next stages of the process including the design development of a proposed master plan:

- Note that at the time of inspection (May 2016) the Links Battery was severely overgrown and essentially inaccessible. The areas accessed indicate that it is in poor condition. Subsequent development applications and works on the site should ensure future repair and maintenance of the Links Battery. Specifically, the item should be stabilised, repaired where necessary and appropriately conserved. Clearing the vegetation will allow for the identification of opportunities to heritage list the item in the future and/or incorporate the item into an Interpretation Plan for the site; and
- An interpretation strategy should be prepared in conjunction with the master planning for the site. The site of the battery could be considered for the location of interpretative devices which communicate the historic values associated with the site.

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[Note: Some government departments have changed their names over time and the above publications state the name at the time of publication.]

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BRISBANE
Level 7, 123 Albert Street
Brisbane QLD 4000
Australia
T +61 7 3007 3800

GOLD COAST
45 Nerang Street,
Southport QLD 4215
Australia
T +61 7 5600 4900

MELBOURNE
Level 12, 120 Collins Street
Melbourne VIC 3000
Australia
T +61 3 8663 4888

PERTH
Level 14, The Quadrant
1 William Street
Perth WA 6000
Australia
T +61 8 9346 0500

SYDNEY
Tower 2, Level 23, Darling Park
201 Sussex Street
Sydney NSW 2000
Australia
T +61 2 8233 9900

CISTRI – SINGAPORE
An Urbis Australia company
#12 Marina View
21 Asia Square, Tower 2
Singapore 018961
T +65 6653 3424
W cistri.com

URBIS.COM.AU

ADW JOHNSON PTY LIMITED
ABN 62 129 445 398

Sydney
Level 35 One International Towers
100 Barangaroo Avenue
Sydney NSW 2000
02 8046 7411
sydney@adwjohnson.com.au

Central Coast
5 Pioneer Avenue
Tuggerah NSW 2259
02 4305 4300

coast@adwjohnson.com.au

Hunter Region
7/335 Hillsborough Road,
Warners Bay NSW 2282
Ph. 02 4978 5100
Fax. 02 4978 5199
hunter@adwjohnson.com.au

Engineering

Working Beyond Expectations

Servicing Report

Rifle Range

Property:
Popplewell Street, Fern Bay

Applicant:
Defence Housing Australia

Date:
June 2018

Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Draft	30/09/2016	AW	LG
B	Minor Amendments	19/06/2017	A Van de Mortel	L Gibbs
C	Minor Amendments	01/06/2018	R Champness	L Gibbs

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This report has been prepared in accordance with and for the purposes outlined in the scope of services agreed between ADW Johnson Pty Ltd and the Client. It has been prepared based on the information supplied by the Client, as well as investigation undertaken by ADW Johnson and the sub-consultants engaged by the Client for the project.

Unless otherwise specified in this report, information and advice received from external parties during the course of this project was not independently verified. However, any such information was, in our opinion, deemed to be current and relevant prior to its use. Whilst all reasonable skill, diligence and care have been taken to provide accurate information and appropriate recommendations, it is not warranted or guaranteed and no responsibility or liability for any information, opinion or commentary contained herein or for any consequences of its use will be accepted by ADW Johnson or by any person involved in the preparation of this assessment and report.

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APPENDIX A

SITE SERVICES PLAN AND DBYD INFORMATION

APPENDIX B

ADVICE FROM HUNTER WATER CORPORATION

LIST OF FIGURES

Figure 1 - Site Locality (Google earth).

1.0 INTRODUCTION

ADW Johnson has been engaged by DHA to form part of a consultant team to seek a rezoning of the DHA owned land in Fern Bay, formally known as the Rifle Range. The purpose of this report is to address the utility servicing requirements for the proposed development and the suitability of the surrounding utility infrastructure to support the proposed development.

2.0 SUBJECT SITE

The subject site is Lot 5 Popplewell Road, Fern Bay NSW 2295. The total lot area is approximately 111 hectares. The planning proposal is for the rezoning of a portion of the site to the southwest from E2 (Environmental Conservation) to R2 (General Residential).

Figure 1 - Site Locality (Google earth).

3.0 METHODOLOGY

Dial before you dig searches were carried out on the site to ascertain the general arrangement of the utility services in the surrounding areas. Further consultation has been made with Hunter Water Corporation to determine the capacity currently in their sewer and water assets to adequately service the proposed development. The Dial before you dig information is attached in **Appendix A**. Whilst the Hunter Water Corporation advice is attached in **Appendix B.**

4.0 POTABLE WATER SUPPLY

The area surrounding the proposed site is well serviced with 150 mm diameter cast iron concrete lined water mains running in all of the adjacent neighbouring streets. These water mains are fed from a 150mm diameter cast iron concrete lined distribution main which is running along Nelson Bay Road. A plan supplied by Hunter Water is attached to **Appendix A** showing the location of the water mains in the surrounding residential areas and the distribution main in Nelson Bay Road.

Advice received from HWC indicates that there is currently sufficient capacity available in the surrounding water mains. It is noted that during the design phase security of supply will need to be addressed in accordance with Hunter Waterõs design guidelines.

5.0 SEWER

The surrounding residential areas are all serviced with 150 mm diameter UPVC sewer mains which drain by gravity to a Waste Water Pump Station on Vardon Road. There are multiple locations in the neighbouring streets where sewer connections could be made to service the proposed development.

Advice received from Hunter Water suggests that the proposed development is located within the Fern Bay 1 Waste Water Pump Station (WWPS) which has sufficient capacity to receive wastewater from the proposed development. It is likely that a portion of the site will require a small pump to enable the wastewater to be transported to the Fern Bay 1 WWPS.

It is noted that the proposed development will utilise the current available capacity in the Fern Bay 1 WWPS and as such allocation of this capacity can only be granted after development consent has been issued from the relevant consent authority. A sewer plan received from HWC is attached in **Appendix A**.

6.0 ELECTRICITY

Popplewell Road currently has an overhead High Voltage transfer main running from north to south. This High Voltage Main services the surrounding residential areas.

It is envisaged that a high voltage connection will be made from the transfer main to service the proposed development. Input will be required from an electrical engineer to confirm the number of substations required to service the proposed development.

7.0 TELECOMMUNICATIONS

A Telstra supply network is currently present in the surrounding residential streets. It is unlikely that this network will have sufficient capacity to service the proposed development. The current NBN roll out plan does not include Stockton and Fern Bay. It is envisaged that in time and with consultation with NBN that a fibre optic connection will be made available to the site.

8.0 GAS

A dial before you dig plan from Jemena shows that there are no domestic gas services in the neighbouring streets. There is a 150 mm Gas Transfer Main shown in Nelson Bay Road.

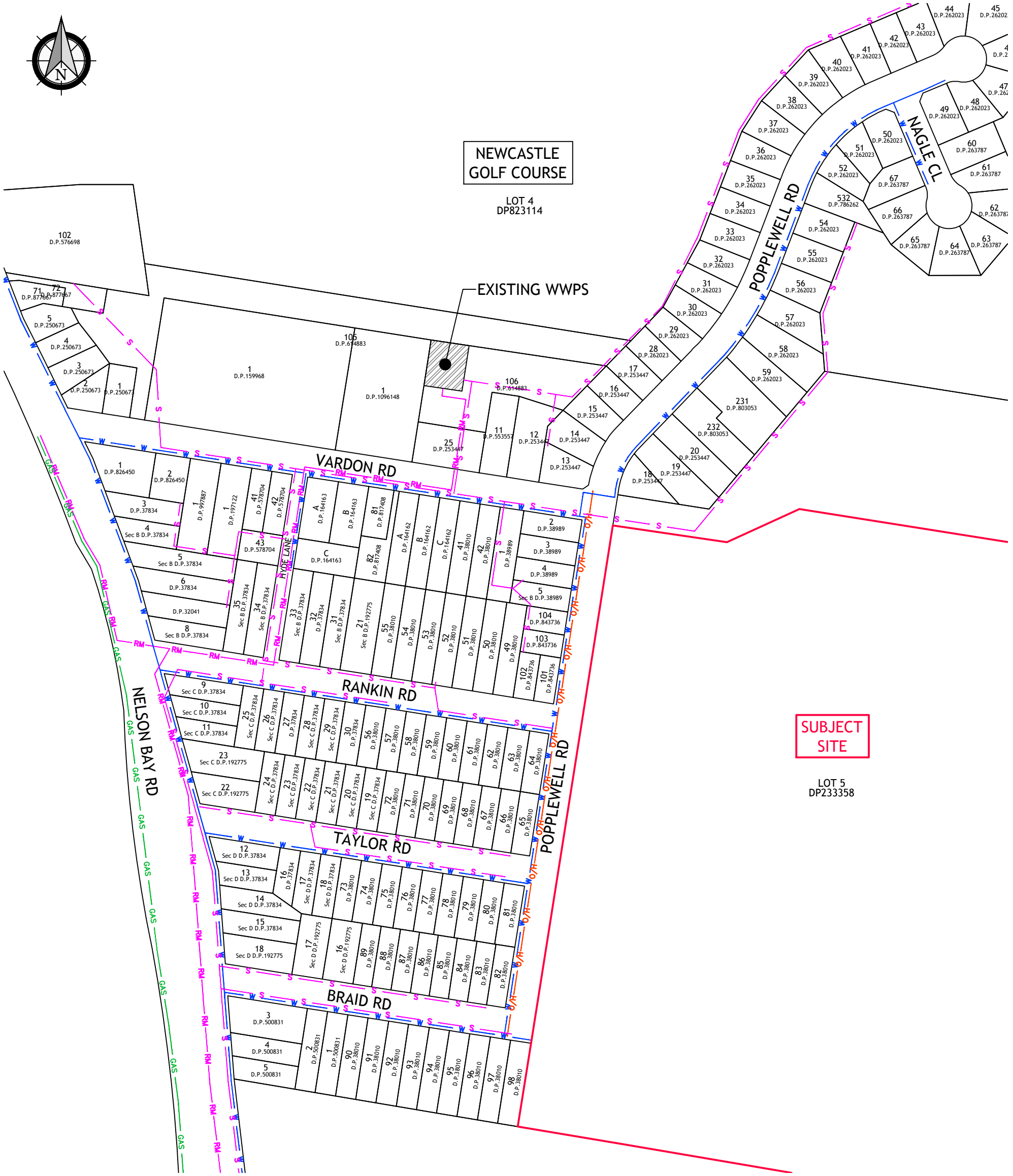
Consultation with Jemena should be sought to clarify whether Jemena will supply any proposed development with gas. It is expected that for commercial reasons Jemena would extend their infrastructure to the site.

9.0 CONCLUSION

In summary, the proposed redevelopment of the Rifle Range Site will be adequately serviced by the surrounding infrastructure and as such there are no constraints to the proposed rezoning due to the provision of services.

Appendix A

SITE SERVICES PLAN AND DBYD INFORMATION



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drawing title:

RIFLE RANGE EXISTING SERVICES PLAN

location: LOT 5 D.P.233358 POPPLEWELL ROAD, FERN BAY

council: PORT STEPHENS

dwg ref: 239478(30)-ESK-001_A

client: DHA Defence Housing Australia

adw johnson
central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
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HUNTER WATER CORPORATION

A.B.N. 46 228 513 446

DIAL BEFORE YOU DIG
SERVICES PLAN - SEWER

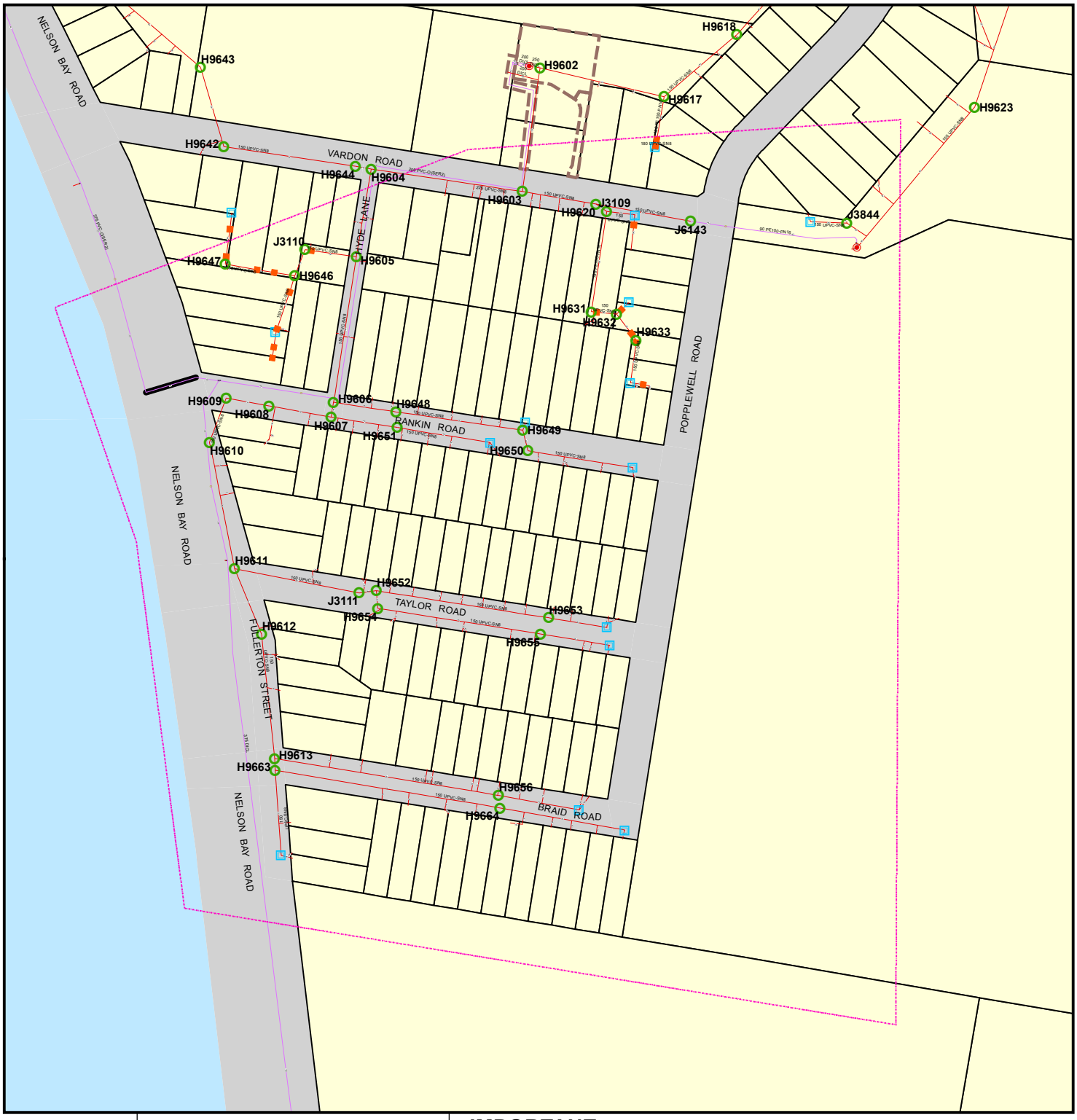
Enquiries: 1300 657 657

APPLICANT: *Mr Andrew Williams*

NOTIFICATION NO.: *11279164*

SEQUENCE NO.: *55856583*

DATE OF ISSUE: 22/09/2016



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SEWER/WATER/RECYCLED WATER/
ELECTRICAL - UTILITY DATA
© HUNTER WATER CORPORATION 2016

CADASTRAL DATA © LPI OF NSW 2016

IMPORTANT

THIS PLAN IS NOT TO BE USED FOR CONVEYANCING

THIS INFORMATION IS VALID FOR 30 DAYS FROM THE DATE OF ISSUE

SERVICE LOCATIONS ARE APPROXIMATE.
HAND DIG UNTIL ACTUAL LOCATIONS ARE IDENTIFIED.
PROPERTY SERVICES ARE NOT SHOWN.
ANY INFORMATION ON THIS PLAN MAY NOT BE UP TO DATE
AND THE CORPORATION ACCEPTS NO RESPONSIBILITY FOR ITS ACCURACY.
REFER TO ATTACHED ADVICE SHEET FOR FURTHER WARNINGS.

HUNTER WATER CORPORATION

A.B.N. 46 228 513 446

DIAL BEFORE YOU DIG
SERVICES PLAN - WATER

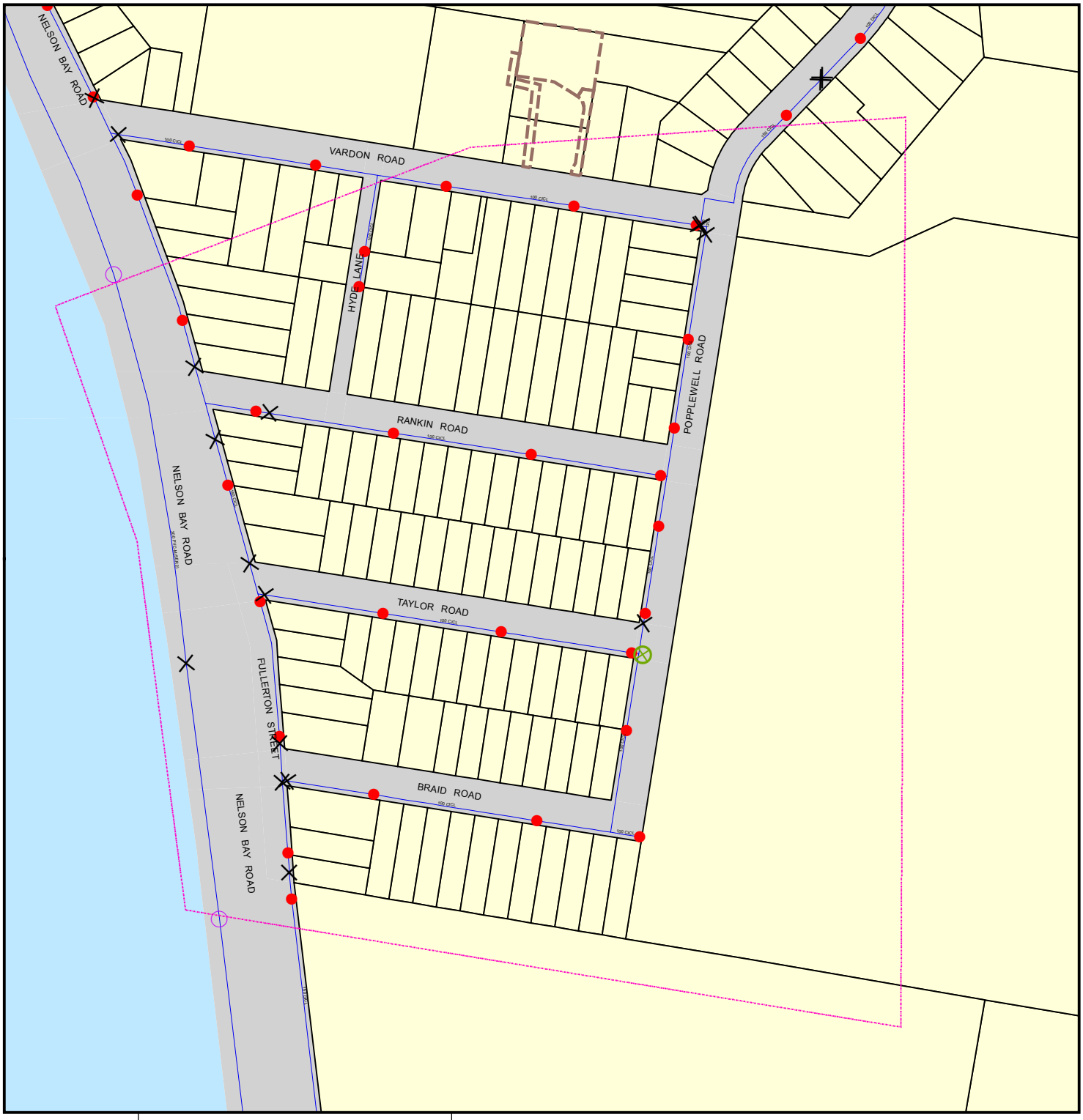
Enquiries: 1300 657 657

APPLICANT: *Mr Andrew Williams*

NOTIFICATION NO.: *11279164*

SEQUENCE NO.: *55856583*

DATE OF ISSUE: 22/09/2016



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SEWER/WATER/RECYCLED WATER/
ELECTRICAL - UTILITY DATA
© HUNTER WATER CORPORATION 2016

CADASTRAL DATA © LPI OF NSW 2016

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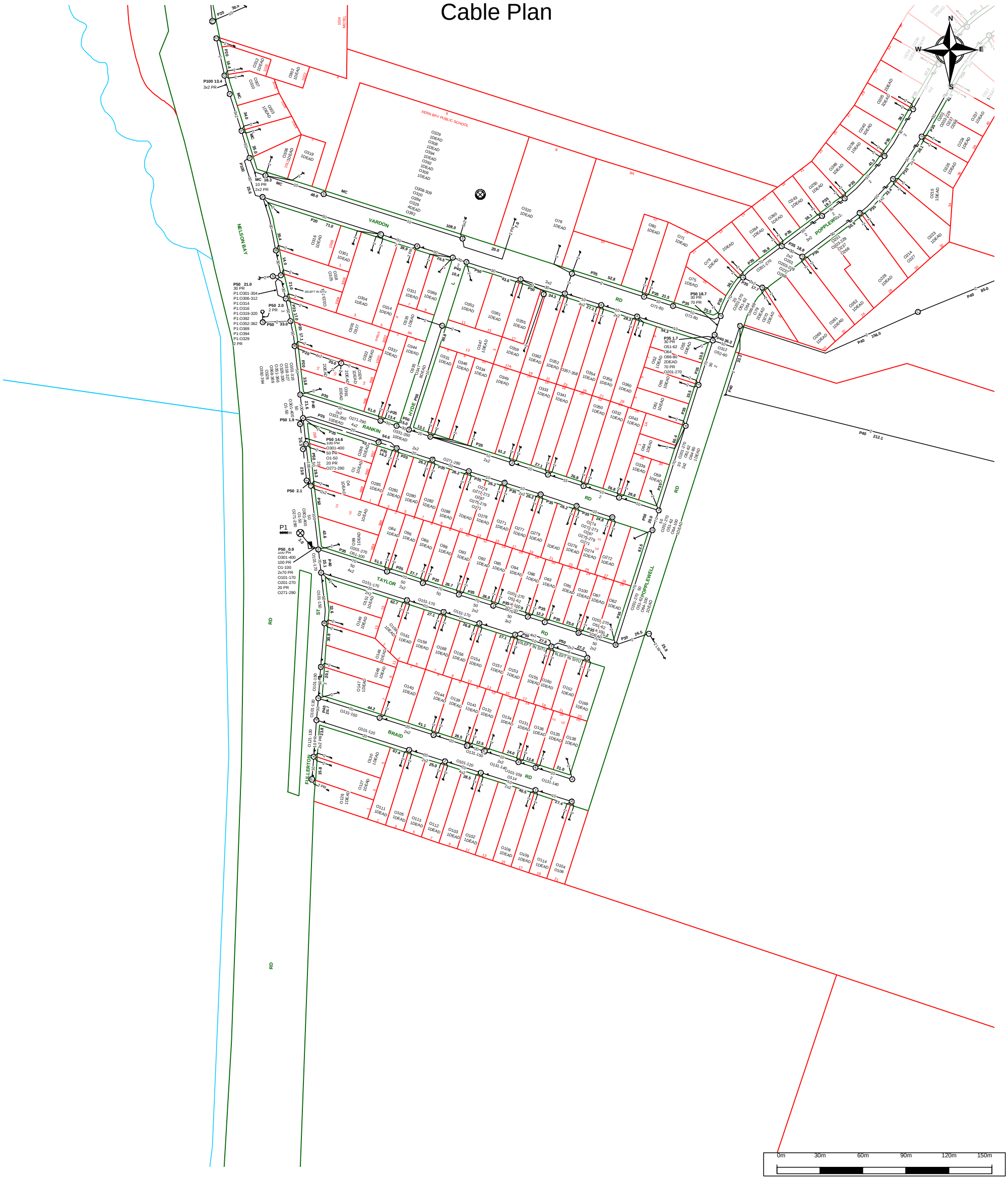
Cable Plan



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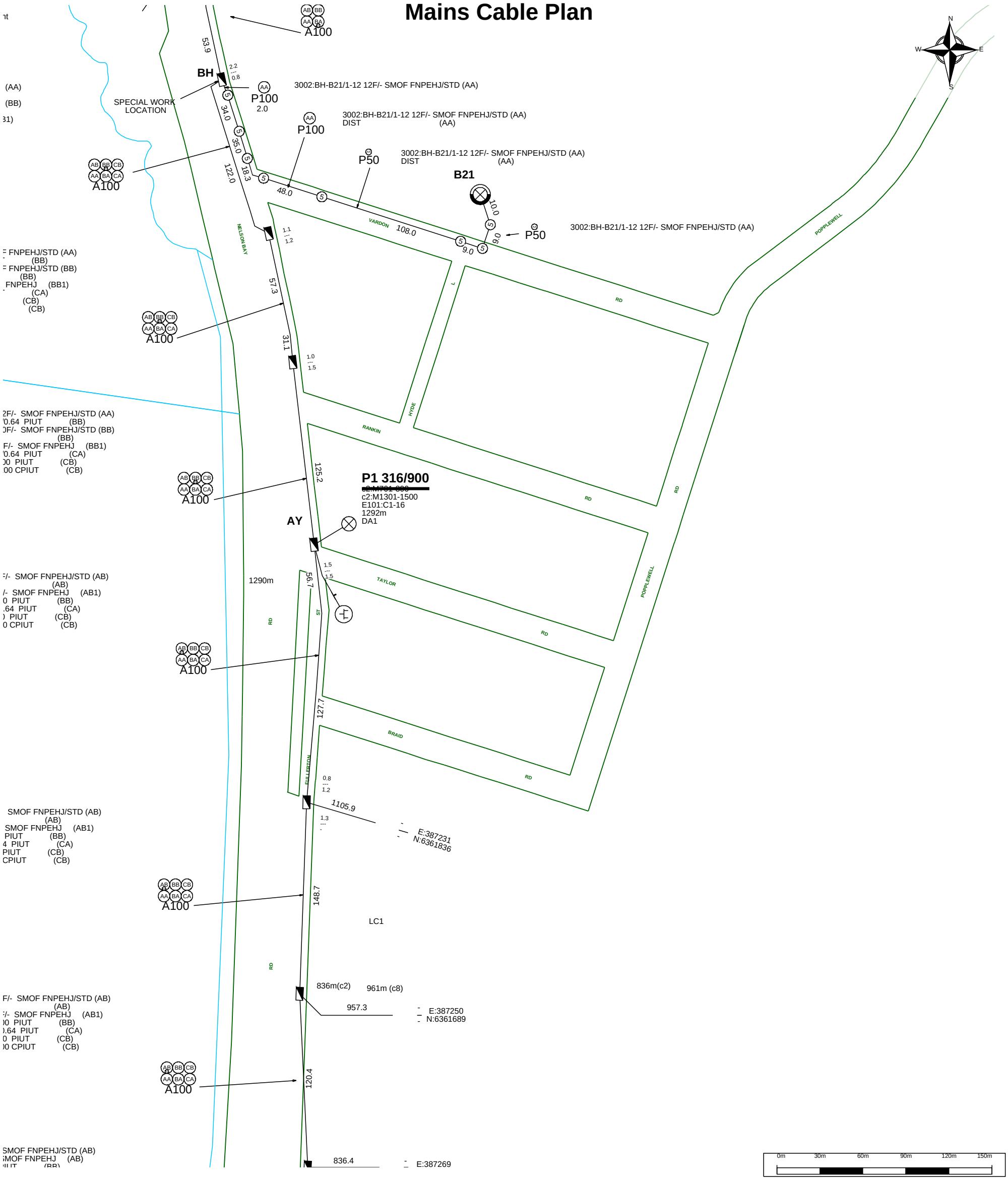
Mains Cable Plan



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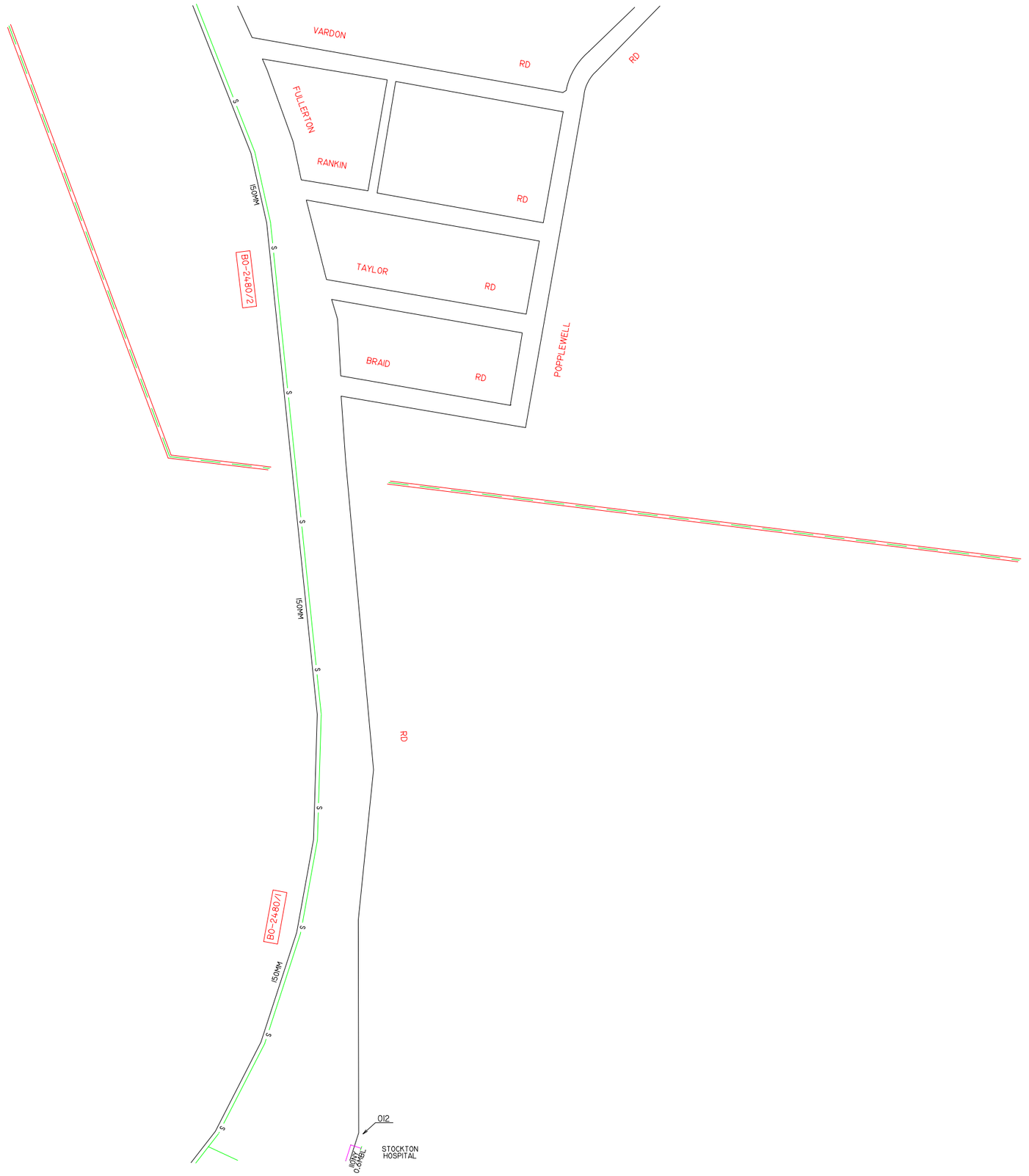


FULLERTON COVE 4D

SCALE 1:2000

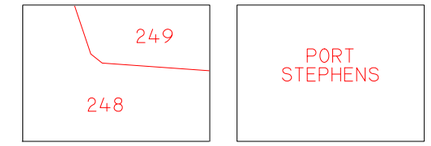
50 0 50 100 150 200

THIS MAP UPDATED ON 22/12/06
THIS PLAN IS DIAGRAMATIC ONLY. DISTANCES SCALED FROM THIS PLAN MAY NOT BE ACCURATE.

DATE ALTERED:..... BY:.....

FC4A	FC4B	FC5A
FC4C	FC4D	FC5C
FC7A	FC7B	-

ADJOINING MAPS



NETWORK AREA MUNICIPALITY AREA

Jemena

KEY

		MAX ALLOWABLE OPERATING PRESSURE
T	TRUNK PIPELINE	7000 kPa
P	PRIMARY MAIN	3500 kPa
S	SECONDARY MAIN	1050 kPa
400	NETWORK MAIN	400 kPa
	NETWORK MAIN	300 kPa
	NETWORK MAIN	210 kPa
100	NETWORK MAIN	100 kPa
30	NETWORK MAIN	30 kPa
	NETWORK MAIN	7 kPa
	NETWORK MAIN	2 kPa
	PROPOSED MAINS	
PR 11-2 3	STEEL MAIN PROJECT NUMBER	
P	PRESSURE MONITORING STATION	
	VALVE	
	SYSTEM PRESSURE REGULATOR	
S	SIPHON	
123	NETWORK NODE	
123S	NETWORK VALVE NODE	
298	VALVE NUMBER	
6NB	6 INCH CAST IRON MAIN	
150MM	150MM STEEL MAIN	
110MM PE/NY	110MM POLYETHYLENE/NYLON MAIN	
6NB 50MM NY	50MM NYLON INSERTED INTO 6NB MAIN CAST IRON MAIN	
1.2MBL	DISTANCE IN METRES OF MAIN FROM BOUNDARY LINE	
1957	YEAR LAID	
	MUNICIPALITY BOUNDARY	
	NETWORK BOUNDARY	
123	HOUSE NUMBER	

FULLERTON COVE 4D

Appendix B

ADVICE FROM HUNTER WATER CORPORATION

Hunter Water Corporation
ABN 46 228 513 446

PO Box 5171
HRMC NSW 2310
36 Honeysuckle Drive
NEWCASTLE NSW 2300
1300 657 657 (T)
(02) 4979 9625 (F)
enquiries@hunterwater.com.au
hunterwater.com.au

26 SEP 2016
BY:

23 September 2016

Our Ref: 2016-1041/3.004

Defence Housing Australia
C/- ADW Johnson Pty Ltd
7/335 Hillsborough Road
Warners Bay NSW 2282

Attention: Mr Lincoln Gibbs

Dear Lincoln

PRELIMINARY SERVICING ADVICE FOR PROPOSED DEVELOPMENT
Lots 100, 101 DP 1152115 & Lot 5 DP 233358 338 Fullerton Street Stockton & 5 Popplewell Road Fern Bay

Thank you for your request for Hunter Water's preliminary servicing advice for the provision of water and sewer services to the proposed development of the proposed 1 into 244 Community Title lot subdivision at Lots 100, 101 DP 1152115, 5 Popplewell Road, Fern Bay and 1 into 105 Community Title lot subdivision at Lot 5 DP 233358 338 Fullerton Street Stockton.

General information on water and sewer issues relevant to the proposal is included in this correspondence. This information is based on Hunter Water's knowledge of its system performance and other potential development in the area at the present time.

Preliminary servicing advice is not a commitment by Hunter Water and may be subject to significant change prior to the development proceeding. General information on the provision of Hunter Water funded and delivered infrastructure may also be provided. This advice may also change substantially due to a range of factors. In particular, you should note that water and sewer systems are dynamic by nature and, as such, capacity availability and system performance varies over time. As a consequence, the advice provided herein regarding servicing availability is indicative only. A detailed analysis of available capacity will be undertaken upon lodgement of an application for a Notice of Formal Requirements.

If you proceed with a development application you will need to lodge a further application with Hunter Water to then determine the formal requirements that shall apply. Hunter Water will then issue a **Notice of Formal Requirements**. You will need to comply with each of the requirements in this Notice for the issue of a Section 50 Compliance Certificate for the specific development.

Hunter Water anticipates that the development will place an additional demand of approximately 349 Equivalent Tenements (ET) on the water supply and wastewater transportation systems and has reviewed system capacity and performance on this basis. As a result, Hunter Water's preliminary servicing advice is as follows:

244 Community Title lots, 5 Popplewell Road, Fern Bay

Water

The site of the proposed subdivision is located in the Newcastle Water Supply System, and is supplied from the North Lambton 1 Reservoir. The property has a frontage to a 100mm Cast Iron Cement Lined (CICL) water main along Popplewell Road, (please refer to Figure 1 attached).

It is noted that security of supply will need to be provided for this development in accordance with Hunter Water's design guidelines.

There is currently sufficient capacity available in these mains to serve the proposed development, however, capacity availability and system performance varies over time. A detailed analysis will be undertaken upon lodgement of an application for a **Notice of Formal Requirements.**

Wastewater Transportation

The development is located within the Fern Bay 1 Waste Water Pump Station (WWPS) catchment which is within the Shortland Waste Water Treatment Works Catchment. There is currently sufficient capacity within the Fern Bay 1 WWPS to serve the proposed development however connection of the development will exhaust the available capacity. Please note that allocation of capacity is subject to a development having determination of a Section 50 application and having a valid development consent issued by the relevant consent authority.

It appears that flows from parts of the development may need to be pumped to access the existing sewer infrastructure, (please refer to Figure 2 attached).

In order to allow connection of this development, a local developer funded servicing strategy should be prepared to investigate the infrastructure required to service this development and any augmentations to Hunter Water's existing wastewater network. It is suggested that the servicing strategy investigate how the development will gravitate wastewater to the existing network - or if a new WWPS is required.

105 Community Title lot subdivision 338 Fullerton Street Stockton

Water

The site of the proposed subdivision is located in the Newcastle Water Supply System, and is supplied from the North Lambton 1 Reservoir. The property has frontage to a 100mm Cast Iron Cement Lined (CICL) water main along Fullerton Street to which connection is permitted, (please refer to Figure 3 attached).

It is noted that security of supply will need to be provided for developments that exceed 100 lots in accordance with Hunter Water's design guidelines.

There is currently sufficient capacity available in these mains to serve the proposed development, however, as noted elsewhere in this correspondence, capacity availability and system performance varies over time. A detailed analysis will be undertaken upon lodgement of an application for **a Notice of Formal Requirements**

Wastewater Transportation

The development lot is located in the Stockton 4 WWPS catchment, (please refer to Figure 4 attached). There is insufficient pumping and emergency storage capacity within this station to accept flows to cater for this development. Furthermore a sewermain extension will be required to connect the property to the Stockton 4 WWPS.

It will be necessary to complete a developer funded sewer servicing strategy to ascertain the optimal means to connect to Hunter Water's sewer system. The strategy should address, but not be limited to, the following matters:

- Adjacent development areas;
- Existing asset constraints;
- Pump and emergency storage upgrades to Stockton 4 WWPS
- Development staging and timing; and
- Alternative connection points.

Wastewater Treatment

The proposed development falls within the Sortland Wastewater Treatment Works (WWTW) catchment which has sufficient capacity for the proposed developments.

Financial Contribution

Dependent on the connection points and utilisation of infrastructure, it may be necessary to pay a reimbursement towards capacity uptake in infrastructure assets constructed by other developers. Hunter Water administers reimbursements for a maximum period of 15 years following hand over to Hunter Water.

It is not possible to calculate reimbursement values at this time due to the tentative nature of information, connection points etc, and accordingly such calculations are usually deferred until definitive information is available.

Environmental Assessment

Please note that a Review of Environmental Factors will be required for any works external to a particular development site, or where the service design includes infrastructure or activities that may have environmental impacts that would not have been specifically addressed in the consent authorities assessment and determination of the proposed development. Examples may be the construction of new or augmented water and sewer pump stations, sewer vents, trunk mains, reservoirs, development in a Wastewater Treatment Plant buffer zone, or development in a water reserve. Furthermore, a Controlled Activity Approval will be required from the NSW Office of Water for any excavation within 40m of a water body or should groundwater be present.

Prior to commencement of environmental assessment please contact the Hunter Water Developer Services Group to confirm the scope and need for such an assessment. It is recommended to meet and agree these matters prior to the developer engaging the services of a design or environmental consultant. In addition, please refer to the Hunter Water Review of Environmental Factors Guidance Notes, located in the Building & Development section of the Hunter Water website. The document provides the minimum requirements and an example template for the preparation of a REF.

Should you require further clarification or assistance please do not hesitate to contact me on 4979 9476.

Yours Sincerely

Paul McKoy
Developer Services Engineer

Attachments:
Figure 1 - Water Supply Connection Point - 5 Popplewell Road
Figure 2 - Sewer Infrastructure - 5 Popplewell Road
Figure 3 - Water Supply Connection Point - 338 Fullerton Street
Figure 4 - Sewer Infrastructure – 338 Fullerton Street

Figure 1 - Water Supply Connection Point - 5 Popplewell Road

Figure 2 - Sewer Infrastructure - 5 Popplewell Road

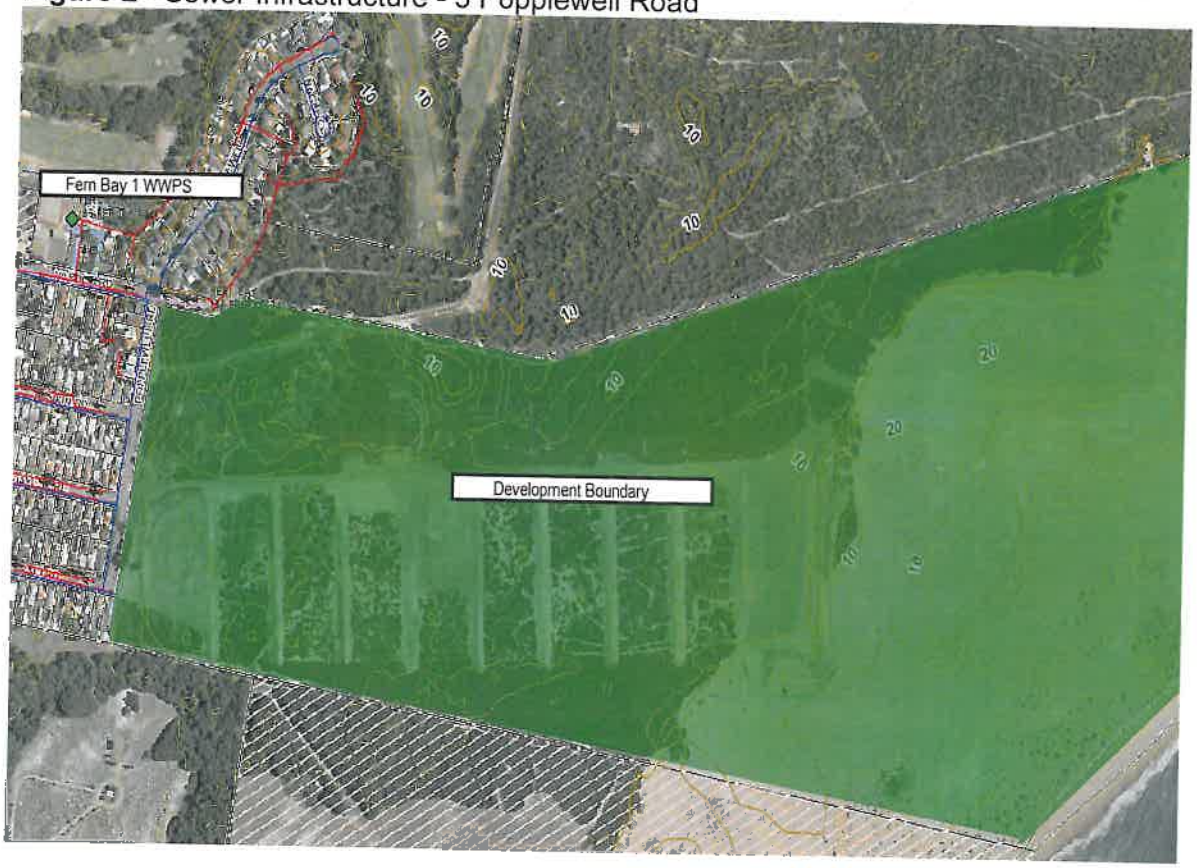


Figure 3 - Water Supply Connection Point - 338 Fullerton Street

Figure 4 - Sewer Infrastructure – 338 Fullerton Street

Stakeholder and Community Engagement Outcomes Report

Fort Wallace and Rifle Range

Client:
Defence Housing Australia

Date:
15 December 2016

FINAL

Contact:
Julie Sutton, Merewether, NSW
julie@elton.com.au
0424 826 612

Sydney
02 9387 2600

Level 6
332 – 342 Oxford Street
Bondi Junction NSW 2022

www.elton.com.au
consulting@elton.com.au
Sydney | Canberra | Darwin | Newcastle
ABN 56 003 853 101

Prepared by	Julie Sutton
Reviewed by	Jenny Vozoff
Date	15 December 2016
Document name	20161212_DHA_RR_FW_Outcomes Report
Version	2

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1 Introduction

Defence Housing Australia (DHA) has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle-based Defence members. DHA has recently purchased two sites: Fort Wallace, Stockton, NSW and Rifle Range, Fern Bay, NSW and intends to obtain the necessary planning approvals to develop these sites for residential use with a mix of housing suitable for both Australian Defence Force (ADF) personnel and the private market.

To develop parts of both sites for residential use, the planning controls need to be amended. A proactive approach to engage and consult with key stakeholders and neighbouring communities to the Rifle Range and Fort Wallace was undertaken between July and early December 2016.

Information distributed to stakeholders and neighbouring communities intended to provide a greater level of certainty in the planning process and confidence in DHA's approach.

Table 1 Summary information of Fort Wallace and Rifle Range:

	Fort Wallace	Rifle Range
Area	31.75ha	111.35ha
LGA	Newcastle	Port Stephens
Existing Zone	SP2 Infrastructure	E2 Environmental Conservation
Notional Yield	100 dwellings	235 dwellings

1.1 Stakeholder and Community Consultation

Communications with key stakeholders and neighbouring communities to Fort Wallace and the Rifle Range commenced in July 2016. The purpose of these communication activities was to ensure stakeholders and the community:

- know who DHA is
- are aware of what is happening at Fort Wallace and Rifle Range
- consider the strong links to community
- consider the cultural heritage within Fort Wallace and the Rifle Range
- understood the planning process and what stage of this process they are at
- were aware of the site opportunities and constraints, indicative masterplans, indicative landscape masterplans and proposed housing typologies
- could speak directly with the project team at informal information sessions, or to call or email for additional information.

This report details the outcomes of the stakeholder and community consultation undertaken prior to the Planning Proposal being lodged with Port Stephens Council and Newcastle City Council. As consultation on both sites was integrated, one consolidated report has been prepared addressing both sites. Where responses have related specifically to one site, this has been noted.

2 Summary of consultation activities

A number of different consultation activities were undertaken over the six month period including face to face meetings, distribution of community newsletters, access to a website and a dedicated 1800 phone line and email address. The purpose of these activities was to drive greater public awareness of the project and provide interested parties with information.

Table 2 Consultation activities

Activity	Detail
Community Information and Feedback Sessions (CIFS)	» In total, 155 people attended one of the three CIFS » Two community newsletters distributed to all Fern Bay and Stockton residents and businesses in July and December 2016 » CIFS 3pm to 6.30pm, Thursday 28 July 2016. Newcastle Golf Course, Vardon Road, Fern Bay » Portside Local Newspaper advertised the Stockton drop-in session Thursday 4 August 2016. Distribution 4000 people » Drop-in Session 2.30pm to 6pm, Thursday 11 August 2016, Stockton IGA, 53 Mitchell Street, Stockton » Portside Local Newspaper advertised the Fern Bay CIFS 24 November 2016. Distribution 4000 people » CIFS 3.30pm to 7pm, Thursday 8 December 2016. Newcastle Golf Course, Vardon Road, Fern Bay
Fort Wallace onsite VIP tour	» 15 people attended the tour including one representative from DHA and one from Elton Consulting » Stockton Historical Society, Fort Scratchley Historical Society, Portside Local journalist, Newcastle Herald journalist and interested persons were invited to attend » 2pm, Tuesday 2 August 2016, Fort Wallace, Fullerton Street, Stockton
Fern Bay & Fullerton Cove Progress Association – monthly meeting	» 16 people attended the meeting including one representative from DHA and one from Elton Consulting » 6.30pm, Thursday 1 September 2016, Fern Bay Community Hall, Vardon Road, Fern Bay

Activity	Detail
Project information – hard copy	» In July 2016, the first issue of a community newsletter was distributed to key stakeholders (via email), and neighbouring communities (letterbox dropped to approximately 3,000 homes) » In November 2016, issue two of the community newsletter was distributed to key stakeholders (via email), and neighbouring communities (letterbox dropped to approximately 3,000 homes).Additional copies were also provided to Stockton RSL, Stockton Bowling Club, Portside Local and Newcastle Golf Course, Fern Bay » At the first round of CIFS in late July/early August, AO display boards were used to convey information about DHA, the heritage and history of the sites and the planning process » At the follow-up CIFS in December, AO boards were used to convey more detail about DHA's proposed development plans including indicative masterplans and housing typologies
Examples of engagement materials	» Please refer to Appendix C for a copy of the July and December community newsletters » Please refer to Appendix D for the A0 Displays used in July/August and December » Please refer to Appendix E for Q&A Sheet » Please refer to Appendix F for CIFS Handout » Please refer to Appendix G for a map of the distribution area
Project 1800 phone line	» A dedicated project information line (1800 959 797) was established on 25 July 2016 » Five calls received from July to September 2016 » Two calls received in November 2016
Project email account	» A dedicated project email contact (dhadevelopments@elton.com.au) commenced 25 July 2016 » Ten emails received between July and September 2016 » One email received in November 2016
Project information – online	» A dedicated webpage is assigned to the project on the DHA corporate website https://www.dha.gov.au/development/residential/fort-wallace-stockton-and-rifle-range-fern-bay » Project information and updates are posted to https://www.dha.gov.au/development/residential/fort-wallace-stockton-and-rifle-range-fern-bay/fort-wallace-stockton-and-rifle-range-fern-bay-details » Commenced mid-August 2016 » Sixteen online sale-related enquiries received
Formal submissions	» Zero formal submissions received by Elton Consulting or DHA.

Fort Wallace VIP Tour – August 2016

3 Summary of feedback received

3.1 Key Feedback

During the community engagement and participation period the large majority of feedback received was **positive**.

Many people said that they appreciated DHA's proactive engagement approach as well as the amount of quality information provided. They also understood that DHA was at the beginning of the Planning Proposal process.

People commented that the developments would create positive benefits for the local area such as **improved public amenity, improved employment and economic growth** as well as making the Worimi Conservation Lands and Stockton Beach more accessible to the public.A large majority of people expressed a desire to **retain the heritage of Fort Wallace** and were positive about adaptive reuse of some existing structures within the site.

Negative feedback received highlighted a variety of community concerns including feelings that **traffic along Fullerton Street and Nelson Bay Road needs to be managed better** at proposed access points of the developments. A number of people expressed concerns about the level of available **parking** at Stockton IGA and Stockton Ferry terminal.

Some people enquired into the status of **future retail outlets and the sea wall** proposed at Stockton by Newcastle City Council.

Fern Bay Community Information and Feedback Session - July 2016

3.2 Community Consultation Reports

Community Information and Feedback Sessions – July 2016

Fern Bay Community Information and Feedback Session	Stockton Drop-in Session
Staff: DHA, Elton Consulting, NCP, Architectus **Time:** 3pm – 6.30pm **Date:** Thursday 28 July 2016 **Location:** Newcastle Golf Course, Vardon Road, Fern Bay **Display:** nine display boards, community newsletter and Q&A handout	**Staff:** DHA and Elton Consulting **Time:** 2.30pm to 6pm **Date:** Thursday 11 August 2016 (pension day) **Location:** Stockton IGA, 53 Mitchell Street, Stockton **Display:** nine display boards, community newsletter and Q&A handout
From 25 to 28 July 2016, about 3000 community newsletters were distributed to residents and businesses of Stockton and Fern Bay inviting people to attend the Fern Bay CIFS and the Stockton drop-in session.	
Interest was generally positive.	Interest was generally positive. Two people expressed a negative view about the proposal.
The team spoke with approximately 60 people.	The team spoke with approximately 50 people.
Positive feedback included: » Generally positive about the development and improved amenity in the area » Level of detail provided to residents so early in the planning process » Generally enthusiastic about the heritage at Fort Wallace and Rifle Range being retained » Many older residents wanted to see Fort Wallace and have a look at the site » Many residents wanted improved access to Stockton Beach » Support for the memorial walk concept » Opportunity to look at new facility for teenagers » Supported housing provided for DHA purposes	**Positive feedback included:** » Heritage to be preserved at Fort Wallace and made available to the public in some way » Beach and dune access is important to the community » Need for more quality housing in the area » Economic benefits of having more people in the area – i.e. it is good for business » People seeking to move from Stockton to Fort Wallace or Rifle Range and wanted sales details » People considered the development a great idea » Appreciated the information and engagement approach with the community
Negative feedback included: » Theft and petty crime is common in the area » Traffic along Nelson Bay Road is busy and it is difficult to turn left or right from Vardon Road and Taylor Road onto Nelson Bay Road » Lack of S94 contributions being invested into the Fern Bay area » Community members had a feeling of	**Negative feedback included:** » Need to better manage traffic along Fullerton Street and Nelson Bay Road » Need to address car parking issues at Stockton IGA and at the Stockton Ferry Terminal » Concern to protect the environment within the sites » Information requested about the proposed sea wall which is being managed by

Fern Bay Community Information and Feedback Session	Stockton Drop-in Session
neglect – no local newspapers, pamphlets, investment from local Council » Concern surrounding mosquitoes and snakes in the local area » Concern for speeding vehicles using Vardon Road and Taylor Road to access Rifle Range » Concern about the lack of retail outlets (especially groceries) in the area » Questions about who may move into the area » Safety concerns	Newcastle City Council
Neutral » Interest in the type of housing, look of the estate and public amenity to be provided » Design is important	**Neutral** » Interest in the type of housing, look of the estate

Project Emails

Ten received

One person suggested having a CIFS on a Saturday, two sales enquires, one employment enquiry, one wanted to know the type of housing, one request for the concept plan and one provided information on the local area.

1800 project calls

Five received

Two people requested a copy of the community newsletter, one raised a neighbouring fence issue, two people wanted additional information about the proposal and appreciated the information provided.

Progress Association Monthly Meeting

Fern Bay and Fullerton Cove Progress Association Monthly meeting
Staff: DHA and Elton Consulting **Time**: 6.30pm to 8pm **Date**: Thursday 1 September 2016 **Location**: Fern Bay Community Centre, Vardon Road, Fern Bay **Display**: nine display boards, community newsletter and Q&A handout
Interest was generally positive. One person expressed a negative view about the proposal.
The team spoke with approximately 14 people.
DHA spokesperson provided the history of the sites and the handover to DHA in 2015.
Positive feedback included: » Open to the idea of a residential housing development » Public access to the Stockton beach and dunes » Preserve the heritage within the sites » Public amenity within the development may be good for teenagers, e.g. basketball court » Appreciated DHA's straightforward approach to answering questions » Hunter Development Corporation Newcastle Port Community Contribution Fund may provide funding for future development
Negative feedback included: » Need to manage traffic flow along Nelson Bay Road, particularly where it intersects with Vardon Road and Taylor Road » The current lack of S94 Contribution invested directly into Fern Bay » Dust that would be generated during construction of the development

Community Information and Feedback Session – December 2016

Fern Bay CIFS – Indicative masterplan, indicative landscape masterplan and housing typologies for Fort Wallace and Rifle Range
Staff: DHA and Elton Consulting **Time**: 3.30pm to 7pm **Date**: Thursday 8 December 2016 **Location**: Fern Bay Community Centre, Vardon Road, Fern Bay **Display**: nine display boards including masterplan, community newsletter and Q&A handout
Interest was overall positive.
The team spoke with approximately 45 people.
Positive feedback included: » Support for residential housing at Rifle Range and Fort Wallace » General acceptance of the proposed Fort Wallace and Rifle Range indicative masterplan and landscape masterplan » Support coastal community approach to the development and the proposed community interface » Valued the strategic location and reasonable scale of the three to four storey apartment sites proposed at Fort Wallace » Interest in the housing typologies (free-standing homes, courtyard homes, townhouses and cluster homes) proposed for both sites and general considerations to touch lightly on the environment » Understood the opportunities and constraints for both sites » Supported two access roads for the Rifle Range site » Support for intersection upgrade at Nelson Bay Road and Vardon Road and/or Taylor Road, Fern Bay » Support for public pedestrian access to the Stockton beach and dunes from both sites » Support bushfire management strategy » Keen interest in preserving the heritage within the sites and promoting this aspect through signage » Supported the proposed public amenity within the developments, e.g. sporting field at Rifle Range for teenagers and connected cycle path and footpath from Fort Wallace to Stockton town centre » Appreciated DHA's straightforward approach to answering questions » Key messages from DHA were congruent with key messages provided in July » Key information regarding each site's indicative masterplan, landscape masterplan and housing typologies was easy to read and understand » Three parties indicated strong interest to purchase land and expressed desire to be informed once sales agent appointed
Negative feedback included: » Strong westerly winds blow over garbage bins, move coal dust and are a bushfire hazard » Stockton Ferry Terminal car parking is at capacity from Monday to Friday during working hours » Currently the Rural Fire Service do not have any facilities in Fern Bay. Fern Bay residents identified the need for an RFA in the local area to effectively manage fires that arise from

Fern Bay CIFS – Indicative masterplan, indicative landscape masterplan and housing typologies for Fort Wallace and Rifle Range
neighbouring bushland threatening existing (and proposed) residential dwellings in Fern Bay » Noted that road users along Fullerton Street, Stockton and Nelson Bay Road exceed speed limit and suggested speed cameras be used

Project Emails

One received

One person wanted to discuss the potential impact that additional people and cars will have on adjacent communities. In particular, the need for additional services required at local schools, supermarkets, retail outlets, doctors, medical services, aged care services, real estate services and additional parking spaces. He was invited to attend the December CIFS to discuss this matter.

Nil reply via email was noted and this person did not attend the CIFS in December 2016.

1800 project calls

Two received

One person wanted to know about the timing of the completed development and the other wished to know about council amalgamation between Newcastle City Council and Port Stephens Council.

3.3 Stakeholder Consultation Summary Outcomes

The table below outlines the sequence of actions to support pre Gateway consultation with relevant agencies from early July to December 2016.

Table 3 Summary outcomes

Stakeholder	Objective	Action Taken	Outcomes
Proactive stakeholder consultation and prepare communications material			
National Native Title Tribunal NSW Native Title Services Office of the Registrar	Brief initiatives	Briefing letter sent by Umwelt	Four Aboriginal parties registered Members of the Worimi Land Council (WCL) are one of the registered parties
Hunter Central Rivers CMA Now: Hunter Land Services	Brief initiatives	Briefing letter sent by Umwelt Consultation logged by Umwelt	Complete Noted by stakeholder

Stakeholder	Objective	Action Taken	Outcomes
Meetings - Port Stephens and Newcastle Council » Planning » Engagement » Ecology » Heritage (Aboriginal and European) » Coastal and biodiversity » Land management	Brief council officers on the proposed approach to consultation and the process for providing feedback Ensure this approach is consistent with council's requirements and best practice Understand the council's consultation outcomes report requirements	Meeting attended by DHA/NCP/ Architectus/Umwelt BMT WBM sent briefing letter to OEH Elton Consulting spoke to Council Engagement officers	In June 2016, engagement officers supported DHA's proposed proactive engagement approach Refer to Architectus report (December 2016) for Fort Wallace and Rifle Range. Indicative masterplans and landscape masterplan modified to suit Council requirements Indicative masterplan, landscape masterplan and housing typologies for both sites were displayed at CIFS December 2016. Overall community supported indicative masterplans and landscape masterplans at December CIFS

Stakeholder	Objective	Action Taken	Outcomes
NSW National Parks and Wildlife and Worimi Board of Management /Worimi Conservation Lands (WCL)	Brief initiatives Determine further opportunities and constraints regarding potential future dedication of the beachfront and bushland within RR Cultural heritage management process; conservation of Aboriginal heritage (Umwelt) Land management – identify initiatives Assess access provisions	Meeting with DHA, Umwelt, Kleinfelder with NSW National Parks and Wildlife WCL Board of Directors notified through registered members	Boundary changes by negotiation Seaside Fern Bay VPA discussed Water to be contained within DHA sites No cats Community title scheme to manage APZ and bushlands APZ needs to be managed within development site Development must take into consideration Aboriginal and European heritage of each site Need to manage access from private residences to WCL, no legal access to National Park from private land No additional land to be given to WCL without due compensation OEH do not want beach land or any additional park Bollards work well along northern boundary of Rifle Range Need to map RV approved land Future walking trail under investigation through WCL to Port Stephens and good extension of Great North Walk Potential impact of bushfire mitigation measures and Vegetation Management Plan on adjoining land NPWS may be interested in collaborated bushfire and weed mitigation management plan along property boundaries Bonded and friable asbestos found on WCL
Fort Scratchley Historical Society	Determine further opportunities and constraints	Meeting with DHA and Elton Consulting Onsite VIP Tour of Fort Wallace	Photos, maps and historical records of Fort Wallace provided Marine Rescue suggested as tenant for observation tower Heritage to be managed accordingly

Stakeholder	Objective	Action Taken	Outcomes
Family and Community Services	Understand The Stockton Centre pending closure, timings, substantial changes Brief FACS on proposed approach, timings	DHA managed briefings at Deputy Secretarial level	Complete Noted by stakeholder
Office of Environment and Heritage » Aboriginal heritage	Umwelt to administer the Aboriginal cultural heritage assessment process. The OEH requirements for Umwelt assessment include provision for public notification to identify interested Aboriginal parties	Umwelt (Aboriginal heritage)	Refer to Umwelt report
Federal MP - Newcastle	Brief initiatives	Briefing with DHA	Complete Noted by stakeholder
State MP - Newcastle	Brief initiatives	Briefing with DHA	Complete Noted by stakeholder
Office of Environment and Heritage NSW Government Heritage Division (European heritage)	Brief heritage sites within Fort Wallace and Rifle Range (note Commonwealth sites)	Urbis sent a notification letter to OEH Heritage	Heritage listing type to be determined Refer to Urbis report
Office of Environment and Heritage » Environment	Confirm issues to be dealt with by Council and OEH (Flora and Fauna Assessment)	Umwelt (ecology) meeting Umwelt (ecology), DHA/NCP and Architectus	Refer to Umwelt report

Stakeholder	Objective	Action Taken	Outcomes
Office of Environment and Heritage » Coast and estuaries	Confirm issues regarding coastal management	BMT WTM sent a notification letter	Noted by stakeholder
Roads and Maritime Services (RMS)	Brief initiatives Consideration on traffic impacts, current capacity of local roundabout and traffic light implications Upgrades of Fullerton St and Nelson Bay Road	Meeting with Better Transport Futures	No specific issues were raised from a traffic and transport perspective Refer to Better Transport Futures report
Hunter Water (HW)	Understand the future of the HW site south of FW and potential to link Stockton to FW via beachfront of the HW site	ADW Johnson discussed project with HW	Noted by Stakeholder Preliminary Services Advice application lodged for the developments
NSW Rural Fire Service	Brief initiatives Identify constraints and opportunities	Kleinfelder coordinated correspondence	Noted by Stakeholder
Regional Emergency Management Officer – Hunter Central Coast (police, fire, rescue)	Brief initiatives Identify constraints and opportunities	Elton Consulting emailed project outline and community newsletter	Noted by stakeholders
Stockton Historic Society	Investigate opportunities to activate and use historic structures (tunnels, rooms at Fort Wallace) Understand servicing requirements, provisions, opportunities	Stakeholders attended Fern Bay CIFS Onsite VIP Tour of Fort Wallace	Noted by stakeholder Heritage to be either protected, managed and/ or preserved

Stakeholder	Objective	Action Taken	Outcomes
Dune Buggy and beach front activity providers	Brief initiatives Understand constraints Beach front provisions addressed	Elton Consulting briefed stakeholder on the project Invited to attend Fern Bay CIFS	Stakeholder is part of Worimi Conservation Lands Refer to Worimi Conservation Lands
Defence Families Australia Defence Communities Organisation RAAF Base Williamtown	Provide information on the proposal, process, constraints and opportunities Consultation and collate feedback on proposal Manage expectations of built form	DHA provided briefing	Need for housing closer to base Traffic congestion on Nelson Bay Road Need for connection to Newcastle
Fern Bay Public School (including P&C, OOSH, Family Daycare)	Provide information on the proposal, process, constraints and opportunities	DHA and Elton Consulting provided briefing	Traffic needs to be better managed at intersection of Nelson Bay Road and Vardon Road for safety reasons School to support new families and school children and acknowledged Defence supported aids Vehicle use on the beach is a safety issue Lack of street lights in Fern Bay Kooragang Island Emergency Management Plan addressed
Marine Rescue	Brief initiatives Identify the opportunity for adaptive reuse of Fort Wallace observation Tower and tenant with suitable organisation	DHA and Elton Consulting provided briefing DHA provided onsite tour of Fort Wallace	Marine Rescue (Newcastle) unable to secure approval to operate from Observation Tower, Fort Wallace due to current leasing arrangements with Council

Stakeholder	Objective	Action Taken	Outcomes
Print Media Newcastle Herald Portside Local	Brief initiatives Answer questions and provide media release when necessary Follow DHA Media Protocol	Journalists attended CIFS Journalists attended Fort Wallace VIP Tour DHA provided written responses to questions	Newcastle Herald ran poll which showed 70% support for proposal Portside Local printed positive and neutral report on proposal

4 Next Steps

Following preliminary assessment by Councils and the Department of Planning and Environment in order to issue DHA a Gateway Certificate, it is expected that the formal public exhibition of the planning proposals will be augmented with the following:

- A DHA community newsletter will be distributed to all stakeholders, businesses and residents of Fern Bay and Stockton, NSW. The newsletter will explain what is happening at Fort Wallace and Rifle Range, what stage of the planning process DHA are up to and an invitation to the next Community Information and Feedback Session (CIFS)
- A newspaper advertisement(s) will feature details of the next CIFS and include the project phone line, project website and project email account
- A CIFS will be held, with the objective of providing all neighbours and those in the broader community the opportunity to review the proposed changes, seek feedback and to garner interest. The communication approach will be positive and genuine. The CIFS will be in a strategic location, during a time to maximise community involvement. Large maps of both development sites with relevant descriptions will also be made available for public viewing
- Project 1800 phone line continues to be answered and the project team continue to respond to questions and notifications
- Project email account continues to respond to incoming correspondence
- Project information provided online is up to date with key information. People can continue to make an online enquiry

On conclusion of the public exhibition period, a final report of the outcomes will be provided to DHA for Council and State Government assessment and final approval.

Appendices

A	Demographic Information
B	Social Infrastructure Maps
C	Community Newsletters
D	AO Displays
E	Q&A Sheet
F	CIFS Handout
G	Distribution Map

A Demographic Information

The following table provides a summary community profile of Stockton and Fern Bay as at the 2011 Census.

	Stockton	Fern Bay
Population	4195	1625
Male vs Female	50:50	50:50
Median age	47	54
Average people per household	2.3	2.1
Married	37.5%	55.6%
Never married	40.7%	18.8%
Median weekly household income	$1072	$690
Median monthly mortgage repayments	$1733	$2200
Occupations	17.5% Professionals	18.2% Professionals
	17.8% Technicians and trade workers	14.7% Technicians and trade workers
	14.2% Clerical and administrative workers	13% Clerical and administrative workers
	11.8% Labourers	13% Labourers
	11.7% Community and personal service workers	11.8% Community and personal service workers
	8.8% Managers	14.5% Managers
	8.5% Sales workers	5.2% Sales workers
	7.5% Machinery operators and drivers	7.2% Machinery operators and drivers
	2% Not stated	2% Not stated
Home ownership	36% Homes are fully owned	65.1% Homes are fully owned
	28% Mortgage	19.8% Mortgage
	33% rent	12% Rent

Based on ABS Census 2011

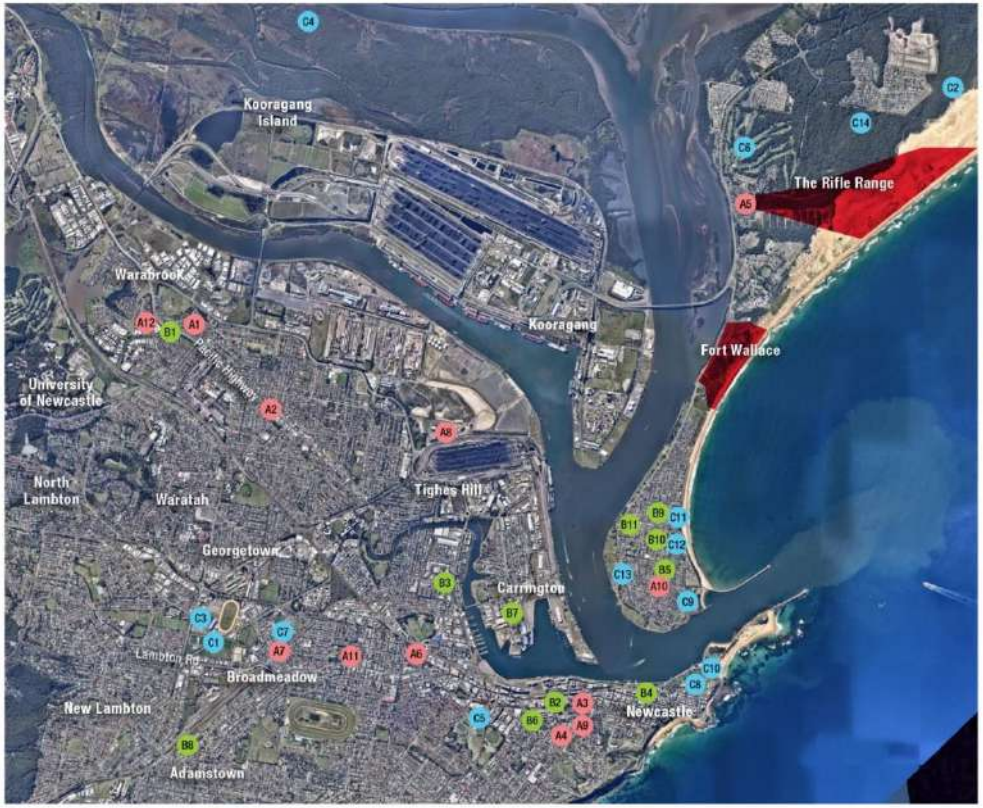
Department of Defence was the highest employer of Fern Bay residents stated in the 2011 Census at ten percent (10%) of respondents.

Stockton has one supermarket, an IGA located in the main shopping precinct between Mitchell Street and Dunbar Street. According to a resident, the majority of people shop at Aldi or Woolworths in Mayfield (13.6km away), or Coles or Woolworths at Medowie (23.3km away and approximately 9.1km north-west of Williamtown).

Locals typically use the petrol station on Koorangang Island. 'Rosies' petrol station was burnt down and has not been rebuilt.

B Social Infrastructure Maps

Stockton Social Infrastructure Map 1



COMMUNITY AND CULTURAL FACILITIES

A1 3rd Mayfield Scouts
A2 Baptist Community Centre Mayfield
A3 Civic Theatre and Newcastle Museum
A4 Cooks Hill Galleries
A5 Fern Bay Community Hall
A6 Newcastle Community Arts Centre
A7 Newcastle Entertainment Centre
A8 Newcastle Mens Shed
A9 Newcastle Region Library and Newcastle Art Gallery
A10 Stockton Branch Library
A11 The Hellenic Community and Cultural Centre of Newcastle
A12 Warabrook Community Centre

COMMUNITY AND EMERGENCY SERVICES

B1 Baptist Community Services
B2 Break Thru Newcastle and Centrelink and Medicare
B3 Challenge Community Services
B4 Hunter Community Legal Centre
B5 Meals on Wheels Stockton
B6 Multicultural NSW
B7 Newcastle Community Transport
B8 St John Ambulance Australia (NSW)
B9 Stockton Fire Station
B10 Stockton Police Station
B11 Wescott Community Care

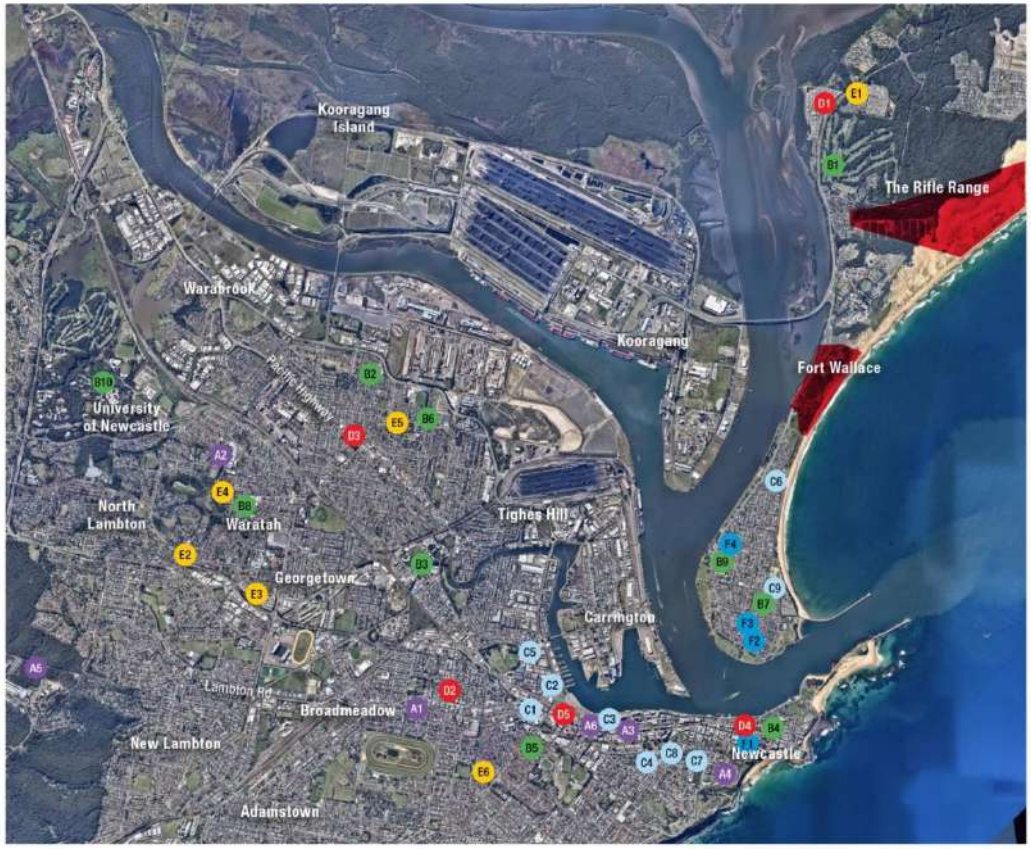
OPEN SPACE AND RECREATION FACILITIES

C1 District Park
C2 Fern Bay Access Trail
C3 Hunter Stadium
C4 Hunter Wetlands National Park
C5 Newcastle City Tennis Centre
C6 Newcastle Golf Club
C7 Newcastle Showground
C8 Nobbys Beach and Reserve
C9 Pitt Street Reserve
C10 Sandhills Community Garden
C11 Stockton Beach
C12 Stockton Bowling Club, Stockton & Northern Districts Cricket Club
C13 Stockton Dog Off-Leash Area
C14 Worimi National Park

Source: Nearmaps 2016

ELTON CONSULTING

Stockton Social Infrastructure Map 2



HEALTH FACILITIES
- A1 Awabakal Aboriginal Medical Service
- A2 Calvary Mater Hospital Newcastle and Mater Mental Health
- A3 Headspace Newcastle
- A4 James Fletcher Hospital
- A5 John Hunter Hospital
- A6 Newcastle Drug & Alcohol HARM (Syringe/IV Services) and Newcastle Community Health Centre

SCHOOLS AND EDUCATION FACILITIES
- B1 Fern Bay Public School
- B2 Hunter Christian School
- B3 Hunter TAFE, Newcastle Campus
- B4 Newcastle Grammar School
- B5 Newcastle High School
- B6 San Clemente High School
- B7 St Peter's Primary School
- B8 St Philips Christian College
- B9 Stockton Public School
- B10 University of Newcastle

CHILDCARE FACILITIES
- C1 Amana Family Day Care Pty Ltd
- C2 Awabakal Newcastle Aboriginal Co-operative Ltd - Childcare Centre
- C3 Brinco Child Care and The Little Unicorn On Honeysuckle
- C4 Cooks Hill Preschool
- C5 KU Wickham Preschool
- C6 Mission Australia Early Learning Stockton
- C7 Newcastle East After School Care
- C8 Samaritans Early Learning Centre
- C9 Stockton School Kids Fun Club Association

PRIVATE/OTHER
- D1 Fern Bay Medical Centre
- D2 Hamilton Medical Centre
- D3 Mayfield Medical Centre
- D4 King Street Medical Centre
- D5 The Hunter Street Medical Centre

AGED CARE FACILITIES
- E1 Bayway Village and Palm Lake Resort Retirement Villages
- E2 Bupa Aged Care Waratah
- E3 Calvary Community Care - Hunter
- E4 Maroba Aged Care
- E5 Mayfield Aged Care
- E6 Orchid Aged Care

PLACES OF WORSHIP
- F1 Christ Church Cathedral
- F2 St Paul's Anglican Church, Stockton
- F3 St Peter's Catholic Church
- F4 Surfside Presbyterian Church

Source: Nearmaps 2016

ELTON CONSULTING

C Community Newsletters

Fort Wallace and Rifle Range

Community Newsletter – July 2016

What is happening at Stockton Fort Wallace and Fern Bay Rifle Range?

Last year Defence Housing Australia (DHA) purchased the Fort Wallace and Rifle Range land holdings from the Department of Defence. This land will be developed by DHA to provide additional homes for Defence members and their families.

In the coming months, we will take the first steps towards requesting the necessary planning approvals required to develop two vibrant and sustainable residential communities. We anticipate both sites will offer high quality public areas, improved access to the sand dunes and Stockton beach, as well as a mix of quality dwellings to house Defence families and the wider public.

Who is DHA?

Defence Housing Australia (DHA) is one of the country's most successful Government Business Enterprises. Our main role is to provide quality housing and related services to Defence members and their families, but we don't just build houses, we build communities.

When planning a new development, our project teams look beyond the front yard and consider the street layout, the footpath connectivity, the road network, and public spaces like parks to ensure a safe and liveable community. Our role is clear – we are charged with creating a place for families to call home.

Today, we can proudly say that the communities we build exceed community standard and are award-winning. Innovation and sustainability is incredibly important to DHA. We have a pipeline of approximately $3 billion committed to produce cutting-edge developments across the country.

With the ongoing support of our many happy investors and our valued partners, we will continue to build futures for all Australians.

Aerial image highlighting Rifle Range and Fort Wallace north of Newcastle

DHA
Defence Housing Australia

Fort Wallace and Rifle Range

Strong links to community

DHA's vision is to develop Fort Wallace and the Rifle Range into unique coastal communities with links to the Newcastle CBD and the growing Hunter region. The location of these two sites is ideal for our requirement to provide more quality housing in close proximity to jobs at RAAF Base Williamtown, Kooragang Island and Newcastle CBD.

We will be considering a variety of opportunities for the two areas, such as integrated bike paths and scenic walking trails that allow people to enjoy various points of interest within the sites. For instance, Fort Wallace offers a unique insight into the bygone "fort" era with history that is integral to the local and wider community.

Fort Wallace offers unique views of Stockton and the Hunter region and both sites have the potential to provide the community access to Stockton beach, its dunes and the surrounding bushland.

Currently, DHA is working with an expert project team, comprising of architects, planners, urban designers and landscape architects plus a range of specialist consultants. This team is working on identifying and reporting on local considerations regarding the environment, traffic, Indigenous heritage, European heritage, dune morphology and 100 year sea level changes.

By consulting with the local community and its stakeholders we hope to achieve an urban design that sensitively responds to the local environment and supports the local amenity. A place where the natural coastal ecology prevails over the built environment and a rich layer of cultural heritage is celebrated and made accessible to the public.

We intend for these sites to provide future residents, and the wider Stockton community, with the opportunity to connect with the natural environment and the sites' heritage. Our aim is to create a vibrant sustainable community with world's best practice as the benchmark.

Fort Wallace Observation Tower – historical image

Cultural heritage

Both sites contain Indigenous and European heritage while Fort Wallace heralds visible remnants of its recent mission to keep Newcastle safe during World War Two.

DHA is committed to working with the local community to understand the significance of these sites and work with local organisations and government with the aim of protecting, managing or providing public access to these culturally significant heritage sites.

Concept of a Memorial Walkway to provide connectivity from the proposed estate to Stockton Beach. Concept Only.

DHA
Defence Housing Australia

Fort Wallace and Rifle Range

What will happen next?

To develop parts of both sites for residential uses, the planning controls need to be amended. The process is called a “Planning Proposal” or “rezoning”. The Planning Proposal will be submitted to Port Stephens Council and Newcastle City Council, and will also need to be assessed and determined by the State Government.

DHA Development Manager discussing Fort Wallace with President, Vice President and Curator of Fort Scratchley Historical Society, July 2016.

Specialist consultants walking the site to identify local considerations.

What is the planning process?

STAGE 1 – Planning Proposal

- Specialist studies; including heritage, traffic, flora and fauna.
- Stakeholder and community consultation undertaken by DHA. **We are here**
- Planning proposals lodged with Port Stephens Council and Newcastle City Council.
- Preliminary assessment by councils.
- Department of Planning and Environment issue a Gateway Certificate, which allows the Planning Proposal to go on exhibition.
- Public exhibition of the Planning Proposal.
- Council and State Government Assessment and approval – the planning controls are amended.

STAGE 2 – Development Applications

- DHA and the consultant team prepare Development Applications (DAs) showing the details of the proposal.
- Public exhibition of the DAs.
- Development Application assessed by Councils and other agencies (as required) and approved, if appropriate.

STAGE 2 – Design and Construction

- DHA to undertake detailed design of the dwellings, parks, and infrastructure, and commence construction.

HAVE YOUR SAY

Make a comment or share your views by coming along to one of our information sessions. See back page for details.

DHA
Defence Housing Australia

Fort Wallace and Rifle Range

Rifle Range and Fort Wallace have the potential to provide the community access to Stockton Beach, its dunes and the surrounding bushland.

Where can I get more information?

DHA is committed to keeping the local community and stakeholders informed, as well as obtaining your feedback as the planning progresses. We will be sending households regular newsletters and providing community information sessions at key stages of the planning process. The Gateway Rezoning process will also provide formal opportunities for public input.

The *community is invited to attend an informal information session* to be held Thursday 28 July 2016 between 3pm and 6.30pm at Newcastle Golf Club, Vardon Road, Fern Bay.

Alternatively, you can drop-in to the arcade in front of the Stockton IGA Thursday 11 August 2016 from 2.30pm to 6pm. Stockton IGA is located at 53 Mitchell Street, Stockton.

At these events you will be able to meet some of the project team and view information about the planning proposal to better understand what can be expected.

Project contact details

For more information about the project, to provide feedback or if you have any questions please contact us by emailing dhadevelopments@elton.com.au or call 1800 959 797.

1800 959 797

dhadevelopments@elton.com.au

DHA
Defence Housing Australia

Fort Wallace and Rifle Range

Community Newsletter – December 2016

What is happening at Stockton Fort Wallace and Fern Bay Rifle Range?

In April 2016, Defence Housing Australia (DHA) took the first steps toward requesting the necessary planning approvals required to develop two vibrant and sustainable residential communities in the local area.

For more background information refer to *https://www.dha.gov.au/development/residential/fort-wallace-stockton-and-rifle-range-fern-bay*

What has happened so far?

By August, over 3,500 Fern Bay and Stockton residents received our first community newsletter and over 100 people attended our information sessions.

In September, we were invited to attend the Fern Bay Progress Association meeting to share details about DHA's plans. The project team has provided information to numerous stakeholder groups at local, state and federal levels.

Overall the feedback has been very positive. People have expressed interest in many elements including:

- how DHA plans to maintain and promote the heritage aspects of Fort Wallace
- how access to the surrounding dunes and Stockton Beach will benefit the community
- the different types of housing being considered and the economic boost and flow-on from having new residents living in the area.

We've listened to local resident concerns regarding the environment, road access and traffic hot spots and the project team has been working on identifying and finding adequate responses to these issues. We expect the project team to have their reports for our Planning Proposals finalised by the end of 2016.

Whilst we understand the planning proposal process has a way to go, we would like to share with the community our initial ideas, provide information as to what has guided us so far and ask for your feedback. Refer to the back page for details.

In August, we hosted a site visit to Fort Wallace for members of the Stockton Historical Society and Fort Scratchley Historical Society.

Opportunities and constraints

We will be considering a variety of opportunities for the two areas, such as shared walking paths with historical significance, scenic walking trails through the dunes to Stockton Beach, public viewing areas, playgrounds, sporting fields and public spaces that allow people to connect with each other.

Fort Wallace is a historically significant site and where possible, DHA plan to adaptively reuse the original Fort Wallace heritage buildings and gun emplacements.

The Rifle Range site contains a potential koala habitat and we are working with Port Stephens Council to ensure there are no negative impacts on the existing habitat.

To help protect homes from bushfire risks our masterplanning includes an asset protection zone. DHA is investigating a more frequent, low intensity fire management strategy to reduce the bushfire danger to both sites.

The indicative masterplans for both sites will be on display at our upcoming information session.

DHA
Defence Housing Australia

Diversity of housing

We anticipate the Fort Wallace and Rifle Range sites will offer a diversity of dwellings for Defence families and the general public to call home.

The proposed ecologically sustainable development includes apartments, townhouses and free standing homes. Five unique typologies are being considered in both masterplans for Fort Wallace and Rifle Range to respond to the unique nature of the sites. A brief description of each housing type is provided below:

Single eco-homes

Larger lot sizes, from 550 to 800m^2, will accommodate single eco-homes. These lightweight homes respond well to all seasons due to their orientation and choice of building materials.

Cluster homes

Coastal Cluster homes, as the name suggests, clusters homes into groups of two, three and four. Homes are carefully designed to increase the sense of connection to the surrounding landscape.

Courtyard homes

Courtyard homes offer families open plan living space, a single garage and ample rear garden. These two storey detached homes will each include three to four bedrooms. Lot size is expected to be 380m^2.

Townhouses with Fonzie Flat

From the front, these three bedroom compact homes will be attractive as all the garages will be located at the rear of each dwelling. Each two storey home will be situated on a 240m^2 lot.

Dune apartments

To optimise a natural looking skyline of the coastal community, the indicative Fort Wallace masterplan show these apartments adjacent to and below the central hillside. The proposed height of the apartment block is one to four stories. From all apartments, residents will be able to see the surrounding natural bushland and communal areas. Each apartment will have one to three bedrooms.

Skillion roof shown on a single eco-home.

Illustration of cluster homes.

Courtyard homes in Little Bay, NSW.

For more information on these housing types please join us at our next information session. We will share with you the proposed masterplans with housing types clearly shown. Refer to the back page for event details.

Fort Wallace and Rifle Range

What will happen next?

To develop parts of both sites for residential uses, the planning controls need to be amended. The process is called a “Planning Proposal” or “rezoning”. The Fort Wallace Planning Proposal is expected to be submitted to Newcastle City Council by the end of 2016 and the Rifle Range Planning Proposal submitted to Port Stephens Council early 2017. Afterwards, the proposals will go on public exhibition. Then will need to be assessed and determined by both Councils and the State Government. The stages involved in the planning process are detailed to the right.

Fort Wallace - historical image.

Historical image of the Fort Wallace gun emplacement. The apparatus is no longer at Fort Wallace.

What is the planning process?

STAGE 1 – Planning Proposal

- Specialist studies; including heritage, traffic, flora and fauna.
- Stakeholder and community consultation undertaken by DHA. **We are here**
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HAVE YOUR SAY

Make a comment or share your views by coming along to our information session. Refer to the back page for event details.

DHA
Defence Housing Australia

Fort Wallace and Rifle Range

Rifle Range and Fort Wallace with Newcastle in the background.

Community Information Session

The community is invited to attend an informal information session to be held Thursday 8 December 2016 between 3.30pm and 7pm at Newcastle Golf Club, Vardon Road, Fern Bay.

At this event you will be able to talk to members of the project team, view proposed masterplans and provide us with your valuable feedback.

Where can I get more information?

For more information about the project, to provide feedback or if you have any questions please contact us by emailing dhadevelopments@elton.com.au or call 1800 959 797.

For more background information refer to https://www.dha.gov.au/development/residential/fort-wallace-stockton-and-rifle-range-fern-bay

1800 959 797

dhadevelopments@elton.com.au

DHA
Defence Housing Australia

D AO Displays

Who is DHA?

DHA is one of the country's most successful Government Business Enterprises. Our main role is to provide quality housing and related services to Defence members and their families, but we don't just build houses, we build communities.

When planning a new development, we look beyond the front yard. We walk down the street and along the footpaths. We play in the parks, run on the ovals and help kids cross the street safely. Our role is important – we are charged with creating a place for families to call home.

Today, we can proudly say that the communities we build exceed community standard and are award-winning. Innovation and sustainability is incredibly important to DHA. We have a pipeline of approximately $3 billion committed to produce cutting-edge developments across the country.

With the ongoing support of our many happy investors and our valued partners, we will continue to build futures for all Australians.

The community park at DHA's Bluewattle, Rasmussen development.

Rifle Range and Fort Wallace

Last year DHA purchased the Fort Wallace and Rifle Range land holdings from the Department of Defence. We anticipate, this land will be developed by DHA to provide additional homes for Defence members and their families.

Fort Wallace is approximately 32 hectares located east of Fullerton Road. The site is situated directly south of The Stockton Centre and north of Corroba Oval at Stockton.

Rifle Range is approximately 111 hectares east of Nelson Bay Road. The site is situated south of Worimi Conservation Lands, east of Fern Bay Public School and west of Stockton Beach.

We are seeking the necessary planning approvals to develop two vibrant residential communities on these sites that will offer a mix of high quality dwellings to house Defence members and their families, with the remaining lots to be sold to the public.

Aerial image highlighting Rifle Range and Fort Wallace north of Newcastle.

Strong Links to Community

DHA plans to develop Fort Wallace at Stockton and the Rifle Range at Fern Bay into coastal communities with links to the Newcastle CBD and growing Hunter region. The location of these sites responds well to DHA's requirement to provide quality housing in close proximity to jobs at Williamtown RAAF, Kooragang Island and Newcastle CBD.

Fort Wallace located along Fullerton Road has good connectivity with the Stockton town and Stockton community organisations such as the Stockton Surf Life Saving Club, RSL, Bowling Club and local activities like Parkrun. The Stockton ferry travels directly to Newcastle and this service provides great access to the CBD's entertainment and shopping precincts.

Rifle Range is next door to Fern Bay Public School and Newcastle Golf Course. A short stroll directly north of the site is Worimi Conservation Lands and Port Stephens is less than an hour away by car or bus.

The local coastal communities are active in the Nippers program at Surf Life Saving Clubs.

What's happening now?

DHA is working with an expert project team, comprising architects, planners, urban designers and landscape architects plus a range of specialist consultants. Planning for the sites has taken into consideration recommendations regarding the environment, Aboriginal heritage, European heritage, ecology, dune morphology and transport/traffic management.

DHA is working on concepts for two masterplanned residential estates with approximately 100 lots planned at Fort Wallace and 220 lots at Rifle Range. There is no commercial, retail or industrial development planned for either site.

Cultural Heritage

Fort Wallace and Rifle Range contain both Indigenous and European heritage. DHA is committed to working with the local community to understand the significance of these sites and work with local organisations and government with the aim of protecting, managing or providing public access to these culturally significant heritage sites.

Concept of a Memorial Walkway that captures the history of the site through signage, public art and landscape design. Concept Only.

The Opportunities

DHA is working with local stakeholders to identify specific areas within Fort Wallace and Rifle Range to protect, manage or share with the broader community.

We will be considering a variety of opportunities for the area, such as integrated bike paths, scenic walking trails that allow people to enjoy various points of interest. For instance, Fort Wallace offers a unique insight into the bygone “fort” era with history that is integral to the local and wider community.

A place where the broader community will be able to enjoy greater connectivity to Stockton beach, its dunes and the surrounding bushland by providing improved access through these new residential estates.

Opportunities for the area include integrated bike paths, scenic walking trails and views of the Hunter region, to name a few.

The Future

DHA expects that the rezoning of these sites will allow future residents and surrounding communities to connect with their local natural environment and heritage in a way that is sustainable, sensitive and is a positive contribution to the community.

Urban design principles help shape the look and feel of any residential estate and ensures that important measures are adopted as the estate matures.

The following urban design principles are being considered for Fort Wallace and Rifle Range:

- Touch lightly on the land where homes are raised and work in with the natural topography
- Coastal ecology is embraced by maximising views to the oceans, dunes, river and bush and only those species found locally are planted
- The local history and cultural heritage of the sites are celebrated by retaining heritage structures where ever possible and explore opportunities to connect with the Worimi Conservation Lands
- A diverse community is created by providing a mix of housing typologies that meets defence, private and affordable housing needs and a range of open spaces for residents to experience
- Accessible to the public via local road, pedestrian and cycle networks; improved public transport links to Newcastle CBD and pedestrian access to Stockton beach and its dunes
- Interesting architectural forms are demonstrated through staggered heights of built forms; use natural building materials and finishes; articulated facades; vaulted and skillion roofs and varied street setbacks.

Concept of a Memorial Walkway to provide connectivity from the proposed estate to Stockton Beach. Concept Only.

Historical Timeline of Fort Wallace, Stockton

Awabakal and Worimi peoples were the traditional owners of the land on and around Fort Wallace. They inhabited the area before European settlement.

1900 to 1915

Fort Wallace was nationally significant as a major component of the integrated system of Defence for the Newcastle Fortress Area. Its prime purpose was protection of Newcastle Harbour and its industries.

Fort Wallace was the third fort built for Newcastle's defence. Field Marshall, Earl Kitchener originally approved the site and work commenced in 1912. Two Mark 7 guns on central pivot mountings were installed in 1915.

Fort Wallace is the only defence installation in Australia comprising both 6-inch and 9.2 inch guns, as well as a range of ancillary structures including a plotting room and an observation tower.

1919 to 1939

The inter-war period saw the Fort relatively unmanned. Due to the approach of WWII, the Fort was modified. From 1938, the Battery Observation Post and one of the 6 inch gun emplacements were removed for the construction of new 9.2 inch gun emplacements.

1939 to 1945

The most active phase of Fort Wallace's history, including the completion of the 9.2 inch installations, proving of the guns and the shelling of Newcastle by a Japanese submarine in June 1942. At the end of the war the fort was closed down and manned by a minimum maintenance staff.

Working at Fort Wallace during World War Two.

Fort Wallace Observation Tower and tunnel entrance.

1963 to 1974

In 1963, work to remove the 9.2 inch guns commenced and the fort was unattended until 1967. In 1967, the 130 Signal Squadron moved to Fort Wallace. New barracks to house 69 people were completed in 1974.

1993

The last members of 130 Signal Squadron left Fort Wallace in 1993.

Planning Process

STAGE 1 – Planning Proposal

Specialist studies; including heritage, traffic, flora and fauna.

Stakeholder and community consultation undertaken by DHA. **We are here**

Planning proposals lodged with Port Stephens Council and Newcastle City Council.

Preliminary assessment by councils.

Department of Planning and Environment issue a Gateway Certificate, which allows the Planning Proposal to go on exhibition.

Public exhibition of the Planning Proposal.

Council and State Government Assessment and approval – the planning controls are amended.

STAGE 2 – Development Applications

DHA and the consultant team prepare Development Applications (DAs) showing the details of the proposal.

Public exhibition of the DAs.

Development Application assessed by Councils and other agencies (as required) and approved, if appropriate.

STAGE 2 – Design and Construction

DHA to undertake detailed design of the dwellings, parks, and infrastructure, and commence construction.

Historical Timeline of Rifle Range, Fern Bay

1900 to 1940

From 1900 until the outbreak of World War Two, rifle shooting was undertaken at Adamstown Rifle Range.

1939 to 1942

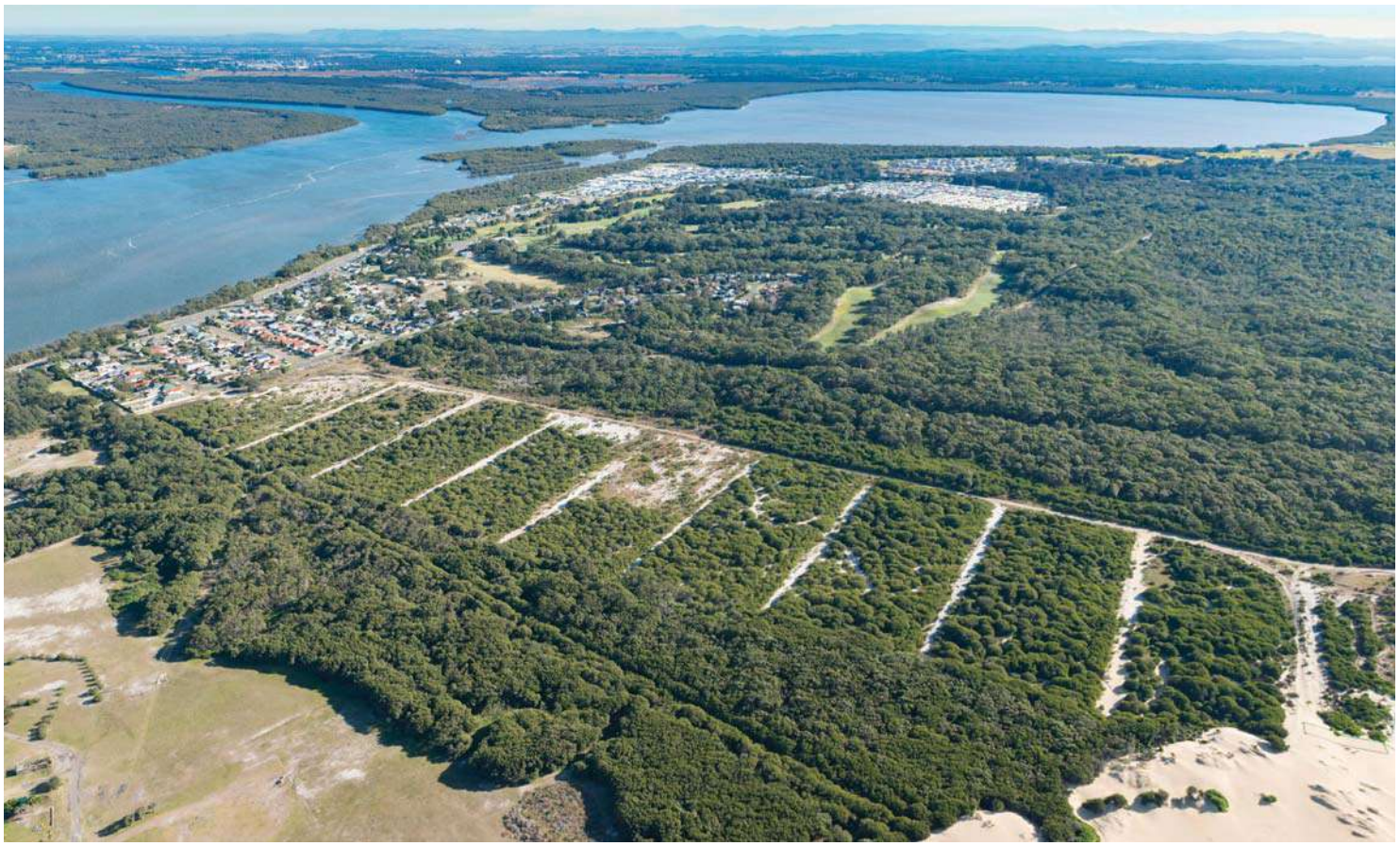
In 1939-1940, construction of the Rifle Range at Fern Bay began to meet extra local demand. The range was officially opened for use on 28 January 1941 however the government did not formally acquire the site until 1942.

1953

From 1953 the site was a training facility for all shooting in the region and was utilised by the police force, military, school cadets and civilian rifle clubs.

1997

The site was no longer required by the military and was closed in December 1997.



Aerial image of Rifle Range, Fern Bay with Fullerton Cove in the background.

Opportunities and constraints Rifle Range

DHA is considering a variety of opportunities for the Rifle Range site, such as scenic walking trails to Stockton Beach, playgrounds, an area for possible sporting fields, viewing areas, and public spaces that allow people to connect.

Topography and landscape

To the east of the site a transient dune rises approximately 12 metres above the old Rifle Range site. Future homes will need to be set back from the dune to allow for natural dune migration. We intend to provide pedestrian access through the dune to the beach.

Water sensitive urban design is reflected in our plans. Engineers have advocated the need to use swales to direct water into basins to help manage stormwater discharge and quality.

Ecological

Coastal Sand Apple Blackbutt forest is growing to the north of the site and Coastal Sand Scrub to the east. The proposed masterplan minimises the impact on the flora in these areas.

The Rifle Range site contains a potential koala habitat and we are working with Port Stephens Council to ensure that any impacts on the existing habitat are minimised.

Heritage

The Rifle Range site contains Indigenous and European heritage. DHA is committed to working with the local community, local organisations and government departments to understand the significance of these sites.

DHA is aware that an old anti-aircraft battery exists within the site and will work with government to ensure this asset is managed in accordance with heritage regulations.

Bushfire

To protect homes from bushfire risks our masterplanning includes an asset protection zone. DHA is investigating low intensity fire management to reduce the bushfire danger to the immediate surrounds.

Coastal hazards

DHA has taken into consideration coastal hazards that may impact the site over the next 100 years. Coastal hazards occur where natural coastal processes, such as beach erosion and coastal inundation, threaten homes and communities in the coastal zone.

Rifle Range from the north looking south towards Stockton and Newcastle CBD.

Indicative playgrounds incorporating Australian native trees.

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Opportunities and constraints Fort Wallace

DHA plan to provide the community with a range of high quality contemporary amenities, such as scenic walking trails through the dunes to Stockton Beach, new pathways, public viewing areas, playgrounds and landscaped public spaces.

Heritage

While Fort Wallace is a historically significant site containing heritage buildings, tunnels and gun emplacements, DHA plan to link these Defence remnants together to form an integrated public domain. We are investigating the reuse of heritage structures to provide a café space or an outdoor classroom.

Fort Wallace also contains Indigenous heritage. DHA is committed to working with the local community, local organisations and government departments to understand the significance of these sites.

Topography and landscape

Our masterplanning considers the site's ranging topography with steep slopes and flat open areas. We propose to sensitively integrate new dwellings into the site's natural topography to build a unique coastal community.

The majority of proposed dwellings will be located within the centre of the site, set back from coastal hazards and utilising the flatter areas. The site offers many viewpoints to the Pacific Ocean, Newcastle CBD, Stockton Beach, Nobbys Head, Hunter River and the broader Hunter region.

Ecological

Coastal Sand Apple Blackbutt forest and Coastal Sand Scrub grow within the site. Grey headed flying fox has been recorded and DHA is working with Newcastle Council and Department of Planning to minimise any impacts.

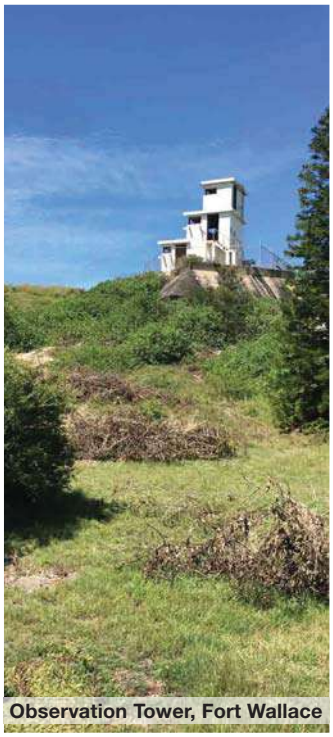
Coastal hazards

DHA has taken into consideration coastal hazards that may impact the site over the next 100 years. Coastal hazards occur where natural coastal processes, such as beach erosion and coastal inundation, threaten homes and communities in the coastal zone.

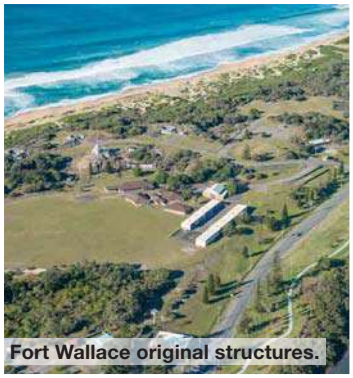
Flat area north of embankment which is shown to the right.

Steps down embankment (looking north).

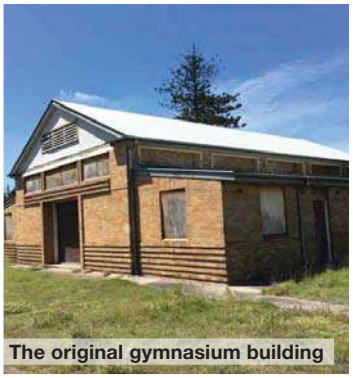
Fort Wallace – historical image.



Observation Tower, Fort Wallace



Fort Wallace original structures.



The original gymnasium building

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Indicative masterplan Rifle Range

We anticipate the Rifle Range site will provide a diversity of dwellings for Defence families and the general public to call home, including free standing homes, cluster homes, townhouses and courtyard homes.

The Rifle Range site will have two access roads connecting to Taylor Road and Popplewell Road providing access to Nelson Bay Road. This will mitigate traffic congestion and emergency egress concerns through the neighbouring community of Fern Bay – upgrade works will likely be required to Nelson Bay Road.

The proposed number of residential dwellings for this site is approximately 235.

Section 1 – Community Interface.

Legend

1/ Existing neighbourhood
2/ Popplewell road
3/ Vegetated stormwater detention basin
4/ Proposed road
5/ Single eco-home

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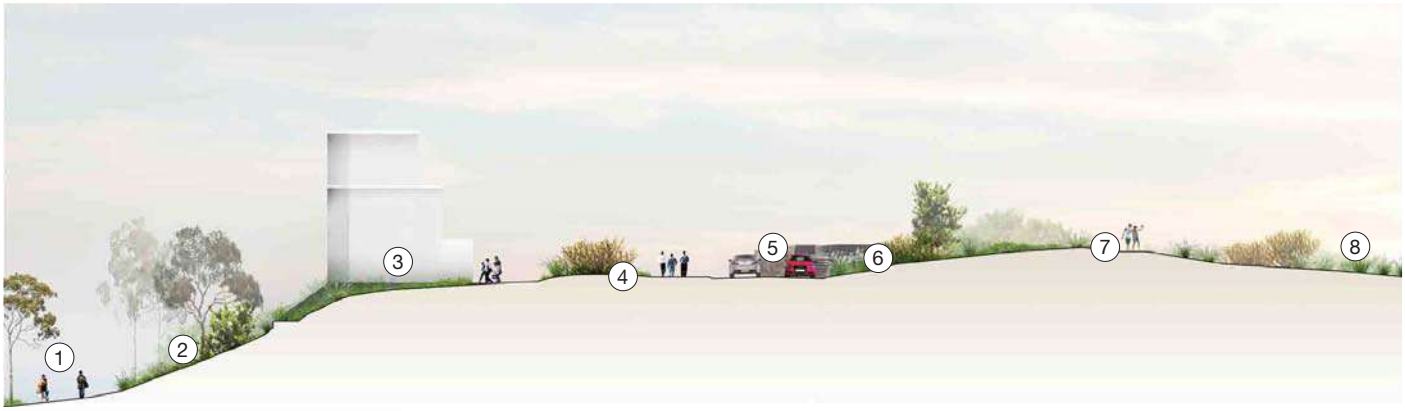
Indicative Masterplan
Fort Wallace

Fort Wallace, located on the Stockton Peninsula, is approximately 32 hectares in size and is five kilometres north of Newcastle CBD.

The proposed ecologically sustainable development includes a diversity of housing types such as apartments, townhouses and free standing homes. Five unique typologies are being considered in this masterplan to respond to the unique nature of the site.

Each home will have its own private open space and the local community will be able to walk or cycle to Stockton, have improved access to Stockton beach and use of new parklands.

The total number of planned residential dwellings for this site is approximately 100.



Section 2 – Interpretive Heritage Park.

Legend

1/ Firetrail bushwalk
2/ Back of dune
3/ Adaptively-reused structure
4/ Gathering and event space
5/ Carriageway
6/ Refurbished heritage structures
7/ Dune bushwalk
8/ Dune re-vegetation zone

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Housing types

Single eco-homes

Larger lot sizes from 550 to 800m^2 will accommodate single eco-homes. These lightweight homes respond well to all seasons due to their orientation and choice of building materials. Each dwelling will include three to four bedrooms. Building heights may be one or two storey.

Indicative single eco-home, not actual design. Architectus 2016.

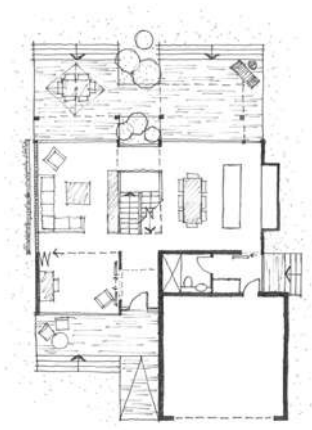
Coastal cluster homes

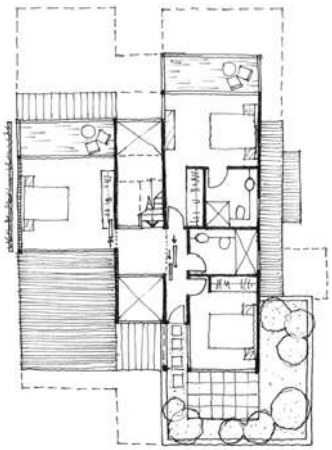
Coastal cluster homes as the name suggests, cluster homes into groups of two, three and four. These homes are carefully designed to increase the sense of the homes' connection to the surrounding landscape.

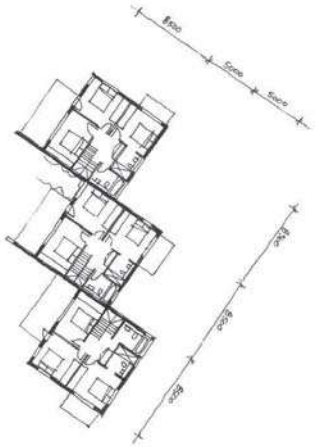
The proposed height of these community title homes is two storey. Each dwelling will include three bedrooms.

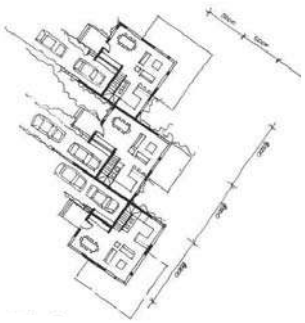
We anticipate single eco-homes and cluster homes to be made of robust environmentally compatible materials, such as corrugated metal sheeting, steel or timber frames and timber panel cladding.

Indicative coastal cluster homes, not actual design. Architectus 2016.









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Housing types

Courtyard homes

Courtyard homes are large family homes, including four bedrooms, three bathrooms, open plan living space, a single garage and an ample rear garden. Dwellings are built to the boundary on one side and set back 1.5 metres on the other. This allows for a side pathway to access the rear garden and improves natural light and ventilation for the dwelling. Lot size is expected to be 380m^2.

External materials used on the courtyard homes will include corrugated metal sheet, timber panel cladding and rendered masonry.

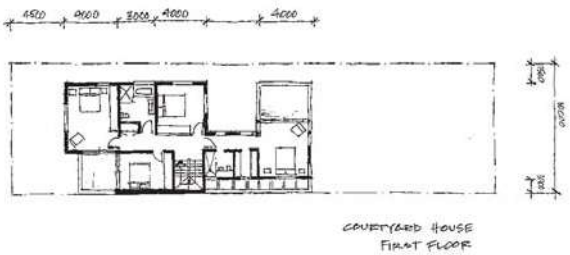
Townhouses with fonzie flat

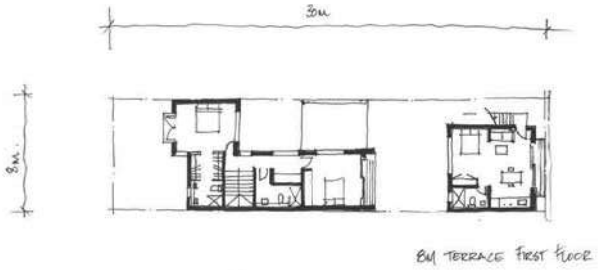
From the front, these three bedroom compact dwellings will be attractive as all the garages will be located on a laneway at the rear of each dwelling. Each two storey home will be situated on a 240m^2 lot.

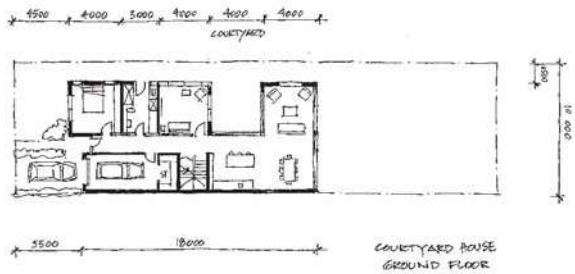
A fonzie flat is a quirky name for self-contained studio apartment, located at the rear of the townhouse above the garage. By placing an apartment over the rear garage, safety and security is improved through passive surveillance over the laneway.

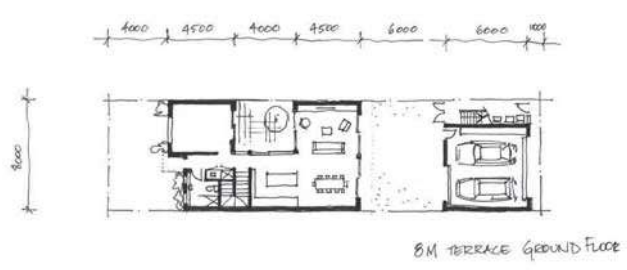
Little Bay, NSW.

Hamilton Corner by Bates Smart for DHA.









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Housing types

Dune apartments

These small scale apartment buildings are designed to minimise the overall building footprint. The buildings are located to respond to the natural topography of the site and minimise visual impacts across the site.

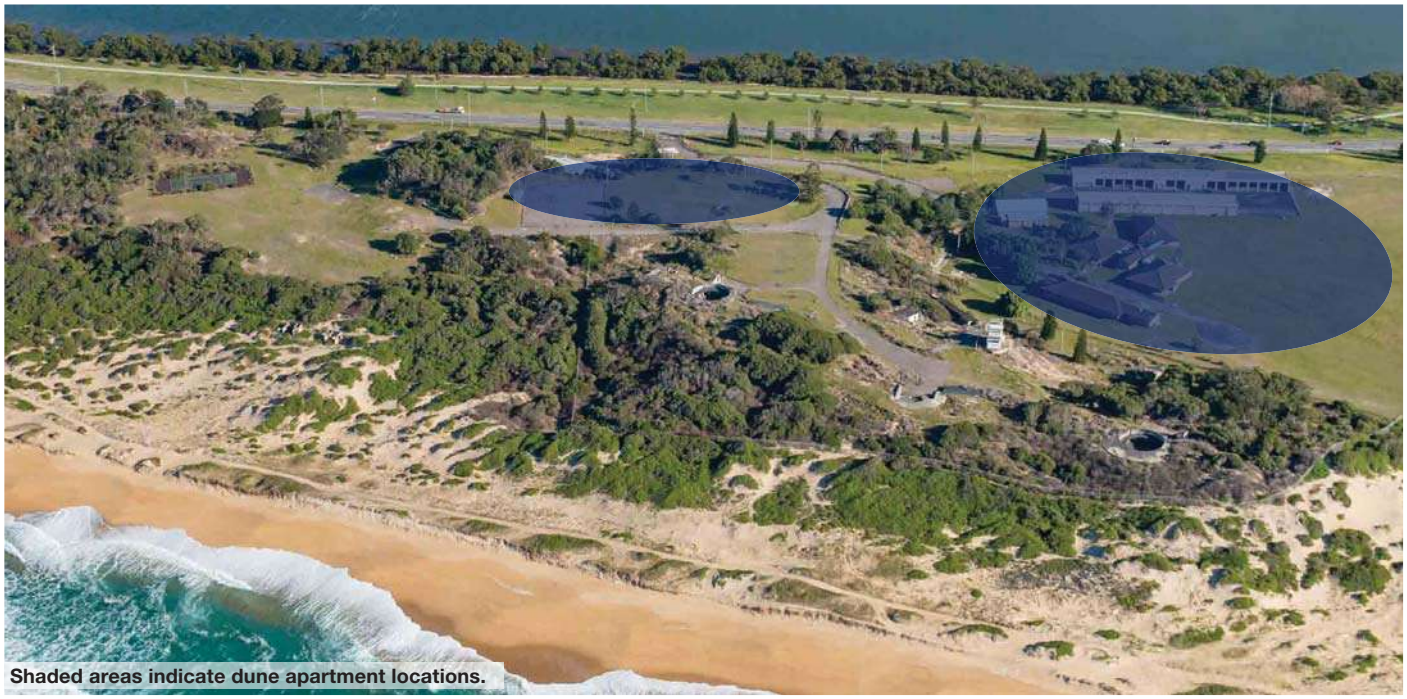
The proposed height of the apartment block is up to four stories. Each apartment will have one to three bedrooms.

From all apartments, residents will be able to see the surrounding natural bushland and communal areas. Clever design will encourage passive surveillance over public areas to promote a safe and secure community.

We anticipate the apartments to be made of robust materials, such as corrugated metal sheeting, concrete slab, steel frames and timber panel cladding.

Maria Alessandra Segantini.

Dune apartments, Little Beach.



Shaded areas indicate dune apartment locations.

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Indicative landscape masterplan Fort Wallace

Legend

1/ Cluster homes
2/ Single eco-homes
3/ Townhouses
4/ Dune apartments
5/ Courtyard homes
6/ Firetrail walking path
7/ Community park
8/ Adaptive reuse community facility
9/ Heritage precinct
10/ Stairway
11/ Dune boardwalk
12/ Landscaped embankment
13/ Gun emplacement

Heritage precinct

The heritage precinct sits at the top of the dunes at Fort Wallace and offers panoramic views in all directions. DHA plans to provide the community access to this precinct. The area will offer visitors an opportunity to engage with Fort Wallace's military history.

We are investigating the reuse of the heritage structures to provide amenities, such as a cafe space or an outdoor classroom. The surrounding dune ecology will be protected and planting will reflect the surrounding native bushland.

Community park

The public parklands emphasize principles of "nature play" through the selection of play facilities, materials, and native planting. Structures will be constructed of natural materials. Trees and shade structures will provide cover from the sun without obscuring views over the dunes. Robust, low-maintenance plantings will blend play areas into the surrounding area.

The dune will act as a windbreak for the area. Picnic tables will be positioned to the east of the dune and therefore sheltered from strong winds from the ocean. The firebreak surrounding the community will double as a bushwalk trail, connecting the park to residential areas. Nearby heritage structures will be adaptively reused to provide public community amenity.

Indicative infrastructure for heritage precinct.

Indicative children's playground.

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Indicative landscape masterplan
Rifle Range

Legend

1/ Extended road network from existing neighbourhood
2/ Cluster homes
3/ Single eco-homes
4/ Courtyard homes
5/ Townhouses
6/ Shared path to dunes
7/ Vegetated detention basin
8/ Community park
9/ Firetrail bushwalk
10/ Dune boardwalk
11/ Access to dune lookout
12/ Worimi Conservation Lands
13/ Potential park / recreation / sporting field

Community interface

The Rifle Range site will be connected to the existing road network and infrastructure. Clear sightlines, foothpaths, and walking trails will join the site to Fern Bay.

DHA intends to create a neighbourhood character that emphasizes qualities of connectedness, feels part of the neighbouring community, and is integrated with the surrounding bushland and coastal ecology.

Community park

In a native plant setting, we plan to provide children the opportunity for “nature play” by providing a selection of play facilities. Structures will be constructed of natural materials and sited within the coastal landscape. Large feature trees and shade structures will provide cover from the sun. Robust, low-maintenance plantings will blend play areas into the surrounding coastal landscape. We plan for the community to enjoy social gatherings, picnics and passive recreation near the centre of the Rifle Range community.

Active living

The Rifle Range community will include a number of opportunities for active recreation and outdoor living. The centre of the development features a large public open space with room available for a sports field, subject to council agreement.

The Rifle Range is surrounded by a network of bushwalk trails and shared pedestrian/cycle paths that double as a firebreak. These trails connect the site to the Worimi Conservation Lands to the north, as well as the dune boardwalk that leads to the beach.

Worimi Conservation Lands and north-west section of Rifle Range.

Indicative children’s playground.

Indicative shared pathway.

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F CIFS Handout

Straight forward answers
Fort Wallace and Rifle Range

Does DHA or the proposed developments at Rifle Range and Fort Wallace have anything to do with the closure of The Stockton Centre?

No. The proposed developments at Rifle Range and Fort Wallace is a DHA initiative. The pending closure of The Stockton Centre is being managed by Families and Community Services (FACS).

DHA's proposed plans at Fort Wallace and Rifle Range have nothing to do with the pending closure of The Stockton Centre.

How will DHA manage the heritage and ecology of the sites?

The planning proposal of the two sites will take into consideration the recommendations of specialist consultants in dune ecology, Indigenous heritage, European heritage, environment and coastal engineering. We are planning on working with the relevant local stakeholders to develop an ecologically sustainable development to ensure the sites support best practice in urban and landscape design.

Do the proposed developments have anything to do with the contamination at RAAF Base Williamtown?

No. The proposed developments by DHA at Fern Bay and Stockton are approximately 11 to 12 kilometres away from RAAF Base Williamtown and is a completely separate matter.

What impact will this development have on traffic?

Traffic studies indicate that the road network has the capacity to meet the needs of road users for the next 50 years.

Areas of safety concerns, such as the intersection of Nelson Bay Road and Taylor Road, Fern Bay, are being raised with Roads and Maritime Services and Transport for NSW.

Will there be any changes to public transport?

DHA will provide regular updates to Transport for NSW regarding users' needs. There are no changes planned as at 2016, to the bus service 118 or ferry service from Stockton to Newcastle. However relevant government agencies will be informed by DHA should public transport needs change in the new areas.

What changes are proposed for the surrounding street network?

In 2016, there are no changes being proposed for the surrounding street network.

Project contact details 1800 959 797 dhadevelopments@elton.com.au

DHA
Defence Housing Australia

MISSING ATTCHMENT M - PROTECTED

DHA

Rifle Range
Social Impact Assessment

August 2017

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Appendices

Appendix A Demographic summary
Appendix B Local Social Infrastructure
Appendix C Age Structure Profile

1. Introduction

1.1 Project overview

Defence Housing Australia (DHA) purchased the Rifle Range site in 2015 from the Department of Defence. The Rifle Range site was considered to be surplus to Defence's operational needs. DHA purchased the site in order to provide high quality, modern accommodation (one to four bedroom dwellings) for Defence personnel and their families, and to the wider community. DHA is seeking amendments to the Local Environment Plan (LEP) through a Planning Proposal to rezone the land for residential uses.

There is the potential that the Rifle Range site will be developed concurrently with the nearby Stockton Fort Wallace site, which was also purchased by DHA. If both sites are developed, cumulatively they would not have a significant impact on current and future populations, and services meeting increased demand.

1.2 Purpose of this report

GHD has been engaged by DHA to prepare a Social Impact Assessment (SIA) in support of the Planning Proposal for the Rifle Range site in Stockton. The SIA has been prepared in accordance with *Port Stephens Council's Social Impact Policy* (Amended 2014). The method and approach adopted for assessment is discussed in section 1.4.

1.3 The proposed development

1.3.1 Site location

The Rifle Range site is located on the Stockton peninsula north of the existing coastal village of Stockton, in Fern Bay. 7km north of Newcastle CBD on the northern side of the Hunter River within Port Stephens LGA. Fern Bay Rifle Range is approximately 115 hectares in area.

The site is bound by the Worimi Conservation Lands to the north, the Stockton Centre and Stockton Cemetery to the south, existing residential subdivision to the west and Stockton Beach and dune system to its east.

The Rifle Range site is currently accessible from the west via Popplewell Road which links back to Newcastle via Nelson Bay Road across the Hunter River. It is a 20 minute drive from Newcastle CBD via the Stockton Bridge, or alternatively 6 km from the 10 minute ferry service between Stockton and Newcastle.

The planning proposal indicates key features of the site including:

- Some European history with remnant defence buildings and gun emplacements with low heritage significance
- Cultural and archaeological significance for the local Aboriginal community
- Coastal dune system to its eastern boundary
- Close proximity to the beach and river

The site location and surrounding features are illustrated in Figure 1.

Source: Rifle Range, Urban Design and Landscape Report, Architectus and Spackman, Mossop and Michaels , 2016

Figure 1 Site location

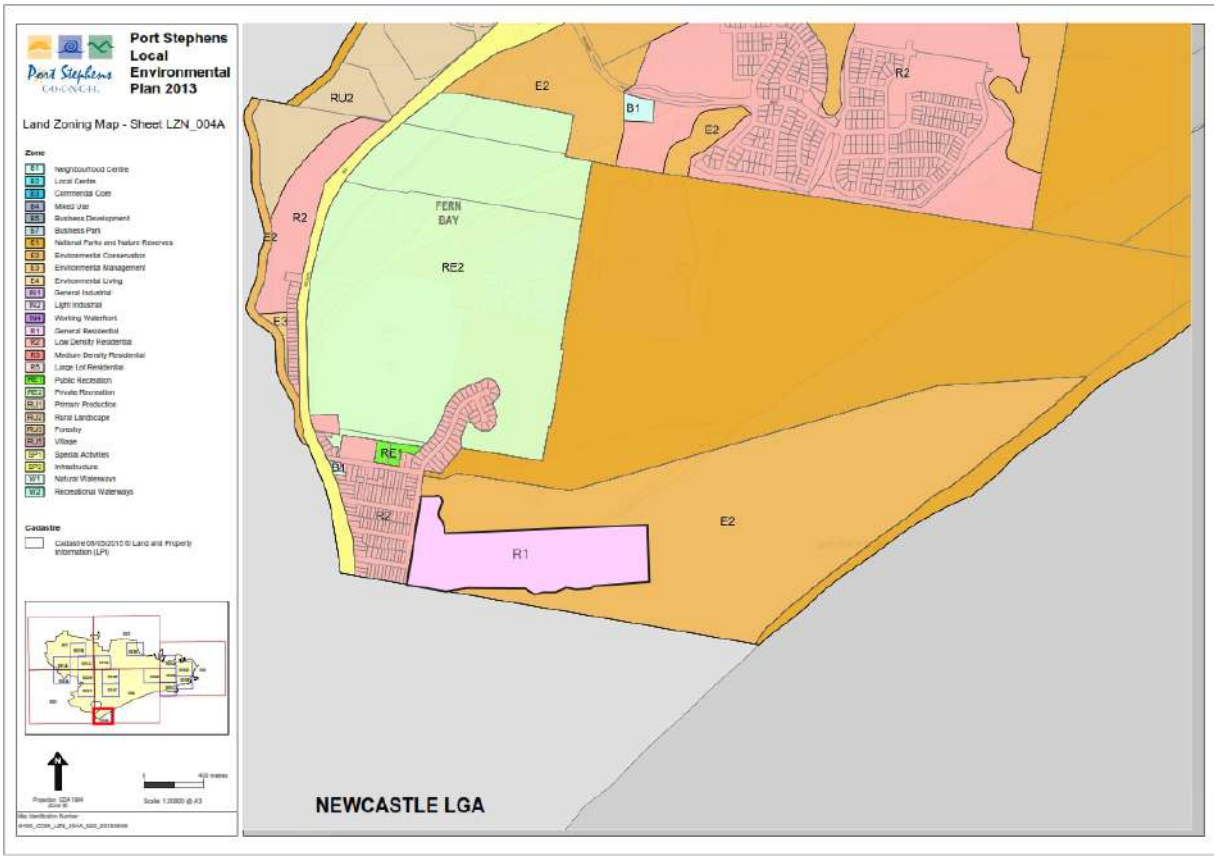
1.3.2 The Planning Proposal

The site sits between the Worimi Conservation Lands and the Stockton Centre, of the communities of Stockton and Fern Bay. The RAAF Base Williamtown is located approximately 11 km north of the site, which would be the place of employment for many of the Defence residents of the subject site. The site is also proximal to the employment areas of Kooragang Island and Stockton, and is accessible to the Newcastle CBD.

The site was utilised for rifle shooting in the early 1900s, and contains an anti-aircraft battery, known as the Links Battery, to the north of the former range. From the 1950s the site was a training facility for all shooting in the region and was utilised by the police force, military, school cadets and civilian rifle clubs. The site also contains some Indigenous heritage.

Defence Housing Australia (DHA) purchased the land in 2015 and seeks to provide high quality, modern accommodation (3 to 4 bedroom dwellings) for Defence personnel and their families, and to the wider community. To develop the site for residential uses, rezoning of the land needs to be approved by Port Stephens Council.

The Planning proposal for this site seeks to partially rezone the land from the existing E2 Environmental Conservation zoning to a R2 Low Density Residential zoning to allow for residential development on part of the site. The planning proposal accordingly seeks to amend the minimum lot size and height of buildings control.



Source: Rifle Range, Urban Design and Landscape Report, Architectus and Spackman, Mossop and Michaels, 2016.

Figure 2 - Proposed Land Zoning Map

1.3.3 Concept Master Pan

To support the planning proposal concept, DHA has developed a Concept Master Plan for the site to illustrate its ability to accommodate residential development, and the nature of planning changes required. The concept master plan is outlined in the Rifle Range Planning Proposal (Architectus, 2016). The master plan responds to the site's natural and historic constraints, and through these considerations proposes a diverse mix of housing to accommodate a residential community. The concept master plan would facilitate the delivery of a residential development including;

- 249 dwellings (a mix of two to four bedrooms)
- Heritage integration
- Community parks and recreational facilities

The concept master plan envisages the 249 dwellings would comprise:

- 113 Coastal cluster homes (clusters of 2, 3 and 4 'apartments', 2 storey, 3 bedroom)
- 32 Single eco-homes (larger lot sizes 1-2 storeys, 3 bedroom)
- 48 Courtyard homes (2 storey, 4 bedrooms)
- 56 Townhouses/row houses with rear lane access (2 storey; 3 bedroom homes plus potential 1 bedroom studio)

The sites heritage would offer residents and visitors the opportunity to engage with the Rifle Ranges' history. The site has no associated heritage listings, but does comprise two items assessed to have heritage significance, including the Anti-Aircraft battery located to the northern

boundary of the site, and the remnants of the 1,000 yard rifle range, being the clear access ways from the central road at 100 yards. The planning proposal supports the sympathetic integration of the Links Battery future works to the Paths and public spaces. This would permit access to the beach, dune ecology and natural vegetation whilst protecting the ecology through:

- Ecological buffer/corridor
- Linear public park
- Conservation/protection zone

The public parklands proposed within the master plan would emphasize principles of "nature play" through the selection of play facilities and materials. An open lawn and playgrounds would be included in these communal spaces.

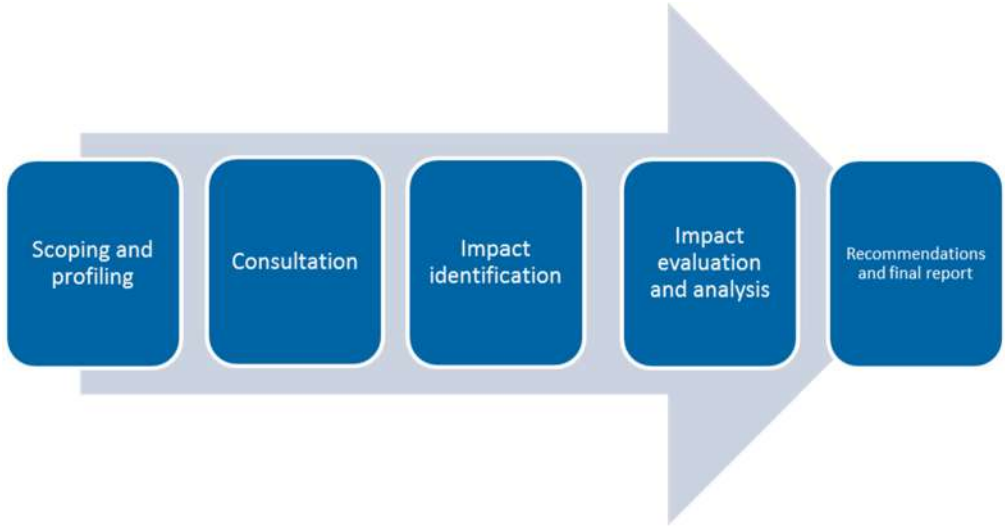
1.4 Methodology

This SIA has been prepared in accordance with Port Stephens Council's *Social Impact Policy* (Amended 2014). The aim of this policy is to facilitate the preparation and assessment of development applications with respect to social considerations in the interests of the developer, the broader community and the future of Port Stephens.

It also reflects the Planning Institute of Australia's *Social Impact Assessment Position Statement* (2010) which recommends that the SIA process involves analysing, monitoring, and managing these social consequences, both positive and negative, and any social change processes invoked by them.

In undertaking the SIA, GHD has undertaken a staged methodology based on the International Association for Impact Assessment *Social Impact Assessment International Principles* (2015)[1]. This process is consistent with Port Stephens Council's requirements for a SIA. The process involves five stages as identified in Figure 3.

Figure 3 GHD's five stages for preparing the SIA



Source: Urban Design and Landscape Report Final Draft, Rifle Range, Stockton 2016.

Figure 4 Concept Master Plan

Stage 1: Scoping and profiling

Scoping was undertaken to identify the primary issues and associated stakeholders potentially impacted by the project, and the spatial extent of these issues in assessing the project area. Scoping was refined and adjusted throughout the profiling process. A visit to the site and surrounding areas was undertaken on 7 - 8 June 2017

A profile of the existing community that has the potential to be affected by the proposed rezoning was prepared based on 2011 census data and information provided by Newcastle Council and Port Stephens Council in regard to development approvals. A demographic profile of the potential future residents of the Rifle Range site and the local area was also prepared. In addition, a review was conducted of the available local social infrastructure.

A review of the Planning Proposal (Architectus 2017) and supporting documents was undertaken , including the Aboriginal Cultural Heritage and Archaeological Assessment Report (Umwelt 2017), Urban Design and Landscape Report Final Draft, Rifle Range, Stockton (Spackman, Mossop and Michaels, and Architectus, 2016) and, the Stakeholder and Community Engagement Outcomes Report (Elton Consulting 2016).

Stage 2: Identification of impacts

An assessment was undertaken to identify the possible risks and social impacts that may arise as a result of the proposed rezoning.

Stage 3: Consultation

Considerable consultation was undertaken in the development of the Rifle Range Planning Proposal. GHD has drawn on these outcomes and consulted with key stakeholders as outlined in section 5. This consultation has informed the SIA in both profiling, identifying impacts and developing mitigation measures.

Stage 4: Impact evaluation and analysis

GHD collated and further analysed the information obtained in Stages 1, 2 and 3. Key questions that were considered include:

- What is the likelihood that the impact will occur?
- Are the impacts likely to be experienced by all persons or will the impact be specific to certain demographic cohorts, stakeholders or special interest groups?
- Is the impact positive or negative? What weight or level of importance should be attached to each impact?
- What measures can be implemented that will mitigate the negative impacts or enhance the positive impacts?

The analysis included a community needs assessment that aimed to determine any gaps in existing community need, and the needs of the likely future population should the site be developed according to its potential under the rezoning proposal. The community needs assessment was informed by leading practice frameworks in social infrastructure, as outlined in section 4.

Stage 5: Recommendations and final report

The final report has been developed with recommendations that outline the options and procedures that could be pursued should the proposed rezoning be adopted and residential development pursued. These recommendations would seek to identify strategies to maximise positive social outcomes whilst also minimise social risk and avoid or ameliorate potential negative social impacts.

1.4.1 Study areas

The local study area determined for the Rifle Range site includes the suburbs of Stockton, Fern Bay and Fullerton Cove. Although these suburbs are different from each other, they share a number of common characteristics including:

- a relatively isolated position in relation to the district and regional areas
- shared access to local infrastructure and conveniences
- bordering two local government areas.

The geography of the suburbs (being on a peninsular spanning two LGAs) also results in the residents accessing district and regional infrastructure within the local government areas of both Port Stephens and Newcastle. The regional study area for the assessment was therefore assessed to include both Port Stephens and Newcastle LGAs.

1.5 Scope and limitations

1.5.1 Consideration of 2016 Census data

This social impact assessment was prepared in June 2017, drawing on demographic data from the 2011 census and informed by consultation with key stakeholders about change in the area and information about the number residential development approvals in the local area, as provided by Councils. At the conclusion of the study much of the 2016 census data became available.

The estimated current (2017) population of 8,141 people used in this assessment is in the order of 645 people higher than that reported in the 2016 census (7,496 people), This variation is likely due to a number of factors including;

- Additional development and occupation of residential dwellings since the 2016 census (resulting in a larger number for 2017 during the period of consideration
- The estimate assuming occupation of all approved development applications that may not yet have been built or occupied
- Errors in the estimate matching the actual situation

The key population number used in this report is the likely future population, estimated at 9,341 people. This estimates the 2011 population plus residential occupation of all currently approved residential developments and is thus considered to remain a relevant estimation for the purposes of the assessment, although it may be somewhat high.

A preliminary review of the 2016 census data for the local area indicates the significant changes since 2011 that were identified during consultation and are reflected and discussed in this social impact assessment (primarily a large overall population growth with the greatest growth in 0-4 years olds and seniors over 60 years of age).

The age structure estimated made for the assessment have varied from that indicated in the 2016 census, but again these can not be expected to be identical as further development in both Seaside and seniors living will continue to modify this structure.

Comparing with the 2016 census data, the likely age structure of the future population expects a higher proportion of 0 – 4 year olds and a lower proportion of over 60 year olds. The ageing population may be under represented in this estimate.

In summary these differences in numbers are not considered to significantly alter the key outcomes of the assessment, as the likely future population estimates are considered suitable

for the purposes of the assessment and qualitative consideration of these issues has been undertaken in the assessment and need and impact.

1.5.2 Limitations

This report has been prepared by GHD for Defence Housing Australia (DHA) and may only be used and relied on by DHA for the purpose agreed between GHD and the DHA as set out in section 1.2 and 1.4 of this report.

GHD otherwise disclaims responsibility to any person other or entity other than DHA arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by DHA and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report, which were caused by errors, or omissions in that information.

2. Policy context

This section provides information about the social policy context of the proposed site and identifies specific plans that align with the proposal and strategies, which inform this assessment. These include NSW Government and Newcastle City and Port Stephens Council documents.

2.1 State government

2.1.1 Hunter Regional Plan 2036

The Plan has been developed to guide the NSW Government's land use planning priorities and decisions over the next 20 years..

The *Hunter Regional Plan 2036* is the NSW Government's strategy guiding land use planning priorities and decisions over the next 20 years. The vision for the region is for a leading regional economy in Australia with a vibrant new metropolitan city of Newcastle at its heart. To achieve the vision, the plan identifies that the growing region would need to support thriving communities and greater housing choice and jobs. Greater Newcastle and revitalising Newcastle City Centre are identified as key components to the region's success. It is intended as a framework to guide subsequent and more detailed land use plans, development proposals and infrastructure funding decisions. The Plan also identifies priorities for each council to guide further investigations and implementation

Overall the growth strategy in the Plan supports the renewal of the site to deliver a diversity of housing to serve the housing needs of the local and defence force community, whilst making the most efficient use of existing social and physical infrastructure.

Although the Plan includes some conflicting mapping of the land use and development expectations for the site, it does indicate the site for residential and employment use in some figures. The Plan, representing a high level framework provides direction to local planning for specific sites. The Department of Planning and Environment has recommended to Councils that assessment of specific planning proposals have consideration for;

- Direction 20 –Revitalise existing communities
- Direction 21 – Create a compact settlement
- Direction 22 – Promote housing diversity
- Direction 23 – Grow centres and renewal corridors
- Direction 24 – Protect the economic functions for employment land

The planning proposal responds to each of these directions;

- increasing demand and viability of existing social infrastructure in the Stockton-Fern Bay area;
- renewal of an area for residential use in close proximity to the city centre;
- seeking rezoning which supports a concept master plan that delivers diverse housing options which would support a diverse community;
- contributing to the development of the locally significant Fern Bay growth centre,
- supporting the nearby Williamstown RAAF base and Defence force personnel in the region by providing housing.

2.1.2 Draft Plan for Growing Hunter City 2015

The *Draft Plan for Growing Hunter City* accompanies the *Hunter Regional Plan 2036*. Hunter City is defined as the metropolitan area extending from Toronto and Swansea in the south to Raymond Terrace in the north and from Newcastle harbour in the east to Lochinvar in the west. The Newcastle City Centre falls under the Inner Newcastle district identified in the plan. It will be a major contributor to achieving the Regional Plan's goals to grow and diversity the Hunter economy. In order to support robust communities, communities will have access to a range of housing opportunities and jobs. Access to jobs, services, shops, recreation opportunities, entertainment and the arts will deliver quality living.

The plan identifies goals, directions and actions to guide land use planning across the Hunter Region including the metropolitan area.

Direction 7.2 in the Plan aims to manage growth to protect the strategic Northern Gateways District (which includes Fern Bay and Stockton). The Plan identified Stockton - Fern Bay as a future housing growth area and notes the NSW Government committing to encouraging urban renewal in areas including Stockton. This planning proposal is therefore consistent with the intentions of this direction.

2.2 Local Government

2.2.1 Port Stephens Integrated Plans 2013-2023

The Integrated Plans (2013-2023) comprise the Community Strategic Plan, Council's Delivery Program and Operational Plan. The Integrated Plans 2013-2023 are organised into five focus areas: Citizens, Lifestyle, Environment, Economy, and Council.

The Community Strategic Plan sets out which other areas of government are responsible for contributing to achieving the Strategic Directions and how these Integrated Plans align with the NSW State Plan NSW 2021 and the Hunter Regional Action Plan.

The key objectives of the Plans relevant to the planning proposal relate to:

- Enhancing public safety.
- Responding to future needs of an ageing population.
- Delivering facilities, services and opportunities for children.
- Providing recreational facilities for residents and visitors.
- Providing Strategic land use planning services.
- Promoting sustainable and improved, accessible and flexible transport modes.
- Support education and training in Port Stephens

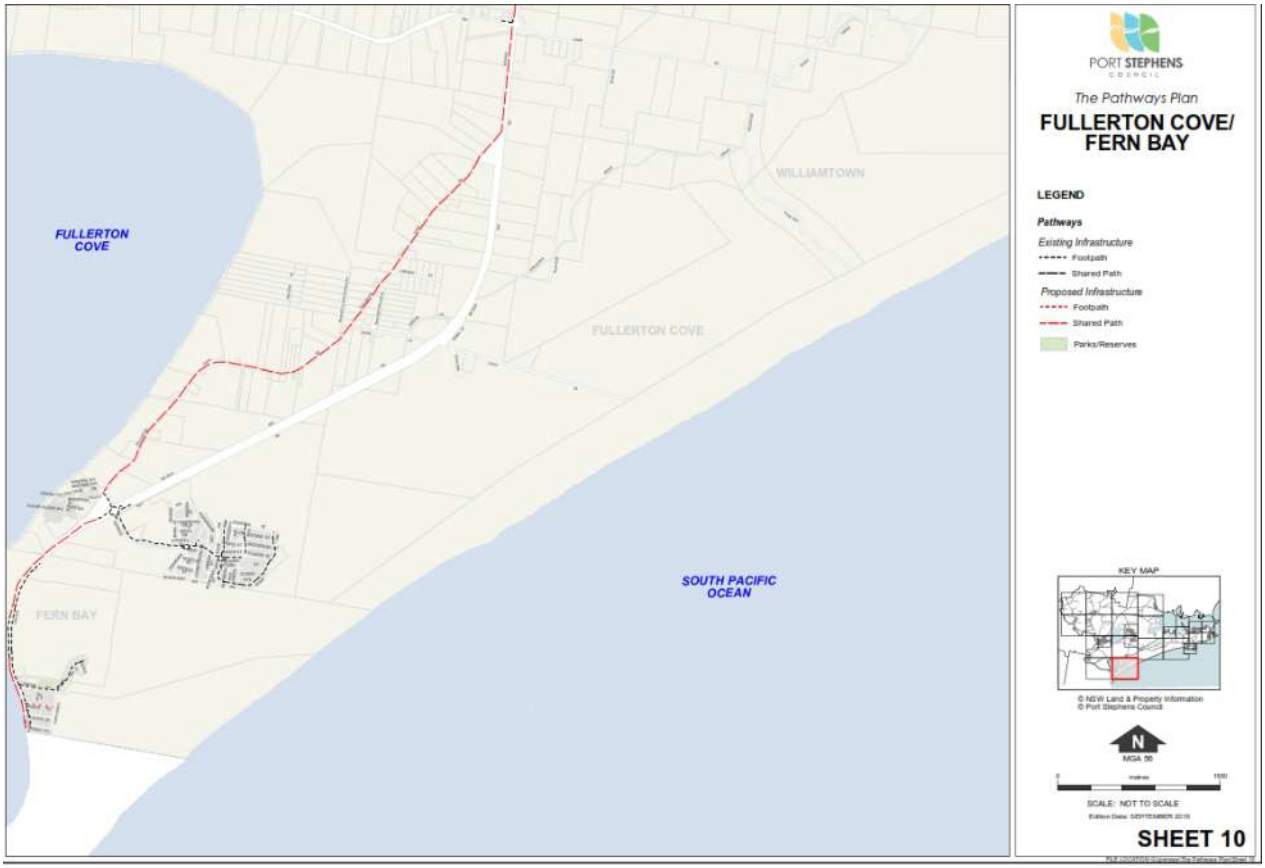
The Plans seek to provide the community with assets to improve the liveability of the Port Stephens area, which have been considered in this assessment.

2.2.2 Port Stephens Pathways Plan 2016

The Port Stephens Pathways Plan is a Councillor adopted plan by the Port Stephens Council, which indicates existing footpaths and shared paths throughout the Local Government Area, as well as identifies locations for future pathways through a series of maps, rather than a report. The identification of future pathway locations will allow Council to prioritise construction and to apply for grant funding to assist Council in the provision of pathway connections and missing links.

The below map is one of 20; the Plan identifies the need for shared pathways in the Fullerton Cove/Fern Bay area.

Figure 5 Port Stephens cycle plan map



Source: Port Stephens Council, 2016. Pathways Plan.

2.2.3 Newcastle 2030: Newcastle Community Strategic Plan

Newcastle 2030 is a strategic community vision developed by Newcastle City Council to inform policies and actions to become a "smart, liveable and sustainable City by 2030" (page 10). It focuses on seven strategic directions for Newcastle to become:

- A connected City;
- A protected and enhanced environment;
- Vibrant and activated public spaces;
- Caring and inclusive community;
- Liveable and distinctive built environment;
- A smart and innovative City; and
- Open and collaborative leadership.

The strategy outlines the key challenges facing Newcastle communities, including meeting the needs of a growing and ageing population. The development directly responds to key opportunities identified in the Plan, including creating public spaces, enhancing the environment and connecting the peninsula.

2.2.4 Newcastle Local Planning Strategy 2015

The Newcastle *Local Planning Strategy* (2015) presents a comprehensive land use strategy for Newcastle. It includes neighbourhood visions and population forecasts up on which planning is based.

Key local visions and objectives for Stockton include;

- Protection and enhancement of the existing beach and harbour side character and existing historic identify

Encouragement of development that is sympathetic to the existing character of Stockton

- Facilitate development of the commercial centre to improve local services and attract visitors
- Promote Stockton for tourism without compromising its residential appeal
- Protection and enhancement of public harbour side reserves

The Plan also includes population estimates for Stockton which indicate an increase in population by 2036 of only 72 people, and only 32 by 2026, noting that the largest increase over the period is likely to be in lone person households. It is apparent that this forecast has not included potential development of the Rifle Range or Stockton Centre sites.

The Plan notes the Stockton commercial area as a local centre, meeting the daily needs of the local community, but recognises that its desired pedestrian catchment (ped shed) does not include norther Stockton and that a new commercial centre may be justified there to meet the needs of new urban release areas.

2.2.5 Newcastle Social Strategy 2016-2019

The Draft City of Newcastle Social Strategy (2016-2019) is a four-year framework outlining the key priorities and actions to be delivered by Council in its commitment to investing in, promoting and delivering community development outcomes in Newcastle. The strategy, together with six others aims to deliver outcomes on the strategic directions outlined in the Newcastle 2030 Community Strategic Plan. The Draft Social Strategy identifies five focus areas for each action, including:

- Community wellbeing
- Innovation and creativity
- Healthy lifestyles
- Community infrastructure
- Community safety

2.2.6 Community Assets and Open Space Policy 2012

The purpose of the *Community Assets and Open Space Policy* is to provide Council with a framework and set of guiding principles for the consistent and integrated planning, acquisition, delivery management and disposal of community assets and open space across the Newcastle local government area.

This policy seeks to provide the community of Newcastle with the following community asset and open space outcomes:

- Encourage social connections, community participation, promote health and wellbeing;
- Multi-purpose, functional, safe and innovative places and spaces that are equitably distributed across the local government area;

- Management of community assets and open space from a quadruple bottom line perspective;
- Diverse places and spaces that accommodate a range of uses that are responsive to changing trends, aspirations and community needs;
- Timely delivery of community assets and open space that is integrated with other assets provided by Council and partner agencies;
- Co-location of community assets and open space to maximise the opportunity for lng community connections and economies of scale; and
- Open and transparent governance and management of community assets and open space that provides the community with clear accountability of Council's actions.

2.2.7 Newcastle Safe City Plan 2017-2020

The City of Newcastle Council's *Safe City Plan* includes actions that contribute to safety and social inclusion within the community. This plan supports the objectives of Council's *Social Strategy 2016-2019* to improve community perceptions of safety. Key safety issues identified include drug and alcohol related crime, disengaged youth, fear of crime, discrimination, malicious damage to the built environment and anti-social behaviour.

In order to address safety issues, Council's priority areas include:

- Improving safety through public domain design and the built environment, such as increasing natural surveillance and perceptions of safety.
- Facilitating community inclusion, such as providing Council facilities that are safe, welcoming and inclusive, and providing open space and community assets that facilitate positive social interaction and wellbeing.

2.2.8 Newcastle Cultural Strategy 2016 – 2019

The Newcastle City Council's *Cultural Strategy 2016-2019* aims to support and develop a thriving creative culture within the city. It prioritises actions and resources to assist the local arts communities and increase opportunities for the community to participate in cultural activity. Priorities include creating:

- Vibrant and activated public places that provide diverse activity, safety and strengthen social connections, where cultural, heritage and place are valued.
- Liveable and distinctive built environments that maintain and enhance the city's sense of identity.
- Smart and innovative city with a thriving community that attracts people to live, work, invest and visit the city.

2.2.9 Newcastle Cycling Strategy and Action Plan 2012

The *Newcastle Cycling Strategy and Action Plan* builds on previous bike plans and expands on cycling- related strategies and initiatives from a range of Council documents.

The overall objective of the strategy is to make cycling a safe and attractive travel option to encourage more peoples to cycle. Strategies and actions to cover the broad areas to do this are:

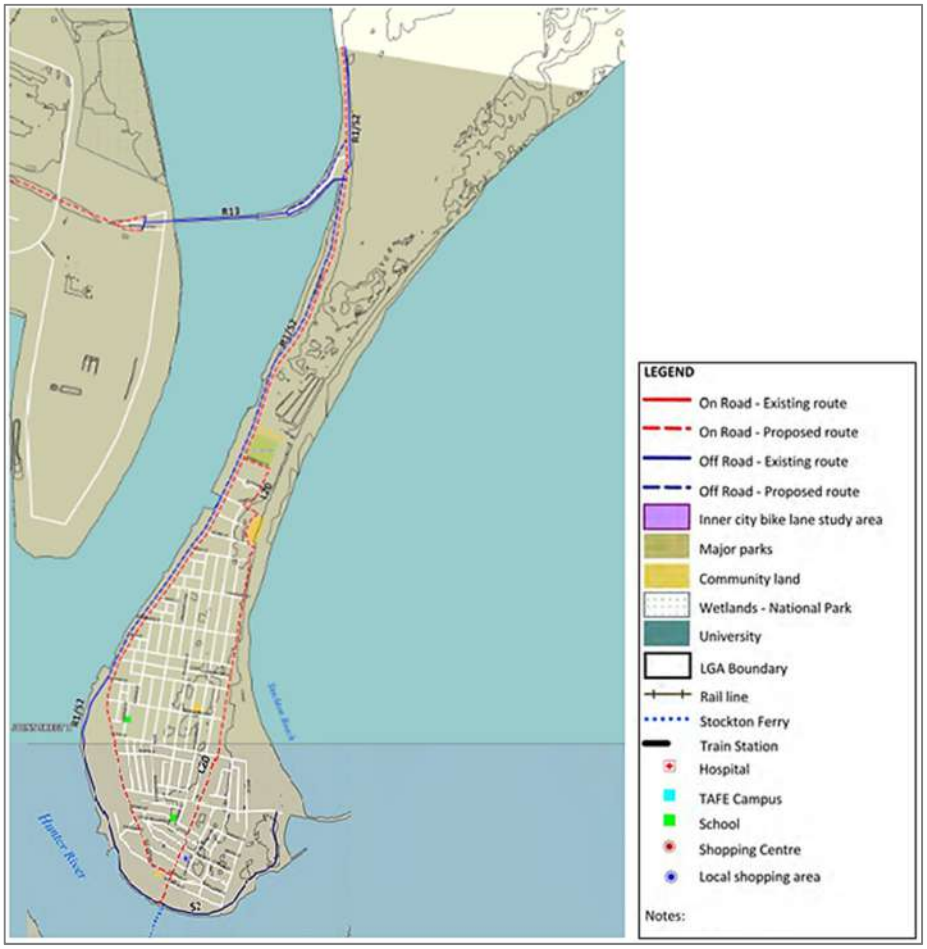
- Bicycle network and infrastructure
- Promotion and education
- Leadership and advocacy

- Planning for active transport
- Monitoring and review

The plan identifies the need for proposed development to tie in with existing and planned cycling networks, and to cater for cyclists through the provision of infrastructure such as bike storage or hoops in both planned residential and commercial areas.

The plan, relevant to this proposal identifies the need for connected pathways in Stockton through the addition of a local bike route (L20 – Stockton). This route was proposed as an on road connector from the ferry terminal to R1 (Adamstown Heights to Fern Bay) at the northern end of Fullerton St, on Mitchell St, Barrie Cr, Griffith Ave Eames Ave and Meredith St. It is to be considered in conjunction with work on the Coastal Revitalisation project, in which an off road path from S2 to connect to R1 near Fullerton St north has been mooted.

Figure 6 Newcastle cycle plan map



Source: The City of Newcastle, 2012. Newcastle Cycling Strategy and Action Plan

2.2.10 Stockton Public Domain and Traffic Plan 2017

Newcastle City Council developed this public domain improvement program in consultation with the local community. Key elements of the plan which support improved community accessibility and social amenity, which is planned to commence in 2017/2018 includes;

- Footpath widening outside Stockton Library, including seating, a table and bike racks and the provision on 1 hour timed parking
- Exploring the provision of public toilets in the commercial centre
- Moving pedestrian crossings to improve safe access and increase parking

- Creating disabled parking spaces outside the seniors centre and surgery
- Potential for occasional road closures to support markets and community events

2.3 Current Council planning

Several strategies and plans are under preparation or planned by both Newcastle City and Port Stephens Councils of relevance to the Rifle Range planning proposal. Of particular note:

- Both Councils advise they are working collaboratively in reviewing Section 94 development contributions plans. As the proposal area is within a cross LGA border area, a contribution sharing arrangement has been agreed in the past and will also occur for future developments, recognising that the suburbs use local services primarily in Stockton.
- A Fern Bay Strategy is also in the early stages of development by Port Stephens Council. The strategy will address needs and demands for residential, commercial and recreational development in the area to guide sustainable future development in the area.

2.4 Implications for the SIA

Table 1 below summarises the implications of these policies for this report.

Table 1 Social policy implication for the SIA

Policy	Implications
Hunter Regional Plan	• Identifies housing diversity , compact settlements and community revitalisation as directions for planning.
Draft Plan for Growing Hunter City 2015	• Identifies the need for residential renewal in Stockton as part of the Northern Gateway.
Newcastle Local Planning Strategy	• Recognises the potential future need for a commercial centre in the north of Stockton to serve existing and renewal populations..
Newcastle 2030 Community Strategic Plan 2013	• Identifies strategies to deal with issues such as growing and aging population, and identifies opportunities including urban renewal, economic strengths and a revitalised town centre.
Newcastle Draft Social Strategy 2016-2019	• Identifies priorities and actions addressing public space activation, use of recreation area, activities and events to build connectedness and inclusion, creating local identity and, supporting urban renewal.
Newcastle Cycling Strategy and Action Plan 2012	• Identifies that new development should tie into existing or proposed cycle infrastructure and networks, and cater for cyclists.
Port Stephens Integrated Plans 2013-2023	• Identifies priorities, needs and actions for addressing a growing and aging population, demand for schooling and facilities for children, and the use and availability of public transport.

Port Stephens Pathways Plan 2016	• Identifies the locations of future pathway locations that will allow Council to prioritise construction in the provision of pathway connections and missing links.

3. Community profile

The sections below provide a summary of the key demographic indicators available from the 2011 census for the local study area as whole and with some notes as to variances between the suburbs. A comparison with the regional area is also included. The section also discusses likely changes in each indicator since the 2011, census based on the results of consultation and estimates of development since 2011.

3.1 Population and age profile

Consultation indicates that in recent years, there has been a significant amount of development within the local area, particularly in Fern Bay and Fullerton Cove. This development has predominantly been seniors living and residential. These include the new seniors living developments of Palm Lake Resort in Fern Bay and The Cove in Fullerton Cove. Expansion of the existing Bayway, a manufactured homes village has also occurred and is also marketed to seniors. The master-planned residential community of Seaside also continues to expand, attracting a younger demographic. The more established residential area of Fern Bay, which adjoins the Rifle Range, is older style one and two storeys dwellings. Stockton, some gentrification of housing has occurred, but the area is largely underdeveloped with older style one and two storey dwellings and key facilities located in the centre of town.

These developments are expected to have resulted in an increase in population, and changes in demographic structure since the 2011 census. To capture a more up to date profile this study has attempted to estimate a population profile based on the development information sourced from the respective councils.

In 2011 the local area had a total population of 6,130. The population of Stockton showed a slight decrease to 4,195 from 2006, whilst Fern Bay increased more than 40 percent to 1,625. A decrease in population for Fullerton Cove was the result of boundary changes reducing the area counted, but in 2011 the suburb recorded a population of 300.

Drawing on information provided by Port Stephens Council, an indicative estimate of the current resident population of the local area in 2017 is 8,141 people (see Appendix C). This estimate is based on information from Port Stephens Council with regard to approved dwellings and estimates of those currently developed for each of the residential developments noted above. Development on the peninsular has occurred in discreet pockets, with seniors living growing in Fern Bay and Fullerton Cove and new residential development in Fern Bay.

Table 2 Indicative local area current population

Suburb	2011 population*	Estimated 2017 population#
Fullerton Cove	300	546
Fern Bay	1626	3,400
Stockton	4,195	4,195
Total	***6,121***	***8,141***

*Source: * ABS Census Data 2011, # GHD estimate based on dwelling numbers provided by Port Stephens Council and census averages*

Table 2 represents a more than 80 percent increase in the population in Fullerton Cove. Fullerton Cove has historically been a rural residential locality; however, with the development of The Cove, seniors living has significantly increased the population in the suburb.

The population of Fern Bay is also expected to have more than doubled since the 2011 census with the expansion of the Seaside residential estate and the seniors relocatable home village, Bayway Village, and a new seniors living development, Palm Lakes Resort. The Stockton population is expected to have remained relatively stable, with little development and an ageing population.

This represents an estimated 498 new seniors living dwellings accommodating around 797 people aged exclusively over 50 years of age. 601 new residential dwellings are estimated to accommodate in the order of 1,642 people in predominantly young families.

In 2011 the local area was considerably older than the regional area, with average ages ranging between the suburbs from 47 and 54 years, compared with the regional average of 40.

An estimate of the likely age structure of the local population in 2017 has also been prepared to inform the assessment of community infrastructure and is presented in section 3.8. Although the estimates are indicative, the estimate indicates that the overall structure of the local area population has not altered dramatically with variations in proportions representation of each age cohort not more the 1.5 percent. By contrast, the older demographics of the local area, compared with the regional area is dramatic.

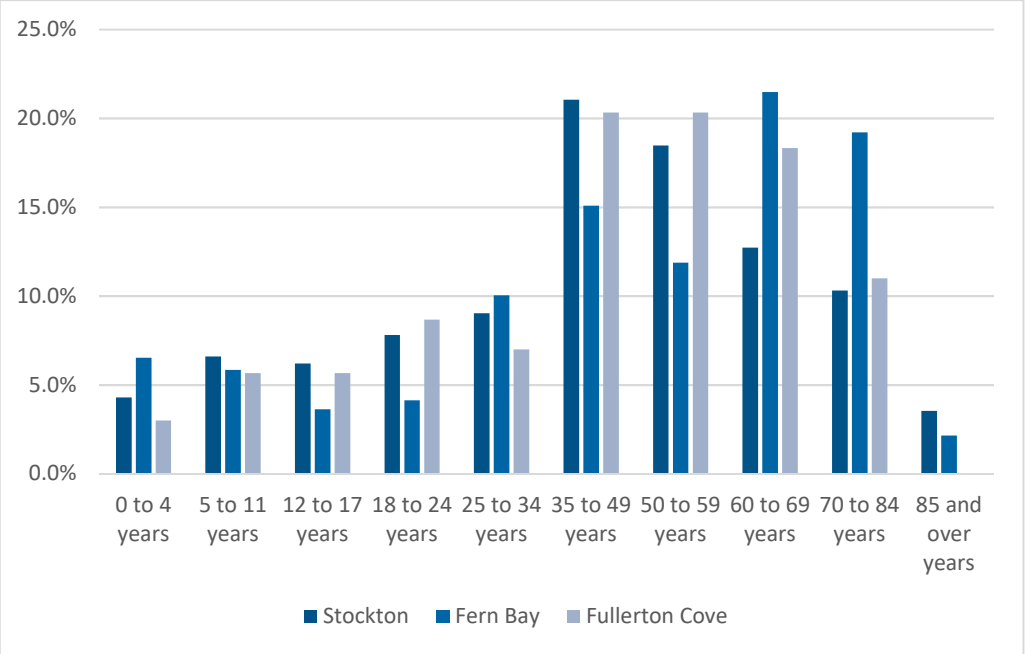
Table 3 Estimated current population and changes

	Local Area						Regional Area	Local vs Regional Area
	2011		2017		Change		2011	
	No	%	No	%	No	%	%	
No. of dwellings	2,588		3,542					
Total Persons	6,121		8,141					
Age groups:								
0 to 4 years	289	4.7%	495	6.1%	206	1.4%	6.2%	0.1%
5 to 11 years	400	6.5%	536	6.6%	136	0.1%	8.2%	1.6%
12 to 17 years	328	5.4%	366	4.5%	38	0.9%	7.0%	2.5%
18 to 24 years	423	6.9%	486	6.0%	63	0.9%	10.3%	4.3%
25 to 34 years	563	9.2%	871	10.7%	308	1.5%	13.2%	2.5%
35 to 49 years	1,197	19.6%	1,554	19.1%	357	0.5%	19.9%	0.8%
50 to 59 years	1,033	16.9%	1,325	16.3%	292	0.6%	12.8%	-3.5%
60 to 69 years	930	15.2%	1,259	15.5%	329	0.3%	10.6%	-4.9%
70 to 84 years	776	12.7%	1095	13.5%	319	0.8%	9.4%	-4.1%
85 and over years	181	3.0%	205	2.5%	24	0.4%	2.5%	0.0%
Aver household size	2.4		2.3					

* assumes a HH size of 1.6 and an age distribution of 20 percent 50-59 years, 40 percent 60-69 years, 37 percent 70-84 years, 3 percent 85 years and over

Reviewing the three suburbs in the local area, age profiles were characterised by:

- Fern Bay has slightly fewer high school aged children from 12 to 17 years (3.6 percent compared to 6.2 percent in Stockton and 5.7 percent in Fullerton Cove)
- Stockton had the youngest median age at 47 years in Stockton, compared with 50 years in Fullerton Cove and 54 years in Fern Bay. Fern Bay had the highest proportion of residents over 60 years of age. However Fern Bay also had a relatively larger young population with the greater proportions (12.3 percent) of children from 0 to 11 years percent compared to Fullerton Cove (8.7 percent) and Stockton (10.9 percent)
- Although Stockton had the highest proportions of primary and high school aged children, Fern Bay had the greatest proportion of 0 to 4 year olds (most likely reflecting the younger Seaside demographic)



3.2 Cultural diversity

The population has low levels of cultural diversity. The percentage of Indigenous residents in the local area ranged from 2.5 percent in Fern Bay to 3.7 percent in Fullerton Cove with a 3.2 percent average. However, school data indicates that the Indigenous population is young, with 12 percent of students at Fern Bay Public School and 10 percent of Stockton Public School students identifying as Indigenous.

In 2011 no residents of the local area were born in non-main English speaking countries with most residents speaking only English at home (91.1 percent) compared with the regional average of 89.7 percent.

3.3 Dwellings and tenure

In Stockton, Fern Bay and Fullerton, the number of dwellings that were separate houses were 75.1 percent, 95.8 percent and 69.3 percent respectively, which was higher compared to the regional average (67.6 percent).

This is a reflection that to date, most housing developments in the local areas have been low and medium density.

Suburbs in the local area and regional area have similar patterns in bedroom numbers. One-bedroom dwellings were the least prominent for all suburbs and the regional area ranging from 5 percent in Stockton and the regional area to the highest one bedroom percentage in Fullerton Cove (8 percent); three bedroom dwellings were the most common for all suburbs and the regional area. The average number of bedrooms for dwellings was highest in Fullerton Cove (3.1 bedrooms) compared to the regional area (3.0 bedrooms), Stockton (2.8 bedrooms), and Fern Bay (2.7 bedrooms).

Table 4 - Average number of bedrooms per dwelling in the Local Area and the Regional Area (2011).

	Stockton	Fern Bay	Fullerton Cover	Regional Area
One Bedroom	5%	7%	8%	5%
Two Bedrooms	27%	35%	14%	34%
Three Bedrooms	47.7%	37%	42%	45%
Four + Bedrooms	17.7%	19%	36%	24%
Average number of bedrooms	2.8 bedrooms	2.7 bedrooms	3.1 bedrooms	3.0 bedrooms

Tenure types indicated that home ownership (outright or with a mortgage) was more common in the local area than the regional area. Much higher proportions of home ownership was noted in Fern Bay and Fullerton Cove (87.4 percent and 92.9 percent respectively) and Stockton (66.0 percent) than in in Newcastle LGA (64.9 percent) and Port Stephens LGA (71.4 percent) in and 66.0 percent in Stockton.

3.4 Households and families

The proportion of family households in the local area varies between suburbs, but is largely within the range of the regional LGAs (63.8 percent in Newcastle LGA, 73.2 percent in Port Stephens LGA). However Fullerton Cove showed a higher proportion with 82.2 percent family households.

The average household size also varies across the local area with the smallest average households in Fern Bay (2.1 people), then Stockton at 2.3 persons and the largest households in Fullerton Cove at 2.8 persons . These compare to 2.4 persons in Newcastle LGA and 2.5 persons in Port Stephens LGA.

Family composition was fairly consistent across all areas. Couple families with children were consistent amongst Newcastle LGA, Port Stephens LGA, Stockton and Fullerton Cove (38.1 percent on average) while Fern Bay local area smaller representation at 28.5 percent. Fullerton Cove and Stockton had higher proportions of single parent families (58.3 percent and 23.2 percent respectively) compared to the other areas (14.0 percent in Fern Bay, 18.5 percent in Newcastle LGA and 16.6 percent in Port Stephens LGA).

3.5 Employment, education and household income

The local areas had a slightly lower labour force participation rate (48.7 percent in Stockton, 39.7 percent in Fern Bay, 53.2 percent in Fullerton Cove) compared to Newcastle LGA (60.5 percent) and Port Stephens LGA (54.4 percent). The unemployment rate in Fern Bay and Fullerton Cove local areas (both 7.0 percent) was slightly higher than that of Newcastle LGA (5.7 percent), Port Stephens LGA (6.2 percent) and Stockton local area (5.7 percent).

In 2011, there was a higher percentage of people who did not have post-school qualifications in Stockton (49.1 percent), Fern Bay (50.0 percent), and Fullerton Cove (43.4 percent), compared to the percentage of people who completed year 12 (23.4 percent, 27.3 percent and 22.5

percent respectively). Of those who finish secondary education only a low percentage of students attended university (2.7 percent in Stockton, 2.2 percent in Fern Bay and 3.4 percent in Fullerton Cove) which is consistent with Port Stephens LGA (2.7 percent) and much lower than Newcastle LGA (8.8 percent).

Across all local areas there was a significantly higher percentage of students attending both government primary (76.6 percent in Stockton, 62.7 percent in Fern Bay, 72.2 percent in Fullerton Cove) and government secondary schools (60.8 percent in Stockton, 55.8 percent in Fern Bay, 64.7 percent in Fullerton Cove). The same trend can be seen with Newcastle LGA (71.7 percent primary students, 65.8 percent secondary students) and Port Stephens LGA (74.8 percent primary students, 70.2 percent secondary students).

Fullerton Cove had a higher percentage of primary students attending a Catholic school (27.8 percent) in comparison to the other local areas (17.1 percent in Stockton, 20.5 percent in Fern Bay) and LGA's (19.2 percent in Newcastle LGA, 13.9 percent Port Stephens LGA). When looking at the statistics for secondary students however, all local areas showed a higher percentage of students attending Catholic school (35.0 percent in Stockton, 30.2 percent in Fern Bay. 35.3 percent in Fullerton Cove) compared to the LGA's (20.2 percent in Newcastle LGA, 13.6 percent in Port Stephens LGA).

The weekly median household income in Fern Bay was significantly lower ($690) than other local areas ($1,072 in Stockton, $1,062 in Fullerton Cove) and LGA's ($1,165 in Newcastle LGA and $999 in Port Stephens LGA).

Department of Defence was the most common employer of Fern Bay residents stated in the 2011 Census at ten percent of respondents (Elton, 2016).

3.6 Vehicle ownership and travel

In the Fullerton Cove local area, all households owned at least one vehicle (100.0 percent) compared to the Newcastle LGA (88.1 percent) and the Port Stephens LGA (94.2 percent). Stockton and Fern Bay households showed similar statistics to the LGA's (84.9 percent and 91.2 percent respectively).

The primary mode of transport across all areas was by car as the driver with an average of 76.4 percent. A highest proportion of residents who worked at home was in Fullerton Cove (10.7 percent) compared to other local areas and LGA's.

The Ferry is a major link in the local area, with strong commuter use in Stockton ((6.6 percent compared to bus use of 2.9 percent), but considerably lower with distance from the wharf (2.3 percent in Fern Bay compared to 2.7 percent for bus use). In Fullerton Cove, no commuter reported using trains or ferries to travel to work, with 2.5 percent using the train.

3.7 Crime and safety

For many common crimes, Newcastle LGA has higher rates than for neighbouring Port Stephens LGA, and the local area generally has rates between the two LGAs, with the exception of domestic and sexual assault which are higher that both LGA averages. Recent statistics indicate that the common crimes (listed in Table 5) have remained stable or have been in decline over the last 5 years.

Table 5 Local and Regional Crime Statistics January 2016 to December 2016

Offence	5 year trend	Rate per 100,000		
		Local Area	Newcastle LGA	Port Stephens LGA
Assault - domestic	Stable	557.1	446.8	502.0
Assault - non-domestic	Down 2.5% /year	685.7	714.9	415.9
Robbery	Down 15.8% /year	21.4	59.4	20.1
Theft	Down 2.5% /year	3428.3	4918.7	3168.0
Sexual offences	Stable	214.3	212.5	212.3
Malicious damage to property	Stable	1234.1	1360.8	1084.5

Source: NSW Bureau of Crime Statistics and Research, 2017,*http://crimetool.bocsar.nsw.gov.au/bocsar/*

3.8 Expected future community

In assessing the potential social impact of development of the Rifle Range site for residential purposes, it is necessary to consider the magnitude and nature of the future residents of the site and also that of the likely local community. This section aims to estimate the possible magnitude and indicative structure of the local area population. This estimate is indicative only for the purposes of assessing the magnitude of future demand for social infrastructure.

Rifle Range site

Defence families likely to be accommodated at the Rifle Range site would primarily be working with the Air Force. The age of Defence personnel eligible to live at this site ranges between 24 and 60 years, with an average age of 40 years. About one-third are expected to have no dependants other than their spouse, with the remainder being households with children.

Of the estimated 249 dwelling yield from the site, 125 dwellings (50 percent of the total dwellings) would be occupied by Defence households with an estimated population of 413. Their likely age structure illustrated is in Table 6[1].

The other 124 dwellings would likely to be sold in the real estate market, and accommodate a population of around 285 people as they are expected to have smaller households. As a result, the Rifle Range site is expected to accommodate in the order of 698 people.

[1] DHA data on eligible Defence households has been adjusted to reflect the service age groups required to assess community needs. Data provided for 5 to 12 years olds has been spilt assuming an average across all ages within the group. Data provided for dependents 13 years or older has been assumed to be 70 percent dependents aged 13 to 17.

Table 6 Estimated future Rifle Range population

	DHA Residents		Non DHA residents		Total
	%	Number			
0-4 years	8%	33	7%	20	53
5-11 years	15%	62	6%	17	79
12-17 years	13%	54	4%	11	65
18-49 years	60%	248	45%	128	376
50 + years	4%	17	38%	109	125
Total		413		285	698
Average household size		3.3		2.3	

Source: GHD estimates based on Forecast id data provided by Newcastle City Council and modified to breakdown percentages for under 18 year olds and 50-60 year olds. Average household size of 2.3 assumed for non DHA residents of the Rifle Range

Expansion of existing developments

The likely future population will also include residents of approved development applications, which have not yet been developed. Population estimates have included new or expanded development, including;

- Existing approvals for further development of seniors, or predominantly seniors living in Bayway Village, The Cove and Palm Lakes
- Further approved development of Seaside residential development

Information provided by Port Stephens Council indicates there are in the order of 262 approved seniors dwellings and 229 approved residential dwellings yet to be developed. The estimate assumes an otherwise low population growth in the existing Stockton community, and has not allowed for other potential new developments in the Stockton – Fern Bay area.

Table 7 Indicative future local area population

Suburb	Likely future population			Rifle Range	Total
	Estimated 2017 population#	Approved DAs#	Future population		
Fullerton Cove	546	176	722		
Fern Bay	3, 400	1,024	4,424	635	
Stockton	4,195	-	4,195		
Total	***8,141***	***1,200***	***9,341***	***635***	***9,976***

Source: # GHD estimate based on dwelling approval and development numbers provided by Port Stephens Council and using relevant average household sizes from 2011 ABS Census SA1 areas.

If rezoning and consequent development of the DHA Fort Wallace site is achieved it is likely that this would generate in the order of a further 263 people in Stockton in the future. Whilst not included in the assessment of social infrastructure, the potential for both this, and the nearby development of the Stockton Centre are noted. To facilitate assessment of the community needs of this population, an indicative age structure has been considered, as noted in Table 8.

Table 8 Indicative age profile for future local area population

Age group	Future Stockton Fern Bay population	
0 to 4 years	7%	653
5 to 11 years	6%	561
12 to 17 years	4%	374
18 to 60 years	53%	4,951
60 years and over	30%	2,802
Total population		653

Source: GHD estimates based on the likely future population in Table 7 and on Forecast id data provided by Newcastle City Council and modified to breakdown percentages for under 18 year olds. These are also comparable with GHD 2017 population age structure estimates in Table 3.

4. Social infrastructure

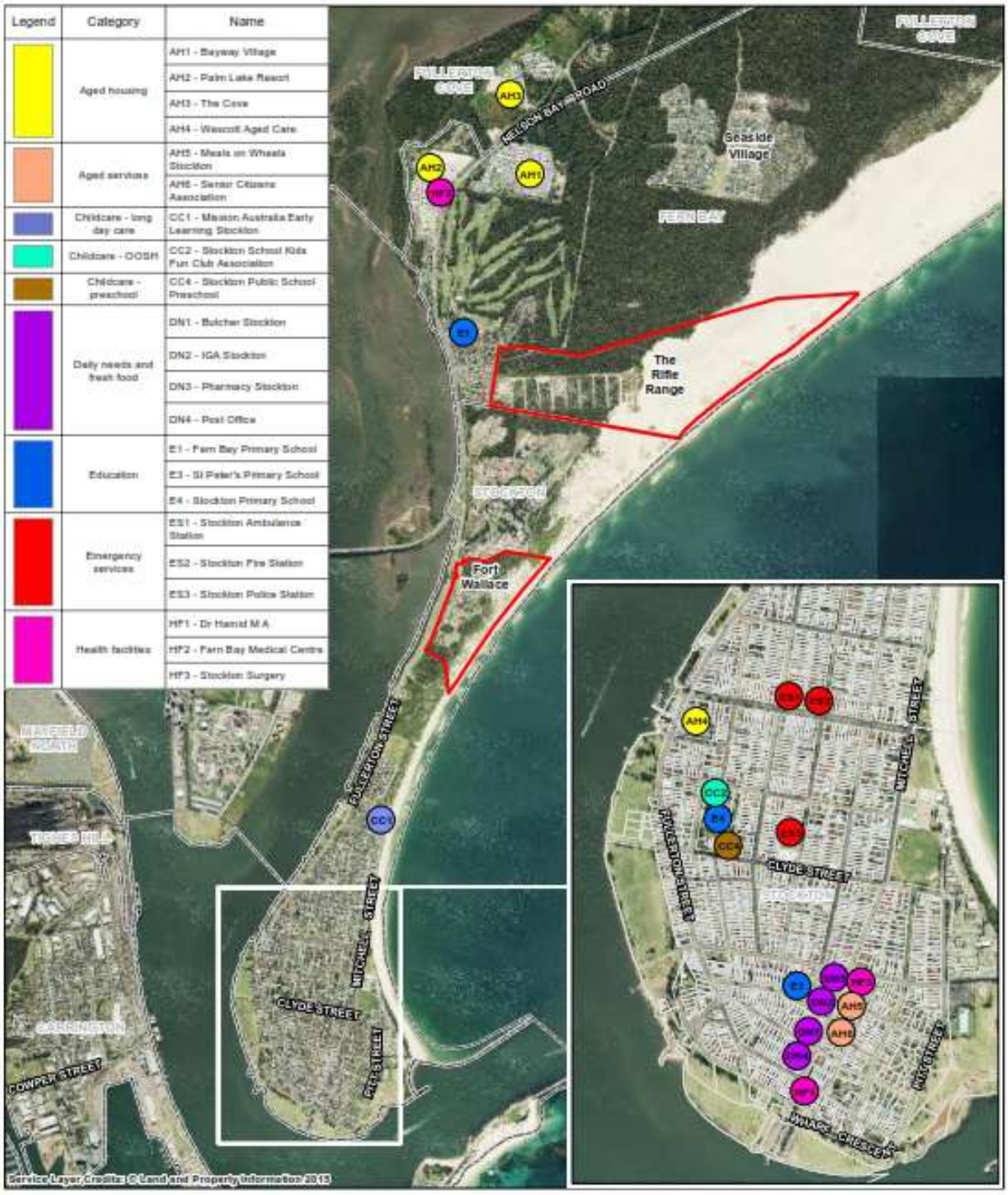
Development of the Rifle Range site will increase demand for social facilities and services. This review of social infrastructure focuses on the capacity of facilities and services currently used at the local level to support the likely future population (as outlined in Table 3 which includes realisation of all currently approved developments in the local area). Local level infrastructure has been defined as that which is required to meet the daily needs of people living in a population catchment of up to 10,000 people.

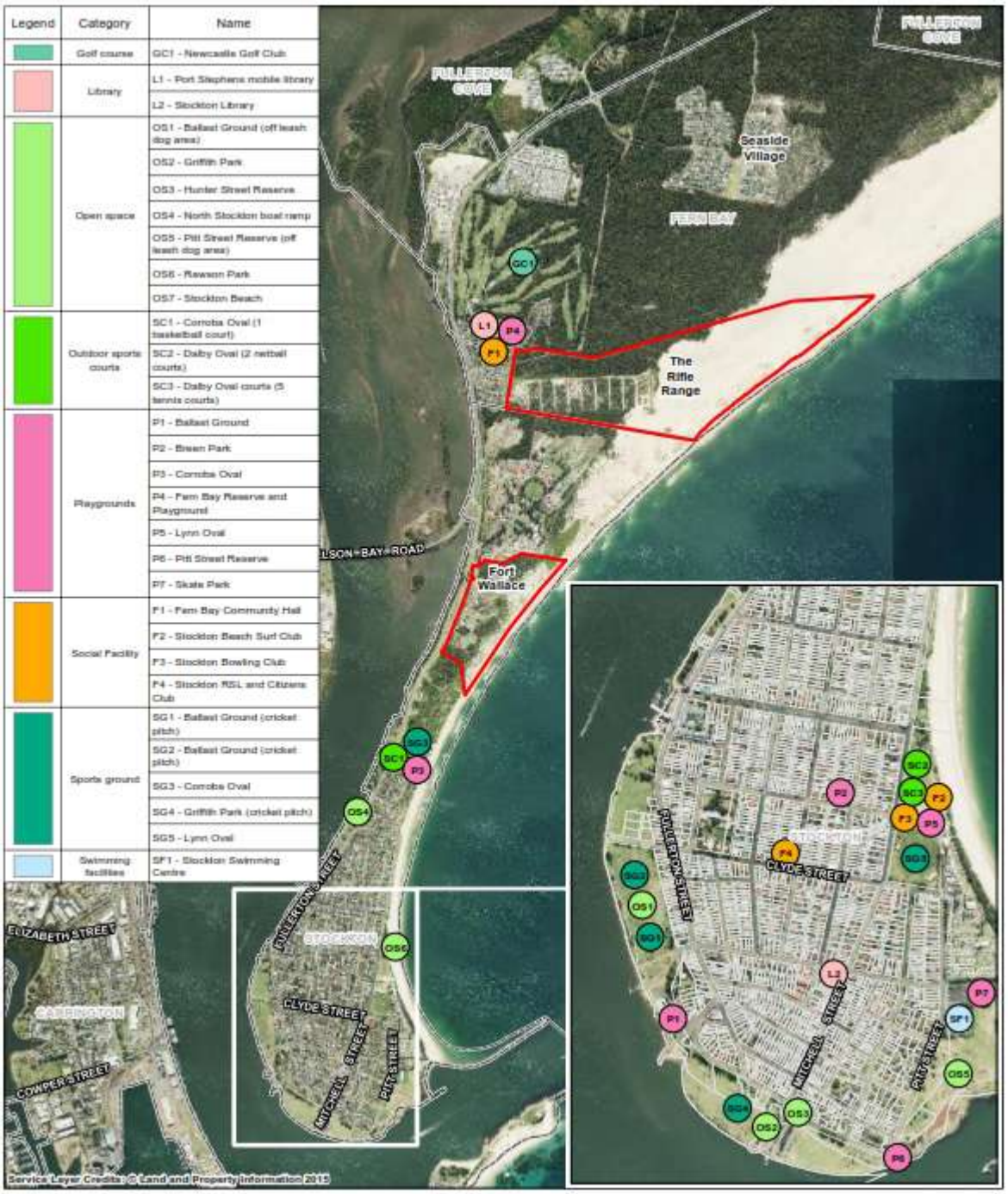
This review identifies current gaps in key local social infrastructure facilities based on ;

- ***demographic*** needs – how the size of the population influences need
- ***identified*** needs – what the community and managers identify as needed
- ***best practice*** needs - based on rates of provision detailed in unpublished *Draft Social Infrastructure Guidelines* developed by GHD for NSW Department of Planning).

Social infrastructure discussed in this section is illustrated in Figure 7.

Figure 7 Local social infrastructure maps




Legend
Category
Name
Golf course
GC1 - Newcastle Golf Club
Library
L1 - Port Stephens mobile library
L2 - Stockton Library
Open space
OS1 - Ballast Ground (off leash dog area)
OS2 - Griffith Park
OS3 - Hunter Street Reserve
OS4 - North Stockton boat ramp
OS5 - Pitt Street Reserve (off leash dog area)
OS6 - Rawson Park
OS7 - Stockton Beach
Outdoor sports courts
SC1 - Corroba Oval (1 basketball court)
SC2 - Dalby Oval (2 netball courts)
SC3 - Dalby Oval courts (5 tennis courts)
Playgrounds
P1 - Ballast Ground
P2 - Breen Park
P3 - Corroba Oval
P4 - Fern Bay Reserve and Playground
P5 - Lynn Oval
P6 - Pitt Street Reserve
P7 - Skate Park
Social Facility
F1 - Fern Bay Community Hall
F2 - Stockton Beach Surf Club
F3 - Stockton Bowling Club
F4 - Stockton RSL and Citizens Club
Sports ground
SG1 - Ballast Ground (cricket pitch)
SG2 - Ballast Ground (cricket pitch)
SG3 - Corroba Oval
SG4 - Griffith Park (cricket pitch)
SG5 - Lynn Oval
Swimming facilities
SF1 - Stockton Swimming Centre
FULLERTON COVE
Seaside Village
FERN BAY
The Rifle Range
Fort Wallace
NELSON BAY ROAD
ELIZABETH STREET
CARRINGTON
COWPER STREET
STOCKTON
CLYDE STREET
MITCHELL STREET
PITT STREET
FULLERTON STREET
Service Layer Credits: © Land and Property Information 2015

4.1.1 Community centres and libraries

The Fern Bay Community Centre is the only Council owned community centre in the local area and is within 400m walk of the boundary of the Rifle Range site. A development application is currently being considered by Council to redevelop this centre. The redevelopment would replace the existing hall and adjacent tennis club building and separate toilets. The site is adjacent to a recently upgraded playground and the Fern Bay Public School. The proposed centre will include a multi-function hall (approximately 160m^2), tennis club office/storage, a kitchen facility, reception desk and publicly accessible amenities.

The Stockton Beach Surf Club, Stockton Bowling Club, Stockton RSL and Citizens Club, and Newcastle Golf Course each have meeting rooms/ and or event halls that are used by residents of the local area. The RSL and Citizens Club has the largest facilities with meetings rooms and an auditorium which fits up to 250 people.

A Defence Communities Organisation funded community centre operates for Defence families at the Williamstown Base. It organises activities including playgroups and social gatherings.

Best practice rates of provision suggest that one multipurpose centre or two community spaces be available to communities of less than 20,000 people, with multipurpose centres having a minimum of 500 m^2. Public, affordable and accessible meeting and activity spaces are important for all communities, and especially so for this local area which is isolated from its district and regional area. The local area also presents specific challenges in regard to the spatial and consequently social dislocation between residential communities or areas, with some of this being related to it's peninsular geography, and some by the nature of the development that has occurred (gated seniors living and pocket residential developments). These factors, as indicated in consultation, reinforce the need for indoor public activity spaces in the local area to support social cohesion and equitable access.

It is likely that a need for a community space in Stockton will remain even after the redevelopment of the Fern Bay community hall. Any such community space would need to be multipurpose and to respond to diverse community needs.

Existing Provision	Demographic need	Identified need	Rates of provision	Facility/service required
Fern Bay Community Centre ~200m^2 No public facilities in Stockton	Population growth of around 33 percent expected since 2011 and up to in the near future	Need for multipurpose centre to centralise services and facilities Need for community facility in Seaside / Fern Bay	1 centre or 2 space: less than 20,000 people	The new Fern Bay Hall may service the needs of the Fern Bay community. It could be revised to be a larger multipurpose centre, or a new space or multipurpose centre developed in Stockton

4.1.2 Other community and cultural spaces

There are Men's sheds in some of the seniors living developments that are for the exclusive use of their residents, however it was noted during consultation that the shed at Palm Lakes Resort has limited use due to restrictions relating to noise. The Newcastle Men's Shed is also without a venue, having been unable to afford their previous site in the Steelworks. Consultation has indicated a demand in the local and regional area for a Men's shed. With an ageing population

in the local area, and a need for social inclusion between seniors, a Men's shed would meet this need, and also provide an opportunity for intergeneration inclusion.

There are no public cultural or indoor youth spaces in the local area. The nearest cultural facilities are located in Newcastle CBD. Best practice suggests that such spaces be incorporated into multipurpose centres or other spaces. Whilst regional level facilities are available in Newcastle, a local space is justified given the relative isolation of the peninsular. Such a local facility could be integrated within any new multipurpose space.

4.1.3 Libraries

The Stockton Library operates two full days and two half days per week. It is a small library (approximately 200 m^2) that reports strong use by both preschool and school ages children and seniors. Newcastle City Library indicates that use of the library has increased over recent years with services such as story time reading for pre-schoolers and young school aged children in creasing from once a month to once a week. Council also notes that they have recorded increasing library registrations from residents of seniors living developments of Fern Bay and Fullerton Cove. Port Stephens operates a mobile library, which visits the Fern Bay Reserve fortnightly for public access and use by Fern Bay Public School. The mobile library does not visit Seaside due to the difficulties in navigability of the roads. Residents in both LGAs have free access to library services in both LGAs.

Each of the seniors living developments and the Bayway relocatable home development have some provision of libraries, community activity and meeting facilities for the exclusive use of their residents which reduces somewhat their demand for external or publically provided facilities however they are also noted to be users of public facilities and services.

Consultation indicates the existing library operations in Stockton are inadequate to meet the growing needs of the existing and future population and the changing nature of library services and roles in the community.

The limited capacity and flexibility of the Port Stephens mobile library service is not currently meeting the demands of the local population. The service is unable to provide services in Seaside as planned, as the mobile library can not safely access the area or gain access to utilities to operate. Consultation suggests increasing the frequency of visits and duration to Fern Bay Hall, and greater integration of services to the site (e.g book return) would improve access for the local community. Potential collocation or integration of library and community space on Department of Education land could be beneficial to both the Fern Bay Public School and the local Fern Bay community

Existing Provision	Demographic need	Identified need	Rates of provision	Facility/service required
Stockton Library ~ 200 m^2 Port Stephens mobile library	Existing unmet needs from local area, especially Seaside residents. Likely growing need from Fern Bay PS	Existing Stockton library requires extended hours until replacement (as no room to expand) Increase in frequency of mobile services to Fern Bay	People Places population based benchmark : 645m^2	Extend existing hours of operation of Stockton Library Increase frequency of Port Stephens mobile library Consider collocation of library in school grounds Consider collocation of library services with any potential future public

				community space in Stockton town centre

4.1.4 Childcare

Long day care

In Stockton there is one long day care centre (49 places) and. four family day care services, two in Seaside and one each in Stockton and Fullerton Cove providing approximately 16 places and some OOSH places (around 6).

A 94 place long day care service has been approved for a development in Seaside.

Consultation indicates many residents are using services at or enroute to their place of work, and that lack of access to long day care is also likely limiting the ability of many parents to return to work. It is estimated that the future community will have a need for 130 long day care places, whereas only 65 are currently available locally. However development of the recently approved 94 place centre at Seaside would meet this demand.

Existing Provision	Demographic need	Identified need	Rates of provision	Facility/service required
49 places, plus around 16 in family day care	Future population of 653 children	No current spare capacity, many families use facilities enroute to and at work	1 place: 5 children ages 0-4 years Suggests need for 130 places.	Newly approved facility should meet this need

Preschool

Stockton Preschool is operated by the Department of Education as part of Stockton Public School, with 40 places. Fern Bay and Fullerton Cove residents are outside the catchment for the Stockton Preschool so they are not prioritised for places in the preschool and as a result have limited access to the preschool. A Defence preschool was formerly located at Williamstown base but was relocated, and is expected that it will relocate to Medowie in 2018 where it would likely be used by Defence families from Rifle Range.

There is clear demand for preschool services in the local area with only 40 places available, and estimated future preschool population of 210, requiring 105 places. 2011 data indicates lower than regional attendance of preschool in the local area. Further, consultation suggests that levels have declined with increasing population yet no expansion of services. Whilst the proposed new long day care centre may meet some of this need (as it will likely offer a preschool program), there is a clear current and future need for a new preschool service, with a gap in the order of 65 places.

Existing Provision	Demographic need	Identified need	Rates of provision	Facility/service required
Preschool				
40	Estimated future population of 210	Strong demand especially from Seaside community with	1 place: 2 children ages 4-5 years	Clear need for an additional service, particularly catering to Fern

		a very young population	Suggests need for 105 places	Bay. Some need will be met through long day care

The Fern Bay Progress Association suggests that a service (potentially mobile) be provided out of the new Fern Bay Hall. Colocation of a Department of Education preschool at Fern Bay Public School could also address this demand.

Out Of School Hour (OOSH) Care

Two OOSH providers service the local area. The Stockton Kids Fun Club provides OOSH services from Stockton Public School with 30 places servicing both the school and St Peters Primary School students (who travel between the schools on the school bus). WeMOOSH, an OOSH business, operates an umbrella service for Fern Bay Public School students from West Mayfield. Children are dropped at the centre in Mayfield in the morning and collected in the afternoon from the Fern Bay Hall. The service aims to negotiate use of the new Fern Bay Hall once completed for a 30 place onsite service. As noted above, around 6 OOSH places are provided through family day care in Fern Bay and Fullerton Cove.

There is clear demand for OOSH services in the local area with only 33 places locally available, and most of these prioritising children from Stockton. With a likely future need for in the order of 110 places, there is clear need for more OOSH services. WeMOOSH expect to provide 30 places in the new Fern Bay Hall when it is completed, going some way to meeting this demand.

Existing Provision	Demographic need	Identified need	Rates of provision	Facility/service required
OOSH				
36 (6 in family day care)	Estimated future population of 552		1 place: 5 children ages 5-11 years Suggests need for 110 places	Strong demand for an additional service. New service may largely meet current demand

Further, as young families in the local area mature, the demand for long day care and OOSH services is expected to increase.

4.1.5 Public open space and recreational facilities

The local areas is well resourced with passive outdoor recreation areas, with proximity and access to beach, river, bushland and parkland areas. Upgrades to facilities such as skate parks and playgrounds are ongoing, and together with the Stockton Swimming Centre are valuable resources for the community and visitors alike. The bulk of this recreational infrastructure however is located in Stockton, with only one park with a playground, two tennis courts and a half basketball court in Fern Bay Reserve. Fern Bay Reserve is adjacent to Fern Bay Primary School, approximately a 400m walk from the nearest boundary of the Rifle Range site. Parks, sporting and recreation facilities in the local area include:

- Pitt Street Reserve and the nearby skate park
- Stockton Swimming Centre
- Griffith Park (concept design for district playground and street skate park)

- Ballast Ground (dog off-leash park)
- Hunter Street Reserve
- Breen Park
- Rawson Park
- Corroba Park
- Lynn Oval (cricket ground)
- North Stockton boat ramp (currently being upgraded)
- Fern Bay Reserve (playground, half basketball court and 2 tennis courts)
- Corroba Oval Courts (1 Basketball court)
- Darby Oval (5 Tennis courts)
- Newcastle Golf Club

Consultation indicates that there is a need for sporting facilities in Fern Bay – Fullerton Cove. Currently there are only two tennis courts in this area. Residents use sports facilities in Stockton and consultations indicate that the quality and facilities of the netball courts, the tennis courts and some other utilities require improvements. The Fern Bay Fullerton Cove Progress Association proposes that two dual marked netball and basketball courts be developed at the Fern Bay Reserve.

Existing Provision	Demographic need	Identified need	Rates of provision	Facility/service required
1 netball/ basketball court and 2 netball courts	Future population expected to be 9,341	Two multipurpose netball/basketball courts at Fern Bay Reserve Existing Stockton courts have no shelter or toilets	2 multipurpose courts per 10,000 people	One to two full sized multipurpose courts at Fern Bay.
4 tennis courts (2 in Stockton, 2 in Fern Bay)		Current supply adequate	2 tennis courts per 10,000 people	No requirement
4 playing fields in Stockton		No provision in Fern Bay, but no land available to support more fields there	1 sports ground (comprising two playing fields per 5,000 people	Adequate overall provision in the local area. Opportunities for provision of playing fields in Fern Bay could be explored in the future.

It is of note that seniors living developments in Fern Bay and Fullerton Cove include significant open space and social and recreational infrastructure to varying degrees including pools, tennis

courts, activity centres and meeting rooms that are available for the exclusive use of residents. As result, there is a lower demand for these services from these residents.

4.1.6 Education

There are three primary schools in the local area. Both Stockton and Fern Bay each have a public primary school. St Peters Primary School is located adjacent to the commercial centre in Stockton.

Stockton Public School currently has 267 enrolments which it considers close to capacity, with relatively stable enrolments in recent years. It has some out of area students from Fern Bay. Consultation with the school indicates that it is close to capacity, however, Department of Education long range plans consider that school classrooms are running at only 60% utilisation (indicating significant potential for absorbing growth). The plans also anticipate further growth in enrolments of 12 students by 2021[2].

Fern Bay Public School is small with only 34 enrolments in 2016, although this has increased significantly to 60 in 2017[3]. The school has one permanent and one demountable classroom[4] and generous open space and recreation areas. It also uses the facilities in the adjacent Fern Bay including the fortnightly visits from the Port Stephens mobile library[5]. Consultation indicates that several factors have contributed to formerly low attendance by Seaside residents; by indicating an intention to attend Stockon Public School residents are eligible to go to Stockton Preschool, the only one in the local area, a historically poorer reputation of Fern Bay Public School compared to Stockton Public School, and the need to travel (by bus or car) to either facility eliminating this as a factor in choosing a local school. Although Department of Education long range plans appear to underrepresent current enrolments, it is still considered to be operating at 200% utilisation, indicating no capacity. With an area of 1.01 ha, the site has considerable space for expansion for accommodate a growing population.

St Peters Primary School currently has 136 enrolments and expects 150 in 2018. St Peters notes its enrolments have expanded significantly since 2015 largely through gain in students from Seaside who represent approximately one third of the school population. The school expectsthat the current capacity and future expansion would be sufficient to accommodate students from a growing population in the near future. The 2011 census indicates 18.4 percent of primary students attend Catholic schools and 73.2 percent attend government schools. 2011 census data also indicates that the proportion of students attending Catholic schools increases in high school, with 34.3 percent of students in the local area at Catholic schools and 60.3 percent at government schools. With the planned development of a new Catholic high school in Medowie, it is likely this school would attract some students from the local area.

Most high school students in Stockton attend Newcastle High School, however consultation indicates Fern Bay residents are more likely to attend catholic schools. The nearest and most common Catholic high school is San Clemente in Mayfield.

4.1.7 Health

Stockton has two GP surgeries, both of which indicate they have capacity for new patients. One has only started taking new patients in recent years due to increased demand. Together the services provide one full time and three part time doctors and two part time nurses, with one bulk billing and the other with some potential to bulk bill. A pharmacy is located in the Stockton commercial centre.

[2] NSW Department of Education, Stockton Public School Land Range Forecast
[3] 2016 Fern Bay Public School Annual Report
[4] NSW Department of Education – Long Range Schools Report
[5] http://www.fernbay-p.schools.nsw.edu.au/school-plans

The Fern Bay Medical Centre is located in Palm Lake Resort but is open to the broader community. This centre has one full time doctor and a part time nurse and generally does not bulk bill. A commercial development approved for development in Seaside includes health consulting rooms.

Residents of seniors living community residents have indicated during consultations that a pharmacy is needed in the Fern Bay area.

An early childhood health service operates home visit services out of Stockton (in the same building as Meals on Wheels). Consultation with Newcastle City Council indicates that the service is experiencing a high demand from the new growth area of Seaside, and that the current building is not meeting the needs of the service, due it its age, cost and facilities.

Overall, current general medical services are considered adequate in the local area, with likely future expansion through an approved health services space in Seaside.

4.1.8 Aged services

Meals on Wheels operates from Stockton delivering meals to around 52 clients in the local area, three days a week. They have indicated that they have capacity for further growth in demand.

Westcott Aged Care facility provides 20 home care packages within the community and also has a respite care facility. Community transport is also available within the local area from Newcastle and Port Stephens Community Transport providers.

Each of the seniors living developments and the Westcott aged care facility have services to their residents which meet many of their daily needs. The Senior Citizens Association of Stockton has a facility in the Stockton commercial centre, next to Meals on Wheels where it is understood they hold social gatherings and activities and offer the centre for hire, though it was not possible to contact them for input to the SIA.

Current services appear to be meeting demand, however as the local area is ageing, and this is intensified by the ageing of the seniors communities, demand is expected to grow significantly. A greater diversity of outreach and locally available aged services will be needed in the future.

4.1.9 Public and active transport

Public transport in the local area is provided by bus and ferry services. A 10 minute ferry service operates between Queen Street Wharf in Newcastle and the Stockton peninsular. The service operates three times an hour in peak hours and one to two times an hour at other times.

The Department of Transport NSW buses service the Stockton area, with bus routes averaging 40 to 50 minutes to get to and from Newcastle CBD as the bus route is through the peninsula along Fullerton Street and across Nelson Bay Road Bridge. Bus times are varied, but generally area available every 30 minutes to an hour.

A school bus services Fullerton Cove, Seaside (with a bus stop inside the development), Fern Bay Public School, St Peters' Primary School and Stockton Public School. This bus is also used for students from St Peters to travel to and from OOSH care at Stockton Public School. The nearest bus stops at the entrance to Rifle Range and the entrance to the adjacent Stockton Centre.

It is also understood that regional coaches operating between Newcastle and Port Stephens regularly stop on Nelson Bay Road opposite Vardon Road for passengers to use the public toilets there. Passengers also regularly cross to the take away food shop on the opposite side of the road.

A shared pathway connects the southern end of the Stockton peninsular to the southern end of Fern Bay. The path runs along the western side of Fullerton Street, crossing at the roundabout

intersection with Nelson Bay Road and continuing north on the eastern side of Nelson Bay Road past the Stockton Centre, through the cemetery and terminating in Fullerton Street, Fern Bay. Further north, a footpath of variable width and quality continues to the bus stop at Bayway Village. A short section of footpath lines the houses on the western side of Nelson Bay Road at Fern Bay, but does not extend to the seniors living developments further north. The development of footpaths will be further assessed in the concept master plan at the development approval stage. There is currently only one pedestrian crossing (outside Stockton Centre) along this north-south road that connects the three suburbs. One pedestrian island is located in the southern sections of Fullerton Road in Stockton and one where the shared pathway crosses Fullerton Road. As a result, access to both western bus stops and much of the shared pathway involves crossing busy roads. In recent years a student was fatality injured crossing Nelson Bay Road.

4.1.10 Emergency Services

The Stockton Fire and Rescue is a retained station that is usually staffed during business hours and is otherwise supported by retained crew in the community. No obvious changes in the number of fire or rescue calls have been observed in recent years and it is likely that it will be adequate to meet the needs of the growing community.

Stockton Ambulance is staffed 24 hours, 7 days a week, with one day time and one night time shift each day. There has been increases in demand state wide with an ageing population, and this is also true of the Stockton-Fern Bay area.

The Stockton Police Station is staffed for up to four shifts per week, with service outside these times provided by the Waratah station. Local staff indicate that incidences in the area have increased in keeping with trends in other areas (but not really a reflection on the growing population) and do not note any specific concerns or hot spots, although incidents are more common in Stockton, than in the northern areas.

4.1.11 Internet and technology

NBN fibre to the node is currently being installed in the local area with connection imminent. Availability of quality broadband will enhance the ability of local service providers and businesses to operate efficiently and enhance connectivity for residents.

Consultation indicates that there are several areas, primarily in Fern Bay and Fullerton Cove where there is no, or very patchy mobile reception, including areas of the Rifle Range.

4.1.12 Fresh food and retail

A small commercial centre is located along Mitchell Street in Stockton. The centre includes a small format grocery store, bakery, butcher, pharmacy, two banks (credit unions), newsagent and a number of other specialist shops and services. However, the main shopping outlets close to the area include the Newcastle CBD or the Mayfield shopping centre. A number of local residents also shop at Medowie. A take away shop in Fern Bay on Nelson Bay Road is the only public commercial facility in Fern Bay. Consultation has also indicated that it is common for elderly residents on restricted drivers licenses to shop at Kooragang (3.5 km from Stockton bridge) where an express supermarket is adjacent to a petrol station which defines the spatial limit of their restricted licenses. Consultation has indicated that many residents of Fern Bay and Fullerton Cove consider a supermarket is needed in the area. Stockton residents have also indicated the need for a larger format supermarket that is more cost competitive.

A commercial development in Seaside has been approved to include a neighbourhood shop which is likely to serve the basic daily needs of local residents. It also understood that there is commercial interest in rezoning some land along Nelson Bay Road for a supermarket and commercial area, although no such zoning has been approved to date.

5. Consultation

5.1 Approach

Consultations to inform the SIA were through face-to-face meetings and phone calls with key stakeholders. Consultation has focussed on the overall provision and capacity of existing social infrastructure, and existing or expected social issues relevant to the proposal and the future population. -

GHD has consulted with;

- Newcastle City Council and Port Stephens Council
- Defence Families Association
- NSW Department of Education
- Stockton Publc School and St Peters Primary School
- Fern Bay Fullerton Cove Progress Association
- Stockton Library
- Facility managers of seniors developments (Palm Lakes Resort, The Cove, Bayway Village, Westcott Aged Care)
- Stockton Police, Fire and Ambulances services
- Local service providers, including medical centres, childcare, preschool and OOSH providers in Stockton and Fern Bay

5.2 Consultation outcomes

The outcomes of all discussions were recorded by GHD and have been reviewed to identify key themes and issues outlined below.

Themes	Issue
Population change and development	A diverse community with varied access to services and varied socio-economic status Extensive new development in seniors living in the local area, with potential expansions in the future Seaside, a new development aimed towards a younger demographic is resulting in new families or couples re-locating to the area
Social infrastructure	Demand for childcare facilities and sportsgrounds/community centres to facilitate the needs of new families with younger children Baby boom in the local area of primary school aged children, highlighting the need for both pre-schools, primary schools and high schools The Port Stephens mobile library van goes to the Fern Bay community hall, but cannot go to Seaside development due to the size of the van and the narrow roads The Fern Bay Community Hall is planned to be rebuilt and there are no other public buildings for community use.
Access and mobility	Nelson Bay Road acts as a barrier to community cohesion as it is not safe to cross, and there are not adequate paths to connect the developments

Themes	Issue
	community would like a shared cycle-way and footpath (to also support motorised scooters) to extend along Fern Bay and to the Ferry, to improve access to amenities and alleviate parking pressures, which could promote social engagement
Social issues	Trend of social exclusion/isolation created through the developments; with both a larger child aged and elderly demographic, an inadequate number of facilities to service both age groups and physical urban forms (i.e. roads) creating a barrier between these populations

The outcomes of the consultation have been considered in the assessment of potential social impacts and the recommended mitigation measures (section 6).

6. Social impact assessment

This section considers the potential social impacts and opportunities that may result from residential development (as informed by the concept master plan) of the Rifle Range, should the site planning proposal be approved. The assessment addresses the potential for residential development rather than the master plan itself in the context of the potential of the site to support a socially sustainable community. As such, it does not consider in detail any elements of the master plan, but rather the vision and nature of development it would facilitate.

6.1 Accommodation and housing

Rezoning of the Rifle Range site would facilitate increased housing supply in Fern Bay and the local area, contributing to the Hunter Regional Plan 2036. The site is estimated to yield 249 dwelings, accommodating in the order of 635 people. Residential development of the site would also respond to the directions for revitalising existing communities, creating compact settlements, and promoting housing diversity contained in the *Hunter Regional Plan 2016* and the *Draft Plan for Growing Hunter City*,

The development, whilst not providing affordable housing as such, is accommodating key worker (Defence personnel) housing. It would provide 125 dwellings for Defence families within an accessible distance of their place of work. The delivery of housing for Defence personnel would support social diversity, housing diversity and affordability for these key workers in the region.

The concept master plan supports diverse housing options with dwellings sizes ranging from two to four bedrooms and including typologies that integrate potential fonzie or granny flats. This is particularly relevant for Fullerton Cove and Stockton with higher proportions of single parent families and seniors within their community. As indicated in Table9 the master plan envisages a higher proportion of dwellings with fewer bedrooms that would suit these varied household types. This is especially important for local housing diversity given that consultation indicates the Seaside development includes predominantly larger dwellings (4 bedrooms and larger) and that many of the smaller dwellings currently in the local area are within private seniors communities.

Table 9 Dwelling size

	Stockton	Fern Bay	Fullerton Cover	Regional Area	Concept master plan
One Bedroom	5%	7%	8%	5%	20%
Two Bedrooms	27%	35%	14%	24%	10%
Three Bedrooms	48%	37%	42%	45%	67%
Four + Bedrooms	18%	19%	36%	24%	3%
Average number of bedrooms	2.8	2.7	3.1	3.0	

6.2 Population change and impacts on social infrastructure

Rezoning of the Rifle Range site would facilitate it's residential development bringing in a new population to the peninsula. As outlined in section 3.8, development of the order demonstrated in the concept master plan is likely to yield of 249 dwellings and a population of 635. It is likely that around half of new residences will be occupied by Defence households and the other half will be private owners and renters, likely attracting both younger couples and families and empty nesters, due to the diverse housing typologies envisaged. The demographic structure of such a population is expected to vary somewhat from the 2011 population, as illustrated in section 3.1.

Development of the Rifle Range site would be unlike recent developments in Fern Bay and Fullerton Cove. Whilst these have increased the population significantly in these suburbs, they have occurred in considerably insular nodules, spatial isolated from the established residential area of Fern Bay. Residential development of the Rifle Range according to the concept master plan would in effect be an extension to this established area, more than doubling its 2011 recorded population of 520 people.

6.2.1 Community centres and spaces

Community centres

As indicated in section 4.1.1 there are no public community centres in Stockton, with privately held halls and clubs providing spaces for community gatherings. The Fern Bay Hall is an old facility and a development application for its replacement and amalgamation with the tennis club is in progress.

There is an existing need for an additional public community centre or space in the local area. As there are no existing public cultural, youth or seniors spaces in the local area, such a new community spaces should be multipurpose with the capacity to provide spaces for these users groups and the services and programs they require. Within the area surrounding the proposed development there is existing demand for an additional public community centre or space. The proposed development at Fort Wallace together with the proposal for Rifle Range has the potential to result in an additional 635 residents. This increase in population would therefore contribute to this demand for a new facility, however it is anticipated that the needs of these future residents could be addressed through the refurbishment of Fern Bay Hall. As the development application for the hall is still in progress, then consideration should be given for multipurpose facilities that could meet the demand both of the new population and the surrounding community.

6.2.2 Libraries

Whilst the potential new population of Rifle Range would add to the demand for currently under met services, this is not a significant increase overall, with minor impact on the determination of need for this infrastructure. Using the People Places (State Library of NSW, 2012) population benchmark, the additional Rifle Range population would increase the proposed needs for space, by 48m^2.

The development would however put further demand on the mobile Port Stephens library. Council provision of services to an expanded population in this par to Fern Bay could explore alternative service mechanisms that could be integrated into the proposed new Fern Bay community hall (e.g. book return facilities, order collection facilities, increased mobile service frequency, cooperation/integration with the Fern Bay Public School).

6.2.3 Child care

Residential development of the Rifle Range site would likely generate in the order of 10 long day care places, 9 preschool places and 12 OOSH care places for new residents. The potential relocation of the Defence preschool to Medowie may result in some DHA families using this facility. This number of places is moderate in the context of overall demand in the local area, as discussed in section 4.1.4. To support a socially sustainable community at the Rifle Range, there will be a need for existing service gaps to be addressed and have capacity for further population growth. Much of this future provision is expected to be delivered by the private or not for profit sector.

6.2.4 Recreation facilities

There is existing need for further sports courts in the Fern Bay area, which, if built, would likely be used by Rifle Range residents.

Rezoning of the Rifle Range site for residential development could facilitate the delivery of public access to a new community park (approximately 6,500 m^2) with a playground within the development, and formal access to the beach and dune environment via a dune boardwalk linking to Stockton in the south, including a beach lookout, as described in the concept master plan.

As noted above, the growing local area has an existing shortage of sports courts, and the population growth facilitated by the proposed rezoning would add to this demand.

6.2.5 Education

Residential development of the Rifle Range site would likely generate in the order of 59 primary school aged and 45 secondary school aged students. The Rifle Range would fall within the catchment of Fern Bay Public School (60 students on a 1.01 ha site). As noted in section 4.1.6, there is no current capacity at the school however consultation indicates it is actively encouraging new enrolments. The school has adequate land to expand its current number of classrooms to accommodation this demand, even though it could represent a potential almost doubling of current enrolments.[6].. Fern Bay Public School is a 400 m walk from the boundary of the Rifle Range, with the furthest residents about 1.1 km from the school. The proposal includes a shared path which would facilitate this access for students to the school If the proposed OOSH services are available at the school, it is likely that the proximity of the school and availability of these services will attract a high proportion of resident students to the school.

Capacity at St Peters Primary School is being rapidly taken up by students of the expanding Seaside development however the school suggests it has capacity for future expansion and would be sufficient to accommodate students of a development at the Rifle Range. The 2011 census indicates 18.4 percent of primary students attend Catholic schools and 73.2 percent attend government schools. 2011 census data also indicates that the proportion of students attending Catholic schools increases in high school, with 34.3 percent of students in the local area at Catholic schools and 60.3 percent at government schools. With the planned

[6] NSW Department of Education, Stockton Public School Land Range Forecast

development of a new Catholic high school in Medowie, it is likely this school will attract some students from the local area.

Overall, it is considered that local primary schools have the capacity (some expansion) to accommodate new residents at the Rifle Range, and that schools planning should consider this new population in Department of Education facilities planning.

Should rezoning of the site be approved, it is recommended that Council advise the Department of Education of this change to consider in their planning, with the expectation that Fern Bay Public School be expanded.

6.2.6 Youth services

There are no youth services or facilities based in the local area. There is a need for a public indoor facility that can host services and activities for young people and also provide a venue to gather and socialise informally. This could be a new multipurpose community centre, as a specific youth centre is not justified at the local level, nor recommended. A multipurpose space would need to be located in close proximity to other services and attractions and easily accessible by public transport. Youth services and programs could also be hosted in the new Fern Bay Hall, and could be included in a Community Development and Welcome Program as discussed in section 6.4.

6.2.7 Aged services

Many of the facilities and programs available to seniors in the local area are provided in the seniors developments, exclusively for their residents. The implications of this inequality in access to services affects social cohesion and connectedness between older residents in different parts of the local area. Older residents of the Rifle Range site would have access to limited aged services in the local area.

Seniors services and programs could also be hosted in the new Fern Bay Hall, and could be included in a Community Development and Welcome Program as discussed in section 6.4.

6.3 Access and mobility

Proximity of residential areas to local infrastructure and services and other destinations of interest is key to their viability. Access and connectivity is a key issue in the local area with spatial separation between Stockton and Fern Bay/Fullerton Cove, and many of the seniors and residential developments in Fern Bay and Fullerton Cove in discreet, independent and often private pockets that discourage or prevent connectivity between communities and limit access. The Rifle Range however will adjoin the established residential area of Fern Bay, with access to passive recreation spaces (Stockton Beach and Worimi Conservation Lands) and within walking distance (within 800 m) to the school, community hall, local convenience store and bus stops on Nelson Bay Road. Should development of the planned shared path along Nelson Bay Road and footpaths along Vardon Road be developed, the Rifle Range would have a quality active travel link south to Stockton and the ferry service to Newcastle CBD. Currently the route comes to within 400m of the site, terminating as it leaves the Stockton Cemetery.

Any likely future commercial development in Fern Bay is likely to be to the north, so the importance of the development of a shared path (for pedestrians, cyclists and in the local area increasingly motorised scooters) is also important. Access to bus stops on Nelson Bay Road is also dangerous for pedestrians, as the road has a 70km/hr speed limit with considerable traffic and no safe crossing points. Consultation indicates that traffic management measures at the intersection with Vardon Road are being discussed with NSW Roads and Maritime. The

inclusion of safe pedestrian crossing in any such changes will be required to support safe active travel in the local area and for residents of the Rifle Range.

Walkable streets with footpaths and active travel networks within the site would facilitate this local mobility and attract and facilitate public access into and within the site, especially the community park and to the boardwalks, which could potentially be part of a longer coastal walk connecting to Stockton.

Consultation indicates that mobile phone connectivity is unreliable on the peninsular, in particular in parts of Fern Bay and the Rifle Range. Future site planning would need to ensure reliable mobile phone reception is available across the site.

Residential development of the Rifle Range, as per the concept master plan will also facilitate public access to a formerly restricted area and enhance access to the coastal area.

6.4 Community cohesion and connectedness

A sense of connectedness is an important contributory factor to achieving significant positive impacts on health, well-being, and mental health for both individuals and groups of people. Communities with strong social capital and sense of identity have improved levels of passive surveillance, stronger informal assets that can be relied upon by members and more inclusive social networks, which celebrate diversity.

A challenge facing potential development of the Rifle Range site is the development of a sense of community and belonging, both internally for residents within the development and for those residents within the broader community. For new residents, this sense of community and belonging can be developed in many ways including:

- Getting to know neighbours.
- Being aware of and using local services.
- Being aware of and involved in local sports or common interest groups.
- Creating new social networks.
- Connecting with people with similar backgrounds.
- Being involved in the decision making process in the local area.

This challenge is exacerbated in the local area by the existing social and spatial separation between Stockton and Fern Bay and between the various discreet developments within Fern Bay and Fullerton Cove. Development of the Rifle Range would avoid creating such isolation, instead creating a public and permeable development that directly connects to an existing community.

For Defence families social connections and community cohesion is of great importance. As a frequently mobile population, they are often remote from friends and family, and rely on each other for social and support networks. The community centre at Williamstown RAAF base will be an important facility for Defence families to meet and development social networks within the Defence community and also learn about the local and regional area. The community park proposed in the concept master plan will also provide important social congregation points in the community for people from both within and outside the development to meet and socialise. However, as noted in section 6.2.1 there is an existing need for a local public community centre or space to provide an accessible and affordable place for people to come together. Such a space could also support the delivery of varied programs and services.

Fern Bay Community Hall would meet some of this need, however it is not a multipurpose centre and is thus limited somewhat in it’s potential uses.

Ensuring development of a welcoming and inclusive community delivers sustainable social outcomes for both individuals and the community. Effective and efficient activation of the communal spaces within the site and use of facilities outside the site for activities that are inclusive of the surrounding community (of both adjacent and broader residents of Fern Bay such as Seaside residents and seniors development residents) would contribute to positive social outcomes and are recommended to be delivered for residents upon development of the site.

It is recommended that a Community Development and Welcome Program be prepared and resourced for the site by any developer of the site. The program would assist new residents with a particular focus on making new residents feel welcome and part of the community, on activating community spaces within the development, and more inclusive activities that engage the broader local community. A particular focus of the program would be to facilitate inclusive activities and social networks between residents of the Rifle Range and the adjacent established residential area of Fern Bay. The program would enhance and complement existing programs and natural social connections such as through schools, sports clubs, seniors groups and playgroups, and include programs for those not engaged, such as youth. The program could potentially be delivered in partnership with a non-profit/community-based organisation. Such a partnership has the benefit of supporting community/non-profit groups; connecting to community networks; utilising grant funding/sponsorship where available and potentially long-term sustainability of the program.

6.5 Health and wellbeing

Access to social and economic resources is essential to support healthy lifestyles through all stages of life. Access to health services, education, child and older peoples care, efficient public transport, to passive and active recreation areas and programs, to fresh food and daily needs, and to public and social spaces is needed to make places liveable and socially sustainable.

The Rifle Range site is located outside a desirable walking catchment to most services and facilities (with the exception of the primary school, reserve and community hall), and will have many of the daily needs of it's community available around 5km away in Stockton. If the proposed shared path identified by Council was to be developed, this would provide a continuous route to Stockton. Alternatively, the potential development of the dune boardwalks would also provide an alternate recreation path to the south.

In addition to the social infrastructure needs identified in section 0, promoting the use of active travel modes to new residents for local trips (e.g to the park, and to school) would enhance their uptake and set in place new travel habits. A community development and welcome program (as discussed in section 6.4) should include an objective as promoting this mode uptake. It should also promote the accessibility of Newcastle by ferry for both commuting and recreational access. Further, the social connections that the program would seek to develop under the plan would deliver social and health benefits across diverse age groups in the new and existing community.

Current access to fresh food is limited in the local area (a small format supermarket and local butcher), with consultation indicating that many people shop outside the local area at major supermarkets. With significant commercial interest in the development of a major supermarket in Fern Bay, it is likely that this will result in coming years and would adequately service the local area.

The Health Foundation is a key driver in Australia of planning for healthy communities. Their 2016 Master Checklist for Healthy Active Living by Design, identifies a number of considerations of relevance to planning for healthy populations at the level of rezoning for residential development. These considerations have been used to consider the health impact of the

rezoning of Rifle Range. The checklist is a tool to help development encourage and support physical activity and health outcomes including healthy eating. The key considerations with regard to the development are considered in Table 10. In general, at this stage of site planning, the concept master plan supports or enables future development in compliance with many of the principles of Healthy Active Design. Those aspects not consistent with the principles have also been identified in other sections of this SIA.

Table 10 Healthy Active by Design Review

Principle Consideration	Assessment	Recommendation
Destinations*: Access* – are they within a safe and easy 400m-800m catchment	Facilities internal to the site are accessible and some locally, however most local services and destinations are more than 5km from the site	Implement the Port Stephens Pathways Plan (section 6.3)
Access – do paths and cycleways connect surrounding communities	Site connects well to the established residential area of Fern Bay	
Open space: *Access*: at least one space within 400m-800m walk	Community park within this catchment	
Sense of place: Have heritage and cultural features been acknowledged, integrated and protected?	Yes	Interpretation and information about the Indigenous history and significance of the area is included in master planning.

6.6 Cultural values and beliefs

Cultural values provide significant meanings and reference points for individuals and groups. The celebration and protection of cultural values is a key element in building strong and resilient communities. The Port Stephens Integrated Plans identify the need to increase access to cultural activities (including the mobile library), increase protection of culturally significant Aboriginal places and objects and increased access to, and opportunities for, recreation and leisure.

The proposed concept master plan would avoid disturbing areas likely to contain significant Aboriginal items and a layout that respects the impact o the development on the boundaries of the Worimi Conservation Lands. The plan would also support improved local pedestrian access to the Stockton Beach and via the dune boardwalks, to the surrounding coastal area, with the potential to create a significant recreational coastal walk.

Consultation with local Aboriginal groups (as part of the Aboriginal Heritage Study[7]) concluded that the Stockton Peninsula, including the site, is considered to have very high Aboriginal

[7] The SIA team was unable to gain input from the Worimi Local Aboriginal Land Council during the SIA study

cultural value to the Worimi people due to a nearby burial site. The Rifle Range has heritage and historic significance due to its former defence use.

It is recommended, if the Rifle Range rezoning is approved, that further consultation should be undertaken with the Worimi Local Aboriginal Land Council and other Aboriginal elders within the area to ensure Aboriginal cultural values of the area are integrated into detailed site planning.

6.7 Local economy and employment

Renewal of currently unused areas through residential expansion will generate increased demand for services and businesses in the local area, further supporting the demand for a growth in retail and social services in the local community. Development of the Rifle Range site to accommodate Defence families is also important for the ongoing sustainable operation of the Williamstown RAAF base, being able to provide quality accommodation close to their personnel's place of work. As identified in the *Draft Plan for Growing Hunter City*, Fern Bay, as part of the Norther Gateway is an important residential area proximal to employment areas in Newcastle city, the port and airport. The planning proposal would therefore complement existing employment lands.

6.8 Crime and safety

Consideration for crime and public safety relate to:

- The safety of new residents in the existing environment.
- How the development will alter the built environment and create or reduce public safety.
- How new residents themselves alter community safety in the area.

Crime in the local area is largely comparable to that in Newcastle, however there are higher levels of domestic and sexual assault. The rezoning of the Rifle Range is not expected to impact the incidence of such crimes, however any future residential development on the site should include awareness raising programs for issues associated with this violence and of support services for victims of it as part of a developer led community development and welcome program.

The concept master plan would create a community with high levels of passive surveillance and aim to create accessible and visible shared open spaces. Should rezoning be approved for the sites, further planning for the site would incorporate Crime Prevention Through Environmental Design (CPTED) principles to maximise community safety. This will be an important consideration in the planning and activation of the heritage precinct.

A Community Development Program could also activate public spaces within the development and in the Fern Bay Reserve and Hall, create a sense of safety and security for community members (both within and surrounding the proposed development) and as a result enhance passive surveillance. The importance of vibrant, active, inclusive and safe communities is reinforced in the Port Stephens Integrated Plans which identify community perceptions of safety as key measures in improving community safety.

6.9 Summary of social impacts

Table 11 below provides a summary of the social impacts, benefits and needs relevant to the potential development of the Rifle Range sites in a manner suggested by the concept master plan, and recommendations in response to these identified issues.

Table 11 Summary of social impacts

Potential impact/risk/opportunity	Impact type	Social Considerations for future development
Accommodation and housing		
Increased housing supply and diversity in Northern Gateway, including smaller format dwellings and varied numbers of bedrooms	Positive	
Delivery of affordable and accessible housing for Defence personnel	Positive	
Population change		
Development will attract households at more diverse life stages and household types	Positive	
Social infrastructure		
Existing unmet need for ***community space and library*** services will be increased by a population at Rifle Range	Need	Port Stephens Council consider potential for the proposed Fern Bay Hall to be augmented to increase its multifunctional capacity Short term increases to Stockton Library hours and increased frequency of Port Stephens mobile library service
Absence of ***cultural or youth spaces*** in the local area which is spatially isolated	Need	New multipurpose facility to meet diverse community needs (community/youth/cultural/ seniors, library)
Existing unmet need for ***preschool and OOSH services***, especially in Fern Bay	Need	Port Stephens Council to facilitate private sector delivery of preschool and OOSH services in the local area, and explore options for sports courts and fields in Fern Bay
Existing need for ***sports courts and playing fields*** in Fern Bay	Need	
Potentially significant increase in student numbers thus a need for expansion in Fern Bay Public School .	Need	Regional Councils liaise with Department of Education in order to plan for any enrolment growth if the Rifle Range is rezoned
The Rifle Range would deliver a local public playground, open space dune boardwalks and beach access	Positive	
Access and mobility		

Potential impact/risk/opportunity	Impact type	Social Considerations for future development
Zoning would support public recreational access to the natural areas, including a coastal dune boardwalk to run along the peninsular	Positive	
Pedestrian access from the Rifle Range to bus stops on Nelson Bay Road is not safe	Need	Port Stephens Council and NSW Road and Maritime consider pedestrian and cycle crossing options for the intersection of Vardon and Nelson Bay Roads
Active travel access to local services (in Stockton) is not complete	Need	Port Stephens Council develop shared paths as per the Port Stephens Pathways Plan 2016, and ensure future commercial development is located along these networks
Limited mobile phone coverage in the area	Negative	Any site developer ensure adequate mobile phone reception throughout the site
Community cohesion and connectedness		
Need to promote social connection between Rifle Range residents and adjacent established Fern Bay residents. Existing communities of the local area are socially fragmented and lack public spaces to connect making inclusion of new residents difficult. This is particularly relevant for teenagers in Defence families and seniors who do not have access to facilities in the private communities	Negative	Regional Councils consider a multipurpose community centre A community development and welcome program be pursued by any site developer
Local economy and employment		
Residential development in an area that supports existing employment lands, especially for Defence staff at Williamstown Base	Benefit	
Growing population to increase demand for services in the area which may assist in prompting private sector delivery	Benefit	
Crime and safety		
Site design should minimise crime risks and maximise resident and visitor safety	Risk	Undertake a CPTED assessment for any future master plan

Potential impact/risk/opportunity	Impact type	Social Considerations for future development
		Implement Community Development and Welcome Plan to address existing crime issues and increase passive surveillance

7. Conclusion and recommendations

The social impact assessment has not identified any social considerations that would preclude the development of the site for residential development.

The proposed rezoning of the Rifle Range would facilitate the delivery of increased housing and housing diversity for key workers at a range of life stages. The concept master plan envisages the delivery of 249 dwellings, with around half of these occupied by Defence households. The site would likely accommodate in the order of 635 residents, would effect renewal of currently unutilised land within a designated future housing growth area and facilitate public access to local natural areas. The development would build on the established residential community of Fern Bay and its facilities, creating a more compact settlement type than has resulted in other areas of Fern Bay in recent years. It would also support the ongoing needs for quality, proximal housing for Defence families working in the region and particularly at the Williamstown RAAF base.

The site is within a local area undergoing considerable development and recent population growth and with existing unmet needs for social infrastructure. Additional social infrastructure (in terms of facilities, services and programs) would be required to support the development of a sustainable, healthy and inclusive community. The recommendations within this SIA and summarised below have been developed to inform future planning that would be required to support socially sustainable residential development under the proposed planning changes.

Area of Change	Proposed mitigation or enhancement measure
Social infrastructure	Port Stephens Council consider potential for the proposed Fern Bay Hall to be augmented to increase its multifunctional capacity Short term increases to Stockton Library hours and increased frequency of Port Stephens mobile library service New multipurpose facility to meet diverse community needs (community/youth/cultural/ seniors, library) Port Stephens Council to facilitate private sector delivery of preschool and OOSH services in the local area, and explore options for sports courts and fields in Fern Bay Regional Councils liaise with Department of Education in order to plan for any enrolment growth if the Rifle Range is rezoned
Access and mobility	Future site planning include pedestrian access to the Stockton Centre bus stop and pedestrian crossing Port Stephens Council and NSW Road and Maritime consider pedestrian and cycle crossing options for the intersection of Vardon and Nelson Bay Roads Port Stephens Council develop shared paths as per the Port Stephens Pathways Plan 2016, and ensure future commercial development is located along these networks Any site developer ensure adequate mobile phone reception throughout the site

Area of Change	Proposed mitigation or enhancement measure
Community cohesion and connectedness	Regional Councils consider a multipurpose community centre A community development and welcome program be pursued by any site developer
Crime and safety	Undertake a CPTED assessment for any future master plan Implement Community Development and Welcome Plan to address existing crime issues and increase passive surveillance

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Appendices

Appendix A Demographic summary

Basic Community Profile File Name (Incl File Extension .xls or .xlsx):	FernBay.xls			Stockton.xls			FullertonCove.xls			Regional Area		
	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct
Population:												
Total Persons	1625	100.0%	0.7%	4195	100.0%	1.9%	300	100.0%	0.1%	213342	100.0%	49.3%
Age groups:												
0 to 4 years	106	6.5%	0.8%	180	4.3%	1.3%	9	3.0%	0.1%	13132	6.2%	49.4%
5 to 11 years	95	5.8%	0.5%	277	6.6%	1.6%	17	5.7%	0.1%	17437	8.2%	49.4%
12 to 17 years	59	3.6%	0.4%	260	6.2%	1.7%	17	5.7%	0.1%	14922	7.0%	49.4%
18 to 24 years	67	4.1%	0.3%	327	7.8%	1.5%	26	8.7%	0.1%	22031	10.3%	49.5%
25 to 34 years	163	10.0%	0.6%	379	9.0%	1.3%	21	7.0%	0.1%	28243	13.2%	49.5%
35 to 49 years	245	15.1%	0.6%	883	21.0%	2.0%	61	20.3%	0.1%	42508	19.9%	49.3%
50 to 59 years	193	11.9%	0.7%	775	18.5%	2.7%	61	20.3%	0.2%	27264	12.8%	49.1%
60 to 69 years	349	21.5%	1.5%	534	12.7%	2.3%	55	18.3%	0.2%	22583	10.6%	49.0%
70 to 84 years	312	19.2%	1.5%	432	10.3%	2.1%	33	11.0%	0.2%	19976	9.4%	49.0%
85 and over years	35	2.2%	0.6%	148	3.5%	2.7%	0	0.0%	0.0%	5247	2.5%	49.1%
Under 18 years	260	16.0%	0.6%	717	17.1%	1.5%	43	14.3%	0.1%	45491	21.3%	49.4%
15 years and over	1395	85.8%	0.8%	3626	86.4%	2.0%	267	89.0%	0.1%	175405	82.2%	49.3%
Median Age (years)	54			47			50			40		
Cultural Diversity:												
Indigenous persons	40	2.5%	0.6%	148	3.5%	2.3%	11	3.7%	0.2%	6251	2.9%	49.2%
Persons born in Non Main English Speaking countries	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%
Language spoken at home other than English	41	2.5%		100	2.4%		11	3.7%		14237	6.7%	
Speaks English Only	1512	93.0%		3862	92.1%		265	88.3%		189373	88.8%	
Speaks other language and speaks English very well or well	30	1.8%		43	1.0%		9	3.0%		8592	4.0%	
Household Characteristics:												
Family households	472	64.5%	0.8%	994	66.8%	1.8%	83	82.2%	0.1%	54852	66.5%	49.3%
Lone person household	250	34.2%	1.0%	442	29.7%	1.9%	18	17.8%	0.1%	23156	28.1%	49.2%
Group household	10	1.4%	0.2%	52	3.5%	1.2%	0	0.0%	0.0%	4418	5.4%	49.7%
Average household size (number of persons)	2.1			2.3			2.8			5		
Family Characteristics:												
Total families	478		0.8%	1,014		1.8%	83		0.1%	55862		49.3%
Couple family with children	136	28.5%	0.6%	382	37.7%	1.7%	29	34.9%	0.1%	22445	40.2%	49.4%
Couple with children under 15 years	99	20.7%		232	22.9%		15	18.1%		15466	27.7%	
Couple with children over 15 years	37	7.7%		150	14.8%		14	16.9%		6979	12.5%	
Couple family without children	270	56.5%	1.2%	379	37.4%	1.6%	42	50.6%	0.2%	22490	40.2%	49.2%
One parent family	67	14.0%	0.6%	235	23.2%	2.3%	12	14.5%	0.1%	10003	17.9%	49.2%
One parent with children under 15 years	26	38.8%	0.5%	110	46.8%	2.1%	7	58.3%	0.1%	5187	51.9%	49.3%
One parent with children over 15 years	41	61.2%	0.8%	125	53.2%	2.5%	5	41.7%	0.1%	4816	48.1%	49.1%
Other family	5	1.0%	0.5%	18	1.8%	1.8%	0	0.0%	0.0%	984	1.8%	49.4%

Basic Community Profile File Name (Incl File Extension .xls or .xlsx):	FernBay.xls			Stockton.xls			FullertonCove.xls			Regional Area		
	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct
Other characteristics:												
Need for assistance	154	9.5%	1.2%	714	17.0%	5.4%	15	5.0%	0.1%	12295	5.8%	48.3%
Dwellings:												
Separate House	732	95.8%	1.1%	1,277	75.1%	2.0%	88	69.3%	0.1%	62738	67.8%	49.2%
Semi-detached, terrace house, townhouse	0	0.0%	0.0%	98	5.8%	1.0%	7	5.5%	0.1%	9655	10.4%	49.7%
Flat, unit or apartment	0	0.0%	0.0%	105	6.2%	1.1%	0	0.0%	0.0%	9218	10.0%	49.7%
Other dwellings	0	0.0%	0.0%	6	0.4%	0.8%	7	5.5%	1.0%	716	0.8%	49.6%
Not stated	0	0.0%	0.0%	3	0.2%	2.9%	0	0.0%	0.0%	99	0.1%	49.3%
Total occupied private dwellings	732	95.8%		1489	87.6%		102	80.3%		82426	89.0%	
Unoccupied private dwellings	32	4.2%	0.3%	211	12.4%	2.0%	25	19.7%	0.2%	10172	11.0%	49.3%
Tenure Type:												
Fully owned	476	67.0%	1.7%	537	37.2%	1.9%	49	50.0%	0.2%	27076	34.0%	49.0%
Owned with a mortgage	145	20.4%	0.5%	416	28.8%	1.6%	42	42.9%	0.2%	26085	32.8%	49.4%
Rented (Total):	89	12.5%	0.3%	490	34.0%	1.8%	7	7.1%	0.0%	26433	33.2%	49.5%
Real estate agent	27	30.3%	0.2%	251	51.2%	1.7%	0	0.0%	0.0%	14283	54.0%	49.5%
State or territory housing authority	0	0.0%	0.0%	136	27.8%	3.0%	0	0.0%	0.0%	4354	16.5%	49.2%
Person not in same household	12	13.5%		87	17.8%		4	57.1%		5582	21.1%	
Housing co-operative/community/church group	0	0.0%		3	0.6%		0	0.0%		609	2.3%	
Other landlord type	43	48.3%		10	2.0%		0	0.0%		1181	4.5%	
Landlord type not stated	7	7.9%		3	0.6%		3	42.9%		424	1.6%	
Other Tenure Type	3	3.4%	0.5%	16	3.3%	2.4%	0	0.0%	0.0%	643	2.4%	49.3%
Not stated	18	20.2%	0.8%	31	6.3%	1.4%	3	42.9%	0.1%	2190	8.3%	49.4%
Individual Income:												
Median Individual Income ($/weekly)	398			508			442			531		
Negative/Nil Income	58	4.2%		160	4.4%		14	5.3%		10963	6.3%	
$1-$199	82	5.9%		221	6.1%		16	6.1%		12806	7.3%	
$200-$299	298	21.4%		357	9.9%		38	14.5%		20746	11.8%	
$300-$399	213	15.3%		547	15.1%		39	14.9%		21040	12.0%	
$400-$599	208	15.0%		770	21.3%		31	11.8%		22172	12.6%	
$600-$799	110	7.9%		340	9.4%		28	10.7%		17878	10.2%	
$800-$999	70	5.0%		236	6.5%		21	8.0%		13657	7.8%	
$1,000-$1,249	69	5.0%		224	6.2%		12	4.6%		13368	7.6%	
$1,250-$1,499	48	3.5%		173	4.8%		9	3.4%		9377	5.3%	
$1,500-$1,999	74	5.3%		204	5.6%		16	6.1%		11612	6.6%	
$2,000 or more	54	3.9%		160	4.4%		9	3.4%		9012	5.1%	
Individual income not stated	106	7.6%		230	6.4%		29	11.1%		12771	7.3%	

Basic Community Profile File Name (Incl File Extension .xls or .xlsx):	FernBay.xls			Stockton.xls			FullertonCove.xls			Regional Area		
	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct
Household Income:												
Median Household income ($/weekly)	690			1,072			1,062			2164		
Negative/Nil Income	6	0.9%		17	1.2%		0	0.0%		824	1.1%	
$1-$199	11	1.6%		25	1.8%		4	4.3%		1124	1.5%	
$200-$299	31	4.5%		42	3.0%		4	4.3%		2749	3.6%	
$300-$399	108	15.5%		130	9.4%		5	5.3%		6826	8.9%	
$400-$599	140	20.1%		166	12.0%		12	12.8%		8626	11.3%	
$600-$799	91	13.1%		149	10.8%		13	13.8%		7427	9.7%	
$800-$999	56	8.1%		114	8.2%		8	8.5%		6514	8.5%	
$1,000-$1,249	38	5.5%		109	7.9%		8	8.5%		6387	8.4%	
$1,250-$1,499	26	3.7%		95	6.9%		11	11.7%		5706	7.5%	
$1,500-$1,999	45	6.5%		147	10.6%		7	7.4%		9111	11.9%	
$2,000-$2,499	35	5.0%		129	9.3%		10	10.6%		6531	8.6%	
$2,500-$2,999	40	5.8%		102	7.4%		6	6.4%		5613	7.3%	
$3,000-$3,499	25	3.6%		55	4.0%		0	0.0%		3365	4.4%	
$3,500-$3,999	9	1.3%		31	2.2%		0	0.0%		1396	1.8%	
$4,000 or more	8	1.2%		28	2.0%		6	6.4%		1921	2.5%	
All incomes not stated	26	3.7%		46	3.3%		0	0.0%		2253	2.9%	
Labour Force:												
Labour force participation	554	39.7%	0.5%	1,766	48.7%	1.7%	142	53.2%	0.1%	102919	58.7%	49.4%
Total employed	515	93.0%		1,665	94.3%		132	93.0%		96869	94.1%	
Employed full-time	329	63.9%		1,023	61.4%		84	63.6%		58887	60.8%	
Employed part-time	154	29.9%		531	31.9%		40	30.3%		31879	32.9%	
Unemployed persons	39	7.0%	0.6%	101	5.7%	1.6%	10	7.0%	0.2%	6050	5.9%	49.4%
Not in labour force	764	54.8%		1,684	46.4%		100	37.5%		63264	36.1%	
Occupation:												
Managers	74	14.4%	0.7%	145	8.7%	1.4%	16	12.0%	0.2%	9895	10.2%	49.4%
Professionals	92	17.9%	0.4%	293	17.6%	1.3%	18	13.5%	0.1%	21826	22.5%	49.5%
Technicians and trades	75	14.6%	0.5%	299	17.9%	2.0%	24	18.0%	0.2%	14616	15.1%	49.3%
Community and personal service	60	11.7%	0.6%	195	11.7%	1.8%	18	13.5%	0.2%	10376	10.7%	49.4%
Clerical and administrative	66	12.9%	0.5%	235	14.1%	1.7%	15	11.3%	0.1%	13507	13.9%	49.4%
Sales	30	5.8%	0.3%	143	8.6%	1.4%	4	3.0%	0.0%	9735	10.0%	49.5%
Machinery operators and drivers	35	6.8%	0.5%	126	7.6%	1.9%	18	13.5%	0.3%	6310	6.5%	49.3%
Labourers	66	12.9%	0.7%	196	11.8%	2.1%	16	12.0%	0.2%	9172	9.5%	49.3%
Not Stated	15	2.9%	1.0%	34	2.0%	2.3%	4	3.0%	0.3%	1429	1.5%	49.1%

Basic Community Profile File Name (Incl File Extension .xls or .xlsx):	FernBay.xls			Stockton.xls			FullertonCove.xls			Regional Area		
	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct
Key Industry:												
Agriculture, forestry & fishing	0	0.0%	0.0%	12	0.7%	2.2%	3	2.3%	0.6%	529	0.5%	49.3%
Mining	11	2.1%	0.7%	50	3.0%	3.0%	6	4.5%	0.4%	1596	1.6%	49.0%
Manufacturing	54	10.5%	0.6%	195	11.7%	2.0%	22	16.5%	0.2%	9274	9.6%	49.3%
Electricity, gas, water & waste services	7	1.4%	0.5%	25	1.5%	1.7%	3	2.3%	0.2%	1416	1.5%	49.4%
Construction	44	8.6%	0.6%	139	8.3%	2.0%	16	12.0%	0.2%	6908	7.1%	49.3%
Wholesale trade	16	3.1%	0.6%	54	3.2%	1.9%	0	0.0%	0.0%	2722	2.8%	49.4%
Retail trade	38	7.4%	0.4%	117	7.0%	1.1%	15	11.3%	0.1%	10420	10.8%	49.6%
Accommodation & food services	27	5.3%	0.3%	135	8.1%	1.7%	3	2.3%	0.0%	7808	8.1%	49.5%
Transport, postal & warehousing	21	4.1%	0.5%	87	5.2%	2.0%	10	7.5%	0.2%	4306	4.4%	49.3%
Information media & telecommunications	6	1.2%	0.5%	19	1.1%	1.7%	0	0.0%	0.0%	1074	1.1%	49.4%
Financial & insurance services	5	1.0%	0.2%	35	2.1%	1.2%	0	0.0%	0.0%	2851	2.9%	49.7%
Rental, hiring & real estate services	4	0.8%	0.3%	23	1.4%	1.4%	0	0.0%	0.0%	1560	1.6%	49.6%
Professional, scientific & technical services	36	7.0%	0.5%	104	6.2%	1.6%	3	2.3%	0.0%	6446	6.7%	49.5%
Administrative & support services	28	5.5%	0.9%	44	2.6%	1.5%	0	0.0%	0.0%	2914	3.0%	49.4%
Public administration & safety	80	15.6%	1.0%	125	7.5%	1.6%	3	2.3%	0.0%	7600	7.8%	49.3%
Education & training	25	4.9%	0.3%	109	6.5%	1.3%	13	9.8%	0.2%	8312	8.6%	49.6%
Health care & social assistance	81	15.8%	0.6%	274	16.4%	1.9%	19	14.3%	0.1%	14210	14.7%	49.4%
Arts & recreation services	12	2.3%	0.9%	22	1.3%	1.6%	3	2.3%	0.2%	1341	1.4%	49.3%
Other services	12	2.3%	0.3%	65	3.9%	1.7%	10	7.5%	0.3%	3736	3.9%	49.4%
Not Stated	6	1.2%	0.3%	32	1.9%	1.7%	4	3.0%	0.2%	1843	1.9%	49.4%
Educational attainment:												
Completion of Year 12 (or equivelent)	326	23.4%	0.4%	990	27.3%	1.4%	60	22.5%	0.1%	71436	40.7%	49.5%
Without post-school qualifications	697	50.0%	0.9%	1782	49.1%	2.3%	116	43.4%	0.1%	76541	43.6%	49.2%
Educational institution attending:												
Total	318			966			82			64375		
Pre-school attending:												
Pre-school	27	25.5%		42	23.3%		6	66.7%		3851	29.3%	
Infants/Primary education attending:												
Government	52	62.7%		206	76.6%		13	72.2%		11723	72.7%	
Catholic	17	20.5%		46	17.1%		5	27.8%		2813	17.4%	
Other Non Government	14	16.9%		17	6.3%		0	0.0%		1585	9.8%	
Total	83	87.4%		269	97.1%		18	105.9%		16121	92.5%	

Basic Community Profile File Name (Incl File Extension .xls or .xlsx):	FernBay.xls			Stockton.xls			FullertonCove.xls			Regional Area		
	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct
Secondary education attending:												
Government	24	55.8%		132	60.8%		11	64.7%		8186	67.4%	
Catholic	13	30.2%		76	35.0%		6	35.3%		2176	17.9%	
Other Non Government	6	14.0%		9	4.1%		0	0.0%		1791	14.7%	
Total	43	72.9%		217	83.5%		17	100.0%		12153	81.4%	
Technical or Further Educational Institution(a):												
Full-time student:										0		
Aged 15-24 years	0	0.0%		20	23.3%		0	#DIV/0!		824	16.4%	
Aged 25 years and over	0	0.0%		12	14.0%		0	#DIV/0!		589	11.7%	
Part-time student:										0		
Aged 15-24 years	0	0.0%		33	38.4%		0	#DIV/0!		1436	28.5%	
Aged 25 years and over	22	100.0%		21	24.4%		0	#DIV/0!		2124	42.2%	
Full/Part-time student status not stated	0	0.0%		0	0.0%		0	#DIV/0!		58	1.2%	
Total	22	1.6%		86	2.4%		0	0.0%		5031	2.9%	
University or other Tertiary Institution attending:												
Full-time student:										0		
Aged 15-24 years	10	33.3%		30	30.6%		5	55.6%		6310	51.2%	
Aged 25 years and over	3	10.0%		13	13.3%		0	0.0%		2288	18.6%	
Part-time student:										0		
Aged 15-24 years	3	10.0%		12	12.2%		0	0.0%		836	6.8%	
Aged 25 years and over	14	46.7%		43	43.9%		4	44.4%		2842	23.1%	
Full/Part-time student status not stated	0	0.0%		0	0.0%		0	0.0%		42	0.3%	
Total	30	2.2%		98	2.7%		9	3.4%		12318	7.0%	
Other type of educational institution attending:												
Full-time student	0	0.0%		4	22.2%		4	100.0%		292	24.8%	
Part-time student	4	100.0%		14	77.8%		0	0.0%		862	73.3%	
Full/Part-time student status not stated	0	0.0%		0	0.0%		0	0.0%		22	1.9%	
Total	4	0.3%		18	0.5%		4	1.5%		1176	0.7%	
Type of educational institution not stated	109	7.8%		236	6.5%		28	10.5%		13725	7.8%	
Mobility:												
Lived at same address 1 year ago	1,267	78.0%		3,430	81.8%		230	76.7%		167716	78.6%	
Lived at same address 5 years ago	747	46.0%	0.7%	2,476	59.0%	2.2%	173	57.7%	0.2%	109668	51.4%	49.2%
Transport:												
Households without a motor vehicle	62	8.8%	0.7%	216	15.1%	2.6%	0	0.0%	0.0%	8028	10.1%	49.1%
One motor vehicle	362	51.5%	1.1%	578	40.4%	1.8%	28	29.2%	0.1%	31561	39.6%	49.2%
Two motor vehicles	211	30.0%	0.7%	452	31.6%	1.5%	30	31.3%	0.1%	28845	36.2%	49.4%
Three motor vehicles	48	6.8%	0.6%	135	9.4%	1.7%	24	25.0%	0.3%	7853	9.9%	49.3%
Four or more motor vehicles	20	2.8%	0.6%	50	3.5%	1.5%	14	14.6%	0.4%	3338	4.2%	49.4%

Basic Community Profile File Name (Incl File Extension .xls or .xlsx):	FernBay.xls			Stockton.xls			FullertonCove.xls			Regional Area		
	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct	No	% Within File	% Of Precinct
Journey to work (by one method only):												
Train	0	0.0%	0.0%	15	1.1%	1.6%	3	2.5%	0.3%	923	1.1%	49.5%
Bus	12	2.7%	0.5%	41	2.9%	1.9%	0	0.0%	0.0%	2148	2.6%	49.4%
Ferry	10	2.3%	4.2%	94	6.6%	39.5%	0	0.0%	0.0%	134	0.2%	36.0%
Tram (includes light rail)	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	3	0.0%	50.0%
Taxi	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	174	0.2%	50.0%
Car, as driver	355	80.3%	0.5%	994	70.0%	1.5%	89	73.6%	0.1%	64432	77.2%	49.4%
Car, as passenger	33	7.5%	0.6%	81	5.7%	1.4%	3	2.5%	0.1%	5527	6.6%	49.5%
Truck	5	1.1%	0.6%	14	1.0%	1.6%	3	2.5%	0.3%	863	1.0%	49.4%
Motorbike/scooter	8	1.8%	1.0%	11	0.8%	1.3%	0	0.0%	0.0%	798	1.0%	49.4%
Bicycle	0	0.0%	0.0%	27	1.9%	1.9%	0	0.0%	0.0%	1406	1.7%	49.5%
Other	3	0.7%	0.7%	15	1.1%	3.6%	3	2.5%	0.7%	396	0.5%	48.7%
Walked only	4	0.9%	0.1%	70	4.9%	2.0%	7	5.8%	0.2%	3482	4.2%	49.4%
Worked at home	12	2.7%	0.4%	58	4.1%	1.8%	13	10.7%	0.4%	3129	3.8%	49.3%

Source: Australian Bureau of Statistics, 2011.

Appendix B Local Social Infrastructure

Name	Address	Size /capacity
Community Centre		
Fern Bay Community Hall	Fern Bay Reserve, Vardon Rd	Around 160m^2 Plans in progress for rebuilding One main hall, Kitchen, tables and chairs, disabled toilets.
Senior Citizens Centre	76 Mitchell St, 2295 - Stockton NSW	Not able to contact
Childcare – long day care		
Mission Australia Early Learning Stockton	2 Barrie Crescent, Stockton NSW 2295	
Childcare – preschool		
Stockton Public School Preschool	10 Clyde Street, Stockton 2295	40 children in two groups
Childcare - OOSH		
Stockton School Kids Fun Club Association	1 Monmouth St, Stockton NSW 2295	30 Placements Serves– St Peters Primary and Stockton Public School
Wemoosh – Mayfield west	Gregson Avenue, Mayfield West	Currently in negotiation to have 30 students in Fern Bay Hall once the construction finishes
Open space		
Stockton Beach		
Stockton Off-leash Dog Area		
Pitt Street Reserve and the nearby skate park	Pitt Street, Stockton	Skate Park.
Stockton Swimming Centre	Pitt Street, Stockton	50m outdoor pool.
Griffith Park (future district playground and street skate park)	Hunter Street, Stockton	

Name	Address	Size /capacity
Ballast Ground	Hunter Street, Stockton	Dog off-leash park
Hunter Street Reserve	Hunter Street, Stockton	
Breen Park	Dunbar St, Stockton	
Rawson Park	Mitchell Street	
Corroba Park	Meredith Street	
Lynn Oval (cricket ground)	Mitchell Street	Cricket ground.
North Stockton boat ramp (currently being upgraded)	Booth St, Stockton	
Fern Bay Reserve and playground	Vardon Rd, Fern Bay	Playground facilities.
Playgrounds		
Pitt Street Reserve	Pitt Street, Stockton	
Hunter Street Reserve	3 Hunter Street	
Griffith Park	5 Hunter Street,	
Ballast Ground	Lot 74 Hunter Street,	
Breen Park	79 Dunbar Street	
Corroba Park	2 Meredith Street	
Sports grounds		
Corroba Oval	Meredith Street	Used for soccer, little athletics and cricket; also has a basketball court.
Lynn Oval	Mitchell Street	Used for both cricket and rugby league.
Outdoor sports courts/fields		
Corroba Oval	Meredith Street	1 basketball court
Dalby Oval Courts	Mitchell Street	Five tennis courts 2 netball courts
Golf Course		
Newcastle Golf Club	Vardon Rd,	18 hole green.
Library		

Name	Address	Size /capacity
Port Stephens mobile library	Fern Bay Reserve, Vardon Rd. Next to school	Once a fortnight
Stockton Library		Opens three days a week
Health Facilities		
Stockton Surgery	78 Mitchell Street, Stockton	2-3 part time doctors and 2 par time nurses
Dr Hamid M A	18 Mitchell Street, Stockton	1 full time GP
Fern Bay Medical Centre	Palm Lake Resort, 1117 Nelson Bay Road, Fern Bay	1 full time doctor, 1 part time nurse
Early childhood health center		
Aged housing		
Westcott Aged Care	128 Fullerton Street, Stockton, NSW, 2295.	128 permanent care bed facility,. 20 community care packages, a day therapy centre and 8 independent living units. Also provides respite care
The Cove	The Cove Village; 15 Fullerton Cove Rd, Fullerton Cove NSW 2318	Currently 200 dwellings, Approximately 380 residents. Over 55's gated and private community..
Bayway Village – over 50s relocatable homes park		532 properties. Gated private community with modest communal facilities. Primarily over 50s, but also have around 10 younger families.
Palm Lakes Resort	1117 Nelson Bay Road, Fern Bay, NSW, 2295	247 villas, approximately 380-400 residents. Over 50's lifestyle resort with extensive facilities. Private- gated. Public medical centre on site.
Aged services		
Meals on Wheels Stockton	74 Mitchell St, Stockton NSW 2295	Service 52 clients, 3 days a week; usage has increased over the past few years
Education		
Fern Bay Primary School	Vardon Rd, Fern Bay	34 enrolments in 2016 and 60 in 2017

Name	Address	Size /capacity
Stockton Public School	Clyde St, Stockton .	267 enrolments, which it considers close to capacity
Newcastle High School	Parkway Ave, Hamilton South	
St Peters Primary School	Dunbar St, Stockton	St Peters Primary School currently has 136 enrolments and expects 150 in 2018.
Emergency Services		
Stockton Fire Station	Hereford St, Stockton	
Stockton Police Station	Douglas St, Stockton	
Stockton Ambulance Station	Hereford St, Stockton	

Appendix C Age Structure Profile

Basic Community Profile	Bayway BCP_1123213.xls					Seaside BCP_1123215.xls					OLDFernBayPL BCP_1123212.xls					Fullerton Cove BCP_1123214.xls					Fern Bay Fullerton Cove				
	2011		Estimated growth since 2011	2017*		2011		Estimated growth since 2011	2017*		2011		Estimated growth since 2011*	2017		2011		Estimated growth since 2011*	2017*		2011		2017		Percentage change
	No	%		No	%	No	%		No	%	No	%		No	%	No	%		No	%	No	%	No	%	
number of dwellings	430		91	521		145		456	601		211		253	464	490	102		154	256	319	888				
Population:																									
Total Persons	741		145.6	833.6		365		1276.8	1641.8		520		404.8	923.8		300		246.4	546.4		1926		3945.6		
Age groups:																									
0 to 4 years	4	0.5%		4	0.5%	59	16.2%	206	265	16.2%	37	7.1%		37	4.0%	9	3.0%		9	1.6%	109	5.7%	315	8.0%	2.3%
5 to 11 years	14	1.9%		14	1.7%	39	10.7%	136	175	10.7%	53	10.2%		53	5.7%	17	5.7%		17	3.1%	123	6.4%	259	6.6%	0.2%
12 to 17 years	6	0.8%		6	0.7%	11	3.0%	38	49	3.0%	34	6.5%		34	3.7%	17	5.7%		17	3.1%	68	3.5%	106	2.7%	-0.8%
18 to 24 years	20	2.7%		20	2.4%	18	4.9%	63	81	4.9%	32	6.2%		32	3.5%	26	8.7%		26	4.8%	96	5.0%	159	4.0%	-1.0%
25 to 34 years	15	2.0%		15	1.8%	88	24.1%	308	396	24.1%	60	11.5%		60	6.5%	21	7.0%		21	3.8%	184	9.6%	492	12.5%	2.9%
35 to 49 years	57	7.7%		57	6.8%	102	27.9%	357	459	27.9%	93	17.9%		93	10.1%	62	20.7%		62	11.3%	314	16.3%	671	17.0%	0.7%
50 to 59 years	94	12.7%	29.12	123	14.8%	38	10.4%	133	171	10.4%	65	12.5%	81	146	15.8%	61	20.3%	49	110	20.2%	258	13.4%	550	13.9%	0.6%
60 to 69 years	259	35.0%	58.24	317	38.1%	3	0.8%	10	13	0.8%	80	15.4%	162	242	26.2%	54	18.0%	99	153	27.9%	396	20.6%	725	18.4%	-2.2%
70 to 84 years	250	33.7%	53.872	304	36.5%	7	1.9%	24	31	1.9%	54	10.4%	150	204	22.1%	33	11.0%	91	124	22.7%	344	17.9%	663	16.8%	-1.0%
85 and over years	22	3.0%	4.368	26	3.2%	0	0.0%	0	0	0.0%	11	2.1%	12	23	2.5%	0	0.0%	7	7	1.4%	33	1.7%	57	1.4%	-0.3%
Median Age (years)	66					33					43					50					51				
Average household size (number of persons)	1.6					2.8					2.5					2.8					2.3				
	*assumes a HH size of 1.6 and an age distribution of 20 percent 50-59 years, 40 percent 60-69 years, 37 percent 70-84 years, 3 percent 85 years and over																								
	Based on data from Port Stephens Council for completed approved dwellings since 2011. Estimates made at the SA1 level. Estimates for Seaside used average household size and age structure from 2011 census.																								

GHD

133 Castlereagh St Sydney NSW 2000

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T: +61 2 9239 7100 F: +61 2 9239 7199 E: sydmail@ghd.com.au

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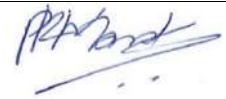
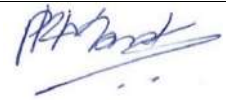
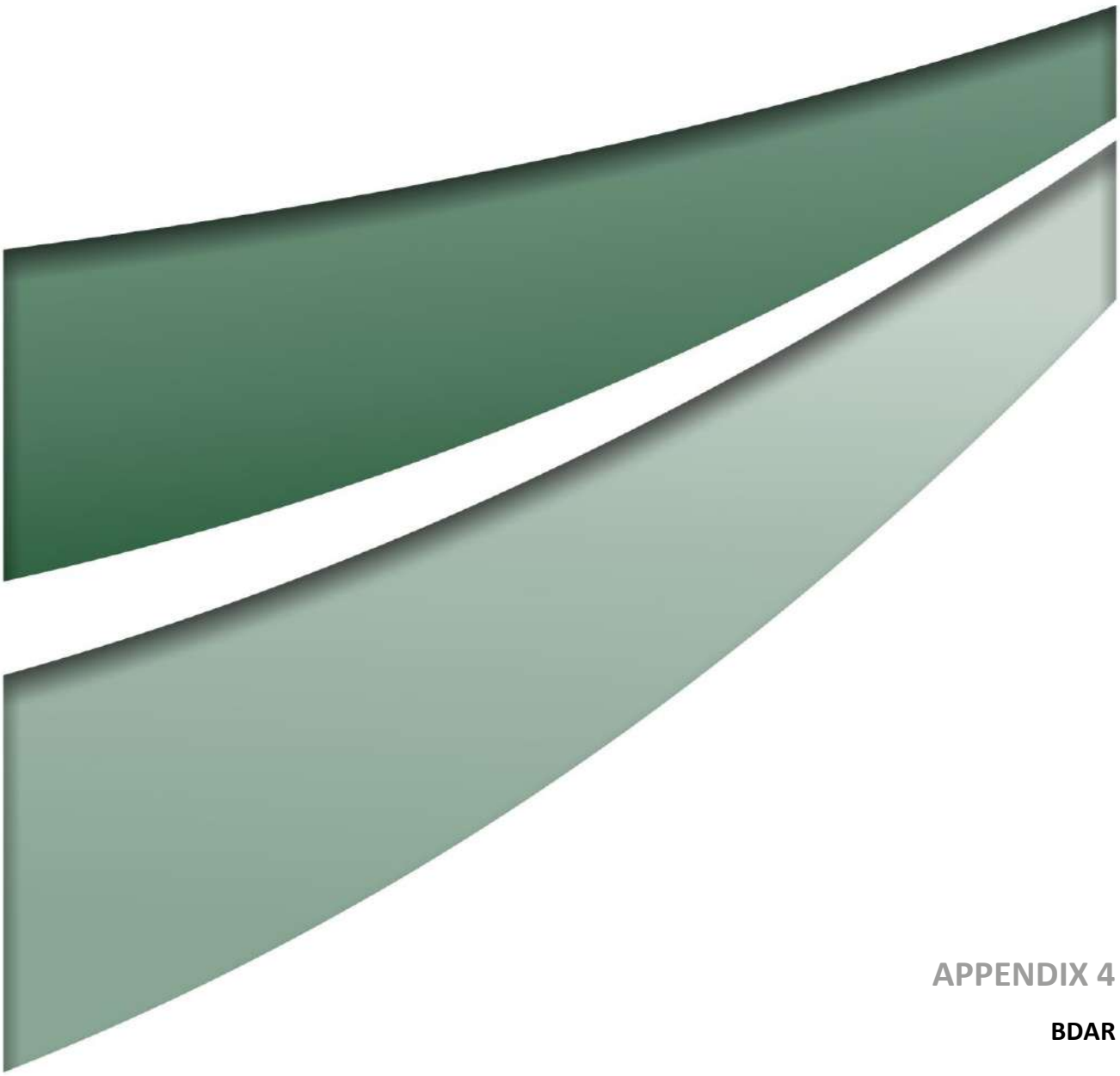
A	A Mithieux	P Mandke		M Lander		29/06/17
0	L Jessup	P Mandke		M Lander		17/07/17
1	L Jessup	M Lander		M Lander		22/08/17



APPENDIX 4

BDAR

umwelt

Inspired people | Dedicated team
Quality outcomes

DHA
Defence Housing Australia

RIFLE RANGE FERN BAY MASTER PLAN RESIDENTIAL DEVELOPMENT

Biodiversity Development Assessment Report

FINAL

June 2019

RIFLE RANGE FERN BAY MASTER PLAN RESIDENTIAL DEVELOPMENT

Biodiversity Development Assessment Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Defence Housing Australia

Project Director:	Naomi Buchhorn
Project Manager:	Bill Wallach
Report No.	3764/R08/V2
Date:	June 2019

Newcastle

75 York Street
Teralba NSW 2284

Ph. 02 4950 5322

www.umwelt.com.au

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Executive Summary

Defence Housing Australia (DHA) is seeking to provide adequate housing for Australian Defence Force personnel and their families in the Newcastle area. To meet this demand DHA are seeking approval to rezone the part of the former Rifle Range at Fern Bay from the current Environmental Conservation (E2) to Medium Density Residential (R3) under the Port Stephens Local Environmental Plan (LEP) 2013 to allow for a master planned residential subdivision and conservation.

The former Rifle Range site is located off Popplewell Road in Fern Bay, in the Port Stephens Council Local Government Area (LGA). The Development Footprint covers an area of 22.65 hectares and is bordered by the coastal sand dunes of Stockton Bight to the east.

This Biodiversity Development Assessment Report (BDAR) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of DHA to assess the potential biodiversity impacts of the proposed residential subdivision in accordance with the Biodiversity Assessment Methodology (BAM).

Surveys of the Development Footprint identified two Plant Community Types (PCTs) across five condition classes being:

- PCT1646 Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- PCT1725 Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast

Following the application of avoidance and mitigation measures, the BAM assessment identified the following biodiversity credits required to offset the residual impacts of the proposed development:

- 196 ecosystem credits for PCT1646 Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- 3 ecosystem credits for PCT1725 Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast.

DHA is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of biodiversity values as a result of the proposed development as required under the *Biodiversity Conservation Act 2016* (BC Act). This will be undertaken using one or more of the following options:

- the establishment and retirement of credits within a Stewardship site
- securing required credits through the open credit market, and/or
- payments to the Biodiversity Conservation Fund.

Glossary

APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BAM	Biodiversity Assessment Methodology
BBAM	BioBanking Assessment Methodology
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
DHA	Defence Housing Australia
CEEC	Critically Endangered Ecological Community
CKPoM	Comprehensive Koala Plan of Management
Development Footprint	The total impact zone associated with the proposed development. The proposed disturbance area is referred to throughout this report as the Development Footprint in accordance with the BAM.
DoEE	Commonwealth Department of the Environment and Energy
Ecosystem credit	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at an offset site.
EEC	Endangered Ecological Community
EP	Endangered Population
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographical Information System
IBRA	Interim Biogeographic Regionalisation for Australia (Version 7)
LEP	Local Environmental Plan
LGA	Local Government Area
MGA	Map Grid of Australia
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool
PSC	Port Stephens Council
SAII	Serious and Irreversible Impact
SAT	Spot Assessment Technique
Species credit	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection database.

Strahler Stream Order	Classification system that gives a waterway an 'order' according to the number of tributaries associated with it (Strahler, A. N. 1952).
TEC	Threatened Ecological Community
TBDC	Threatened Biodiversity Data Collection
VIS	Vegetation Information System

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1 Introduction

1.1 Background

Defence Housing Australia (DHA) is proposing a Master Plan residential development for a parcel of land commonly referred to as the 'Rifle Range', the boundary of which is Lot 5 DP 233358 (the Study Area) in Fern Bay, NSW (refer to **Figure 1.1**). As part of the development, DHA are seeking rezoning of part of the Study Area from the current Environmental Conservation (E2) to Medium Density Residential (R3) under the Port Stephens Local Environmental Plan (LEP) 2013 to allow for a residential subdivision and conservation.

The Study Area has been subject to ongoing investigations (including ecological survey) as a potential development site since 2008. The ecological features identified as part of such investigations (including current and previous field survey) have been used to guide the design of an appropriate Master Plan that informs the planning proposal, with the aim of providing a development approach which balances the economic potential of the Study Area with appropriate biodiversity conservation outcomes for the broader Stockton area.

The Study Area covers a total of approximately 112 hectares (ha), extending east from Popplewell Road Fern Bay, through the predominately vegetated (although much of it is regeneration) block, over the secondary dunes and through to the primary dunes of Stockton Beach. The proposed area of development, referred to hereafter as the Development Footprint (in accordance with BAM), only covers an area of 22.65 ha.

The proposed Rifle Range Master Plan Residential Development will be assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). In accordance with Section 7.7 of the *Biodiversity Conservation Act 2016* (BC Act) any application for a Part 4 development (other than state significant or complying) if it is likely to have a significantly effect on threatened species, is to be accompanied by a Biodiversity Development Assessment Report (BDAR). Section 7.2 of the BC Act identifies that an activity is likely to significantly affect threatened species if it is determined as such by a five part test of significance or if it exceeds the Biodiversity Offsets Scheme (BOS) minimum threshold area. The Rifle Range Master Plan Residential Development exceeds the BOS thresholds for development (Clause 7.2 of the Biodiversity Conservation Regulation 2017) in that, the proposed clearing associated with the development at 22.65 ha is greater than the allowable extent for the minimum lot size of the site as mapped in the LEP. As part of this scheme the impact of the development on threatened species and threatened communities and their habitats is assessed in accordance with the Biodiversity Assessment Methodology (BAM).

This Biodiversity Development Assessment Report (BDAR) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of DHA to assess the potential biodiversity impacts of the proposed master plan residential development in accordance with the BAM.

1.2 Project Description

DHA has an ongoing requirement to provide additional housing in the Newcastle area to cater for Newcastle-based Australian Defence Force (ADF) personnel and their families and to replace existing DHA dwellings that do not meet current standards. To meet this ongoing demand, DHA have recently purchased two sites near the Royal Australian Air Force (RAAF) Base Williamtown. The two sites are Fort Wallace at the northern edge of Stockton in the Newcastle local government area (LGA) and the Rifle Range at Fern Bay in Port Stephens LGA. DHA is working with both Councils, the NSW Department of Planning and Environment and other agencies to obtain the necessary planning approvals to develop these sites for residential use with a mix of housing suitable for both ADF personnel and the private market. This BDAR is only relevant for the proposed Rifle Range Residential Development.

The Study Area is located close to the RAAF Base Williamtown which lies approximately 11 kilometres to the north. The Newcastle central business district lies a few kilometres to the south across the Hunter River.

1.2.1 Proposed Master Plan – Rifle Range

The proposed Master Plan for the Rifle Range site includes a mix of residential typologies primarily placed within the former Rifle Range footprint (refer to **Figure 1.2**). The Master Plan has sought to retain the Rifle Range landscape and focus development within the previously disturbed areas of the site. The residential typologies for the Rifle Range include the following:

- **Townhouses –** up to 68 attached one to three storey dwellings with a lightweight design that facilitates layouts that are responsive to site features and context.
- **Coastal cluster houses –** up to 120 townhouse style dwellings set within natural landscape areas. Private open space is limited to decks and immediate terrace areas attached to each dwelling.
- **Courtyard homes –** up to 48 large courtyard family homes including four bedrooms, three bathrooms, open plan living space, single garage and an ample rear garden.
- **Single eco-homes –** up to 16 lightweight, climate responsive individual homes set within generous lots.
- **Dune apartments –** up to 66 small scale apartments with one to three bedrooms each, in blocks up to four stories.

The Master Plan residential development requires an Asset Protection Zone (APZ). The impacts of the APZ have also been considered in the BDAR. Details of the APZ are provided in the Rifle Range Bushfire Assessment prepared by Kleinfelder (2018). In summary the APZ varies from between 13 metres (m) and 32 m in width, depending on aspect, vegetation classification, slope and Bushfire Attach Level (BAL).

Furthermore, the APZ will incorporate two levels of clearance depending on where it occurs in relation to the Master Plan. Where the APZ intersects with proposed residential lot boundaries, infrastructure (roads, access tracks…etc) it is assumed that all existing vegetation will be removed (including ground layer, mid-storey and canopy vegetation). While in the outer boundary of the APZ, i.e. where it occurs outside of direct impacts from the proposed development, the existing vegetation will be managed to reduce bushfire hazard and partially impacted. That is, in these areas, Umwelt understand that the existing ground layer and mid-storey will be entirely removed, while the existing canopy layer will be thinned to approximately 30 percent of what is currently present to reduce canopy connectivity.

Image Source: Nearmap (May2016)
Data Source: LPI NSW (2009)

0 1.0 2.0 2.5km
1:50 000

Legend

- Study Area
- National Park
- State Conservation Area
- Regional Park

FIGURE 1.1

Locality Map

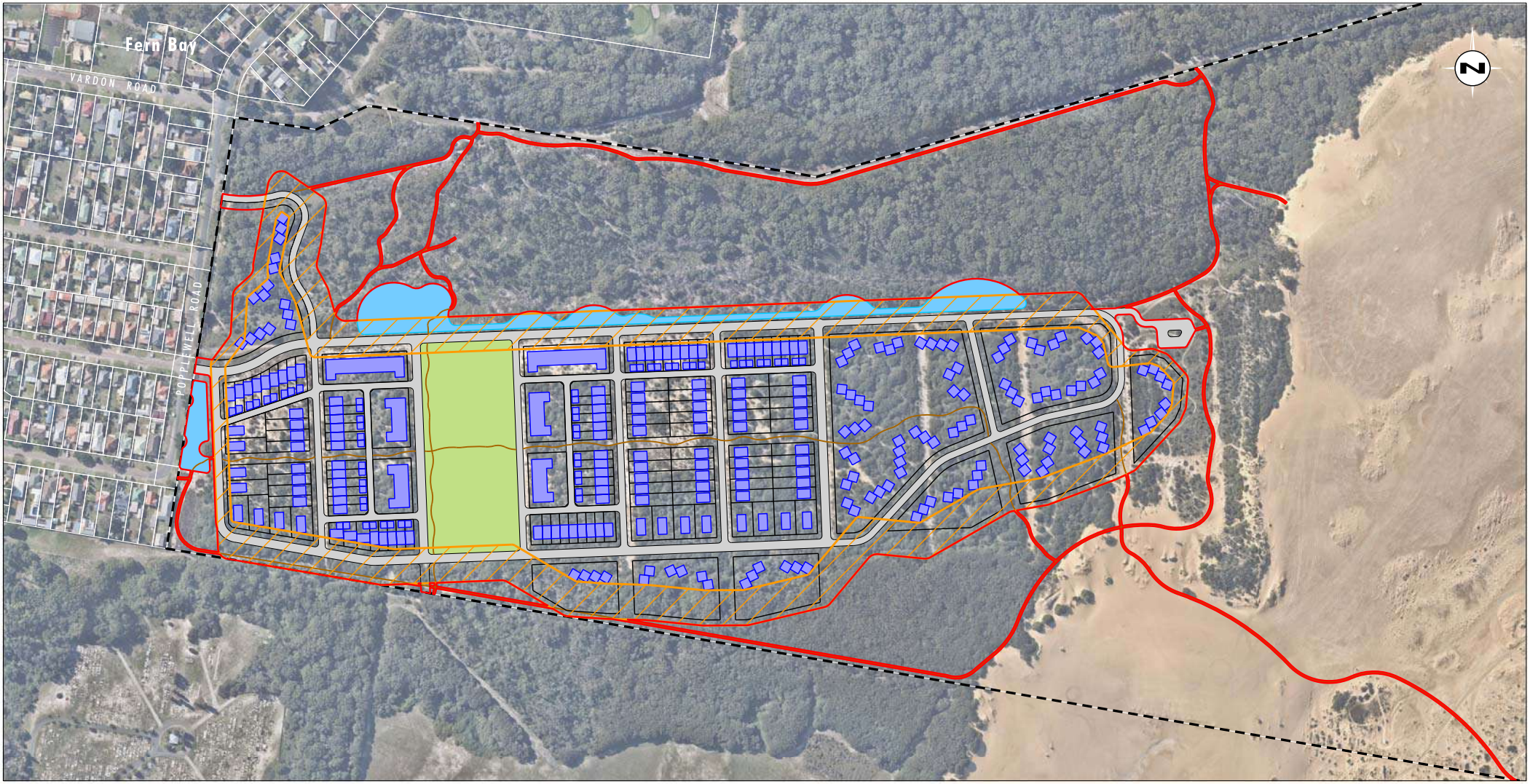

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2017), Architectus (2019)

0 100 200 250m
1:5 000

Legend

- Study Area
- Development Footprint
- Asset Protection Zone
- Proposed Dwelling and Existing Heritage Buildings
- Tracks
- Stormwater Detention Basin
- Park Area

FIGURE 1.2

Proposed Master Plan

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20190326 11.33

1.2.2 Guiding Principles

It is envisaged that a residential development at the Rifle Range would develop the site and the areas of Stockton and Fern Bay as unique coastal communities with strong links to Newcastle and the growing Hunter region. The Master Plan aims to provide residential housing while balancing the natural coastal environment and cultural heritage assets of the site.

Guiding principles for the rezoning and development of the Rifle Range, which have shaped the design considerations of the Master Plan, include the following:

- **Touch lightly on the land –** raised building (no slabs), working with the existing natural topography to minimise earthworks.
- **Embrace the coastal ecology –** minimisation of private open space and boundary fencing, native endemic planting only, maximise views to the ocean, dunes, river and bushland.
- **Celebrate history and cultural heritage –** retain heritage structures, connect with the Worimi reserve.
- **Create a diverse community –** mix of building typologies for defence, private and affordable housing needs, and recreational opportunities for visitors.
- **Open the gates to the public –** provide public access via the local road, pedestrian and cycle networks, controlled access to the beach and dunes.
- **Utilise interesting architectural forms –** staggered building heights, natural materials and finishes, varied street setbacks.

1.3 Development Footprint Information

The Development Footprint will be subjected to a range of disturbances as described in **Section 1.2** and **Section 5.**

The location of the development footprint in the landscape is summarised in **Table 1.1**.

Table 1.1 Development Footprint Location in the Landscape

Development Footprint Location in the Landscape	
IBRA Bioregion	NSW North Coast
IBRA Subregion	Karuah Manning
Mitchell Landscape	Sydney – Newcastle Barriers and Beaches
LGA	Port Stephens Council
Development Footprint Size	22.65 hectares
Assessment Type	Site-based
Lot and DP	Lot 5 DP233358
Total Lot Area	111.66 hectares

Vegetation in the Development Footprint has been subjected to human disturbances including activities during the active use of the Rifle Range, particularly within the former firing mounds and more recently recreational vehicles and illicit dumping. Unauthorised access through the Development Footprint is evident through numerous locations of illegal dumping of materials while there are also a number of sites that appear to be used for gatherings (i.e. presence of chairs and fire pits).

The Development Footprint comprises variable vegetation, ranging from remnant vegetation north of the existing main access track and along the southern boundary as well as disturbed dense scrub through the central portion of the Development Footprint and a series of cleared access tracks. The remnant vegetation also varies between being of reasonable quality in the north to poorer quality in the south with increased cover of high threat weeds. Retained vegetation in the northern portion of the Study Area adjoins the Worimi Regional Park and represents the highest quality vegetation and habitats on the site.

1.4 Local Ecological Context

The Development Footprint is located on the western edge of Fern Bay, NSW, at the southern extent of the NSW North Coast IBRA region, (refer to **Figure 1.3** and **Figure 1.4**). It is located between residential development and conservation lands, including housing to the west of Popplewell Road, the Stockton Centre and Fort Wallace to the south, active sand dunes to the east and the Worimi Regional Park adjoining the northern portion of the site.

The Worimi Regional Park constitutes part of the wider Worimi Conservation Lands (WCL). The WCL occur between Fern Bay and Anna Bay along Stockton Bight and includes a national park, state conservation area and regional park. The WCL provide an important habitat link within a broader sub-regional wildlife corridor from the Hunter Wetlands National Park in the estuary of the Hunter River to the northwest through to Tomaree National Park and Tilligerry State Conservation Area in the north.

The active sand dune system of Stockton Bight borders the eastern boundary of the Development Footprint. This coastal sand dune system extends from Stockton, approximately 28 km north to Anna Bay, NSW.

The majority of the WCL are dominated by frontal dune blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*) forests on the freely draining quaternary sand with coastal tea-tree banksia scrub on low dunes rises and slopes in the south (Bell and Driscoll 2010, OEH 2015). Along the length of the beach, depressions in the dune system where groundwater meets the surface support beach wetlands with and foredune spinifex occurring sporadically along the mobile dunes (Bell and Driscoll 2010).

Fauna habitats in the locality include forests, coastal sand scrub and sand dunes. Where there is remnant native vegetation in the wider locality, a number of Threatened Ecological Communities (TECs) as listed under the BC Act are known to occur including Coastal Saltmarsh, Swamp Sclerophyll Forest on Coastal Floodplains, Freshwater Wetlands on Coastal Floodplains, Swamp Oak Floodplain Forest and River-flat Eucalypt Forest. Where there is suitable habitat a range of threatened flora species are known to occur in the coastal dune system of Stockton Bight including Earp's gum (*Eucalyptus parramattensis* subsp. *decadens*), sand doubletail (*Diuris arenaria*), rough doubletail (*Diuris praecox*) and coast groundsel (*Senecio spathulatus*) all listed under the BC and/or EPBC Acts (OEH 2018a).

Records of threatened fauna species in coastal dune system of Stockton Bight include; powerful owl (*Ninox strenua*), wallum froglet (*Crinia tinnula*), little tern (*Sternula albifrons*), masked owl (*Tyto novaehollandiae*), white-bellied sea eagle (*Haliaeetus leucogaster*), New Holland mouse (*Pseudomys novaehollandiae*), koala (*Phascolarctos cinereus*), squirrel glider (*Petaurus norfolcensis*), grey-headed flying fox (*Pteropus poliocephalus*), little bentwing-bat (*Miniopterus australis*), eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), east coast freetail-bat (*Mormopterus norfolkensis*) and greater broad-nosed bat (S*coteanax rueppellii*) (OEH 2018a).

Image Source:Nearmap (Jan 2019)
Data Source: Department of Finance, Services & Innovation (2018)

0 0.25 0.5 1.0km
1:25 000

Legend

- Development Footprint
- 1500m Buffer Area
- Cadastre
- Drainage

FIGURE 1.3

Site Map

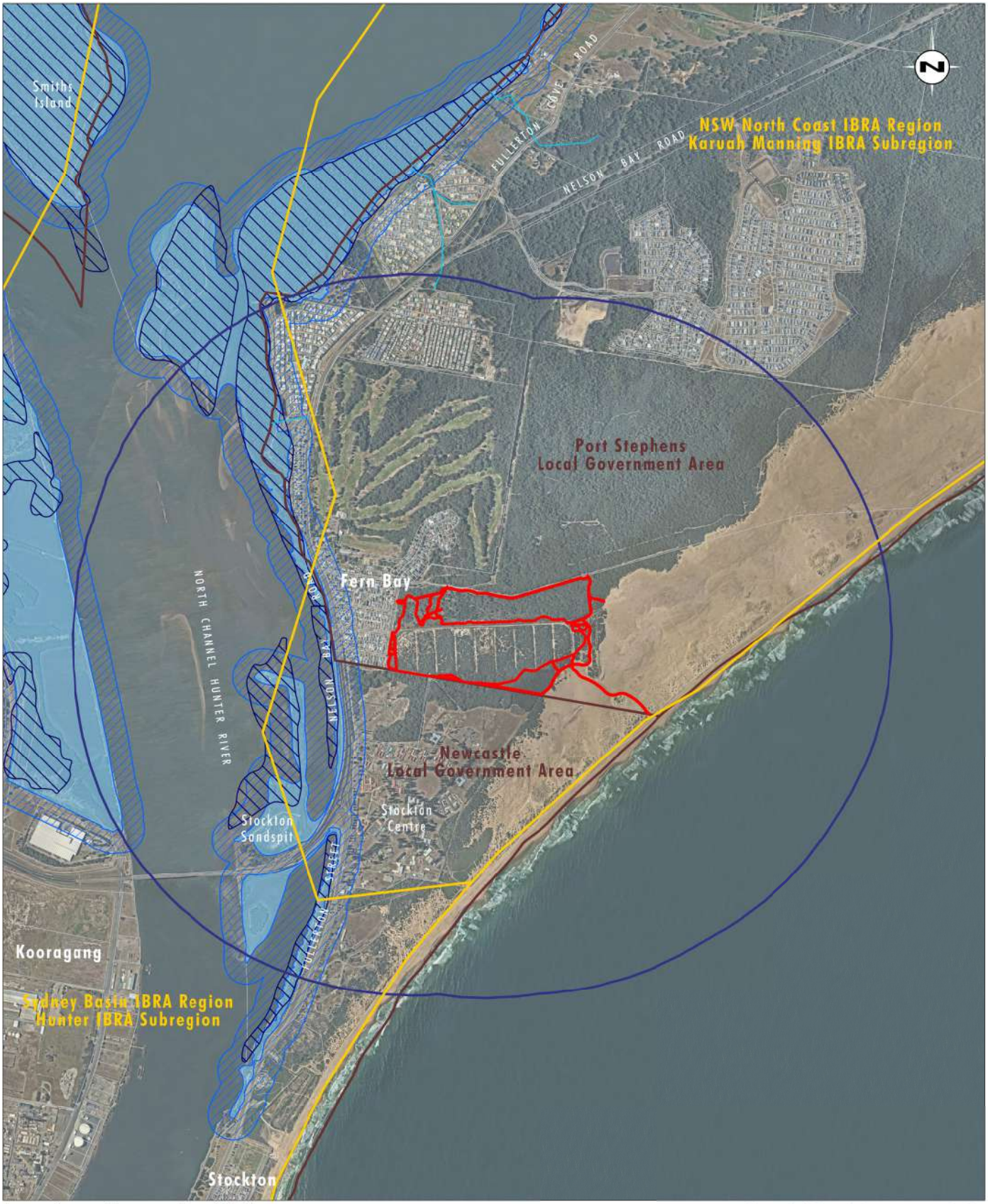

Image Source:Nearmap (Jan 2019)
Data Source: Department of Finance, Services & Innovation (2018)

0 0.25 0.5 1.0km
1:25 000

Legend

- Development Footprint
- 1500m Buffer Area
- Local Government Area
- IBRA Region/Subregion Area
- Cadastre
- Drainage
- Coastal Wetlands
- Proximity Area for Coastal Wetlands
- SEPP14 Wetland

FIGURE 1.4

Location Map - IBRA Regions/Subregions and Local Government Area

File Name (A4): R08/3764_056.dgn
20190326 13.04

Image Source:Nearmap (Jan 2019)
Data Source: OEH (2017)

0 0.25 0.5 1.0km
1:25 000

Legend

- Development Footprint
- 1500m Buffer Area
- Native Vegetation

Mitchell Landscapes:

- Lower Hunter Channels and Floodplains
- Sydney - Newcastle Barriers and Beaches

FIGURE 1.5

Location Map - Landscape Features

1.5 Key Resources, Policies and Documents

The following key resources, policies and documents were used during the preparation of this BDAR for the Proposed Modification:

- Biodiversity Assessment Method (OEH 2017a)
- Biodiversity Assessment Method Operational Manual (Stage 1) (OEH 2018d)
- Biodiversity Assessment Calculator
- BioNet Atlas of NSW Wildlife database and mapping tool (OEH 2018a), accessed December 2018
- Threatened Biodiversity Data Collection (TBDC) (OEH 2018b), accessed February 2019
- Vegetation Information System (VIS) Classification Database (OEH 2018c), accessed February 2019
- NSW Guide to Surveying Threatened Plants (OEH 2016) and
- Department of the Environment and Energy (DoEE) Protected Matters Search Tool (DoEE 2018a), accessed November 2018.

1.6 Report Preparation

This BDAR was prepared by Bill Wallach (Senior Ecologist and Accredited BAM Assessor), Emily Gardiner (Ecologist) and Amber Wilson (Ecologist). Field surveys were undertaken by Bill Wallach, Allison Riley, Rhys Osborne, Amber Wilson, James Garnham and Emily Gardiner. A review of this document was completed by Project Director, Naomi Buchhorn (Principal Ecologist).

Table 1.2 outlines the details of the Accredited BAM Assessors involved in the survey, calculations and reporting for the Proposed Modification. In addition to the two ecologists presented below, James Garnham has recently completed the necessary BAM training and awaits his formal accreditation.

Table 1.2 Accredited BAM Assessors and their Role on this Proposed Modification

Name	Assessor ID	Role
Bill Wallach ***Senior Ecologist***	BAAS17068	BDAR Preparation BAM Calculator Application Field Surveys Vegetation Mapping and PCT Allocation
Allison Riley ***NSW Ecology Manager***	BAAS17042	Field Surveys

2 Methods

2.1 Landscape Features and Site Context

Landscape features such as IBRA bioregions, IBRA subregions and NSW Mitchell Landscape regions, native vegetation extent within a 1500m buffer area, cleared areas, rivers, streams, wetlands and connectivity features were identified within the Development Footprint where appropriate in accordance with Section 4.2 of the BAM (OEH 2017a).

Determining the 'Site Context' of the Development Footprint is calculated by assessing the native vegetation cover and patch size within the Development Footprint in accordance with Section 4.3 of the BAM (OEH 2017a).

2.2 Native Vegetation Assessment

2.2.1 Literature and Database Review

A review of previous documents and reports relevant to the Master Plan residential development was undertaken. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species, endangered populations (EPs) and TECs.

Relevant documents included:

- Threatened Biodiversity Data Collection (OEH 2018b) reporting for known/predicted threatened communities in the NSW North Coast - Karuah-Manning IBRA subregion
- PlantNET (Royal Botanic Gardens Sydney) database search for Rare or Threatened Australian Plant species within the Port Stephens LGA, accessed September 2016
- VIS Classification Database (OEH 2018c), accessed November 2018
- DoEE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed August 2018
- Ecological Constraints Assessment – Rifle Range, Stockton Peninsula (Kleinfelder 2015)
- Ecological Constraints Report, Stockton Rifle Range, Stockton, NSW (SMEC 2008)
- Rifle Range Defence Housing Project – Ecological Assessment Report (Umwelt, 2018)
- Vegetation of the Worimi Conservation Lands Port Stephens, NSW: Worimi NP, Worimi SCA and Worimi RP (Bell and Driscoll 2010)
- Fern Bay Seaside Village Ecology Assessment Report (ERM 2009a)
- Worimi Regional Park Vegetation Management Plan (ERM 2009b)
- Worimi Conservation Lands Plan of Management (OEH 2015)
- Port Stephens Council Comprehensive Koala Plan of Management (PSC 2002)

- Port Stephens Council Koala Habitat Planning Map (PSC 2007)
- Greater Hunter Native Vegetation Mapping (Sivertsen et al. 2011).

2.2.2 Previous Field Surveys

Ecological field surveys have been carried out in the Study Area over many years and seasons including in December 2002 (Ecotone 2003), April 2007 (SMEC 2008), October 2015 (Kleinfelder 2015). Throughout these surveys, the following has been undertaken:

- Flora surveys including four 20m x 20m quadrats
- Diurnal fauna observations including signs of presence surveys and targeted bird surveys
- Habitat assessments
- Nocturnal spotlighting, call playback and Anabat surveys, and
- Reconnaissance vegetation mapping and weed mapping.

The results of these surveys have been reviewed as part of the literature review outlined in **Section 2.1**.

A site inspection was undertaken by Umwelt ecologists on 25 May 2016 in order to complete ground-truthing of previous surveys and identification of any important ecological features. Surveys were undertaken in accordance with the BBAM (2014). This included:

- Rapid vegetation mapping reconnaissance
- Systematic plots/transect surveys
- Targeted orchid surveys
- Habitat tree survey
- Recording dominant weed species and infestations
- Habitat assessments for threatened species
- Diurnal bird surveys
- Spot Assessment Technique (SAT) surveys for koala (*Phascolarctos cinereus*) as per Phillips and Callaghan (1995)
- Call playback for masked owl (*Tyto novaehollandiae*), powerful owl (*Ninox strenua*), squirrel glider (*Petaurus norfolcensis*) and koala
- Spotlighting searches for nocturnal threatened fauna
- Two remote camera survey locations over seven nights targeting ground-dwelling threatened mammal species
- One Anabat survey location over seven nights targeted threatened micro-bat species (set up on 25 May 2016 and collected after seven nights on 1 June 2016) and
- Opportunistic observations throughout the site inspection.

Targeted orchid surveys were completed by two Umwelt ecologists on 8 September 2016 for sand doubletail (*Diuris arenaria*) and rough doubletail (*Diuris praecox*) within suitable habitat. Known records of the species were visited prior to this survey to confirm flowering. No individuals were recorded (Umwelt 2018).

Full details on the previous ecological surveys completed by Umwelt are provided in the previous Ecological Assessment (Umwelt 2018).

2.2.3 Floristic and Vegetation Integrity Survey

Floristic and vegetation integrity surveys were undertaken over the following survey periods:

- 16 August 2018
- 17 August 2018
- 21 September 2018, and
- 19 December 2018.

A total of **14** BAM plots were conducted within the Study Area including **10** BAM Plots within the Development Footprint during the surveys undertaken for this assessment (refer to **Figure 2.1**). Floristic and vegetation integrity data was collected in accordance with requirements under the BAM (OEH 2017a).

At each floristic and vegetation integrity plot, data was recorded according to Section 5 of the BAM (OEH 2017a). This involved setting out 20 x 50 m, 20 x 20 m and 1 x 1m plots. The location of each plot was recorded using a hand-held GPS with accuracy of ± 5 m. The Map Grid of Australia (MGA) coordinate system was used.

At each plot/transect, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 m plot. Searches of each 20 x 20 m plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of any shrub, mid-storey, canopy and emergent layers were also thoroughly examined.

For each flora species recorded in the plot, the following data was collected in accordance with Table 2 of the BAM (OEH 2017a):

- stratum/layer in which the species occurs
- growth form
- scientific name and common name
- cover and
- abundance.

The following attributes were recorded at each vegetation integrity plot, in accordance with the BAM (OEH 2017a) to determine the condition of the vegetation zone:

- ***Composition*** - native plant species richness by growth form (within the 20 x 20 m plot)
- ***Structure*** – estimate foliage cover of native and exotic species by growth form (within the 20 x 20 m plot)
- ***Function*** **-** (within the 20 x 50 m plot) including, number of large trees, presence or otherwise of tree stem size classes, presence or otherwise of canopy species regeneration, length of fallen logs, percentage cover for litter (recorded from five 1 x 1 m plots), number of trees with hollows and high threat exotic cover.

Table 2.1 outlines the floristic survey effort in the Development Footprint.

Table 2.1 Adequacy of Floristic and Vegetation Integrity Survey in the Development Footprint

Veg. Zone	Plant Community Type (PCT) *Condition Class*	Area in the Development Footprint (ha)	Number of Floristic and Vegetation Integrity Plots	
			Required	Completed
1	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Forest)*	0.68	1	1
2	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Tea-tree – Banksia Scrub)*	15.14	3	3
3	PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast *Moderate*	0.12	1	1
4	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Disturbed (Forest)*	1.55	1	1
5	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Cleared*	5.02	3	3
N/A	Beach Wetlands – No equivalent PCT (avoidance measures addressed in **Section 4.1**)	0.01	N/A	N/A
N/A	Sand Dunes – No equivalent PCT (avoidance measures addressed in **Section 4.1**)	0.13	N/A	N/A
TOTAL		**22.65**	**9**	**9**

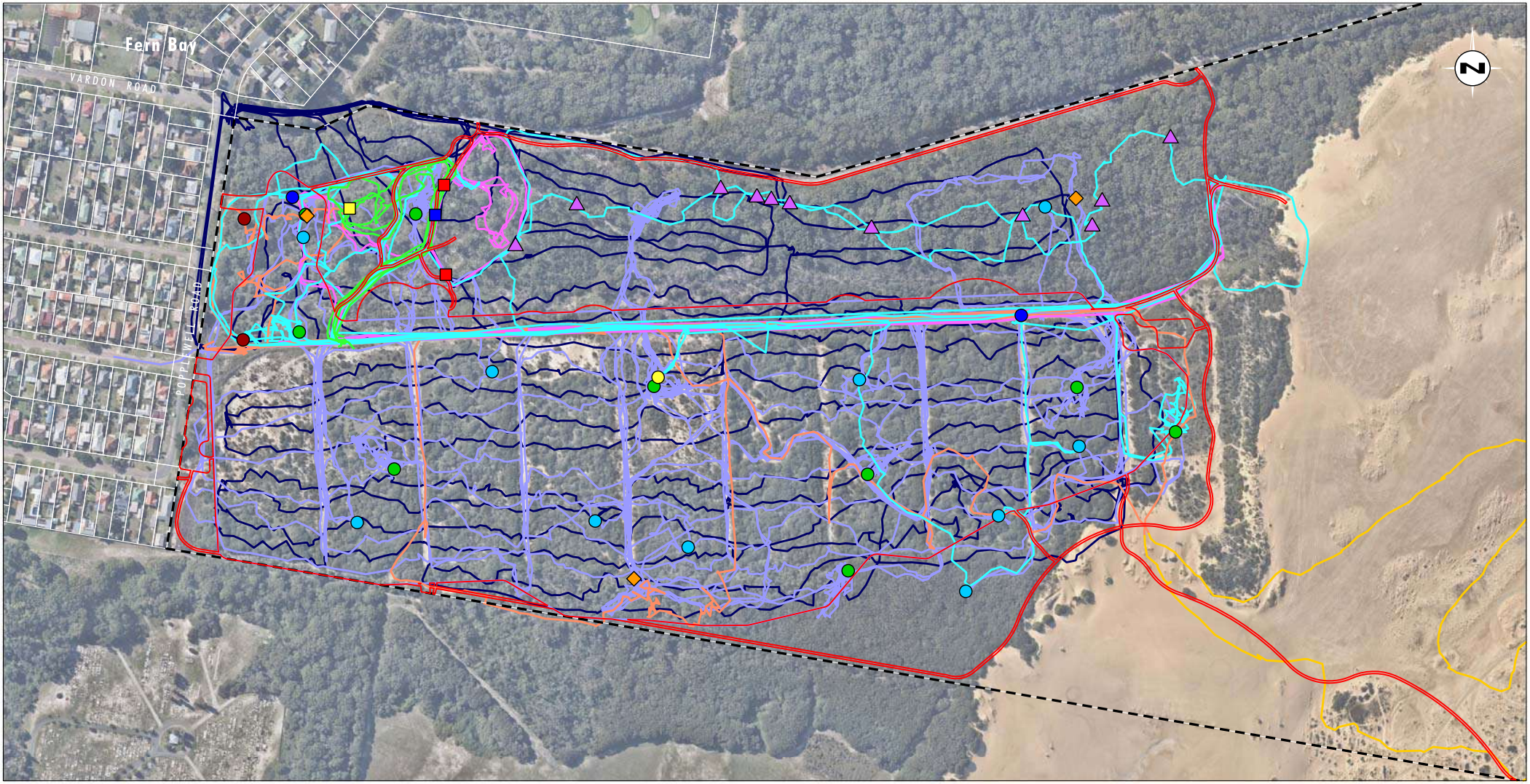

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2017), Architectus (2019)

0 100 200 250m
1:5 000

Legend

- Study Area
- Development Footprint
- Targeted Threatened Flora Transect (Aug 2018)
- Targeted Threatened Flora Transect (Sep 2018)
- General Transect (Dec 2018)
- Amphibian Spotlight Transect (Jan 2019)
- Koala SAT Transect (Feb 2019)
- Spotlighting Transect (Feb 2019)
- Shorebird Transect (Feb 2019)
- Amphibian Call Playback (Dec 2018)
- Amphibian Call Playback (Feb 2019)
- Amphibian Call Playback (Jan 2019)
- BAM Plot Location
- Bush Stone-curlew and Amphibian Call Playback (Dec 2018)
- Bush Stone-curlew Call Playback (Dec 2018)
- Call Playback Winter Birds (Aug 2018)
- Hollow Bearing Tree Inspection (Dec 2018)
- Koala SAT Transect
- Remote Camera

FIGURE 2.1

Current Survey Effort

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20190326 13.55

2.2.4 Targeted Threatened Flora Transects

The *NSW Guide to Surveying Threatened Plants* (OEH 2016) was released to guide assessors to identify the minimum standards to use when surveying for threatened plants. Surveys undertaken in accordance with this guide are a requirement under the BAM.

Transects of between 5 and 10 metres in suitable habitat for cryptic threatened flora were completed across the site to meet this requirement for the following flora species (refer to **Figure 2.1**):

- *Diuris praecox*
- *Diuris arenaria*
- *Corybas dowlingii*
- *Tetratheca juncea*

Surveys were completed by two suitably experienced ecologists over the following survey dates to coincide with known flowering periods for the target species:

- 16 August 2018
- 17 August 2018, and
- 12 September 2018.

2.2.5 Digital Aerial Photograph Interpretation

Digital imagery (aerial photographs) of the Development Footprint was viewed prior to and after vegetation survey to identify spatial patterns in vegetation, land use and landscape features. These informed field survey design and implementation, ecological assessment and vegetation community mapping of the Development Footprint.

Vegetation communities in the Development Footprint were mapped on-screen overlaying the October 2016 Google Earth imagery. Mapping was undertaken using the Manifold System 8.0 GIS and ESRI ArcMaps 10.6.

2.2.6 Plant Identification and Nomenclature Standards

All vascular plants recorded or collected within plots and on meandering transects were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results. Updated taxonomy has been derived from PlantNET (Botanic Gardens Trust 2018).

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

2.2.7 Vegetation Mapping

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the Development Footprint. Vegetation mapping involved the following key steps:

- preliminary review of digital airborne imagery to explore vegetation distribution patterns as dictated by change in canopy texture, tone and colour, as well as topography
- predicting the distribution of particular vegetation communities based on understanding the distribution of PCTs (OEH 2018c), plant communities as described in *Vegetation of the Worimi Conservation Lands Port Stephens* (Bell and Driscoll 2010) and the Greater Hunter Native Vegetation Mapping (Sivertsen *et al*. 2011).
- ground-truthing of the vegetation map based on survey effort
- revision of vegetation community floristic delineations based on plot data, and
- revision of the vegetation map based on ground-truthing.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata.

2.2.8 Threatened Ecological Community Delineation Techniques

Where applicable, vegetation communities identified in the Development Footprint were compared to TECs listed under the Commonwealth EPBC Act and NSW BC Act and an assessment of similarity with the NSW Scientific Committee Final Determinations and the Commonwealth Threatened Species Scientific Committee Listing and Conservation Advice completed. The following approach was used:

- full-floristic plot assessments and meandering surveys to determine floristic composition and structure of each ecological community
- comparison with published species lists, including lists of 'important species' as identified on the listing advice provided by the NSW Scientific Committee and/or Commonwealth Threatened Species Scientific Committee
- comparison with habitat descriptions and distributions for listed TECs
- assessment using guidelines and recovery plans published by the Commonwealth DoEE and the NSW OEH
- comparison with other assessments of TECs in the region.

2.2.9 Plant Community Type (PCT) Allocation

Each of the vegetation communities described within the Development Footprint were aligned with an equivalent PCT as detailed in the VIS Classification Database (OEH 2018c). For each vegetation community described in the Development Footprint, the dominant and characteristic species were entered into the online plant community identification tab and an initial list of PCTs was generated. The profiles for each of the possible PCT were then interrogated and the most appropriate match assigned based on floristic, structure, soil, landform and distribution details.

Further detail regarding this allocation for individual PCT is outlined in **Section 3.2.1.**

2.3 Threatened Species

2.3.1 Literature and Database Review

A review of previous documents and reports relevant to the proposed Master Plan residential development was undertaken. This included ecological reports, previous ecological surveys undertaken in the vicinity of the Development Footprint and also relevant ecological database searches. Relevant documents and resources included:

- OEH BioNet Atlas of NSW Wildlife database and mapping tool (OEH 2018a), accessed December 2018
- OEH Threatened Biodiversity Data Collection (OEH 2018b) for known/predicted threatened species in the Karuah Manning IBRA subregion, accessed February 2019
- PlantNET (Botanic Gardens Trust) database search for threatened plants within a 10 kilometre radius search from the Development Footprint, accessed February 2019
- DoEE Protected Matters Search Tool (DoEE 2018a) for known/predicted EPBC Act-listed species, accessed November 2018.

A preliminary assessment using the TBDC was undertaken which provided a list of species-credit species that might require survey and the suitable survey periods for each species. The results of these database searches, literature review and TBDC review were used to design the appropriate survey requirements for species-credit species.

2.3.2 Ecosystem-credit Species

Ecosystem-credit species are those threatened species that can be predicted by vegetation surrogates and landscape features. Ecosystem-credit species are not required to be specifically targeted during field surveys, however an assessment of the suitability of habitat in the Development Footprint is undertaken to determine the species presence or otherwise in the vegetation zones identified.

Appendix A outlines the ecosystem credit species predicted by the BAM calculator or identified in the literature review.

2.3.3 Species-credit Species

Appendix B outlines the species-credit species predicted by the BAM calculator or identified in the literature review and the targeted survey effort undertaken in accordance with BAM survey requirements. **Appendix B** also notes where species-credit species were not considered to require further survey in accordance with Section 6.4 (Step 3) of the BAM (2017).

Species-credit surveys considered the following survey guidelines:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* – Working Draft (DEC 2004)
- *NSW Guide to Surveying Threatened Plants* (OEH 2016)
- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009)
- *Draft Survey Guidelines for Australia's Threatened Orchids* (DoE 2013).

Targeted and opportunistic surveys and walking transects for species-credit species were undertaken across the Development Footprint in August 2018, September 2018, December 2018, January2019 and February 2019 (refer to **Figure 2.1**). **Table 2.2** outlines the dates, methods and species targeted during the surveys.

Table 2.2 Species credit species survey methodology and timing

Survey Date	Method	Species Targeted
16 - 17 August 2018	BAM floristic surveys and vegetation integrity data collection	N/A
	Threatened species transects Opportunistic observations and habitat mapping Walking transects	*Eucalyptus parramatensis* subsp. *decadens* *Diuris praecox* *Diuris arenaria* *Corybas dowlingii* *Tetratheca juncea*
	Call playback and habitat mapping for winter birds	*Anthochaera phrygia* *Callocephalon fimbriatum* *Calyptohynchus lathami* *Cercartetus nanus* *Haliaeetus leucogaster* *Hieraaetus morphinoides* *Lathamus discolor* *Lophoictinia isura* *Pandion cristatus*
16 August 2018 – 19 December 2018	Remote cameras targeting threatened terrestrial and arboreal mammals (left onsite until December 2018)	*Phascolarctos cinereus* *Phascogale tapoatafa* *Planigale maculata* *Petaurus norfolcensis*
12 September 2018	Targeted threatened species transects and habitat mapping Opportunistic observations and habitat assessments	*Diuris arenaria* *Diuris praecox* *Corybas dowlingii* *Tetratheca juncea*
21 September 2018	BAM floristic surveys and vegetation integrity data collection	N/A
	Opportunistic observations and habitat mapping	*Eucalyptus parramatensis* subsp. *decadens* *Diuris praecox* *Diuris arenaria* *Corybas dowlingii* *Tetratheca juncea*

Survey Date	Method	Species Targeted
21 September 2018	Opportunistic observations and habitat assessments	*Anthochaera phrygia* *Callocephalon fimbriatum* *Calyptohynchus lathami* *Haliaeetus leucogaster* *Hieraaetus morphinoides* *Lathamus discolor* *Lophoictinia isura* *Pandion cristatus* *Phascolarctos cinereus*
19 December 2018	BAM floristic surveys and vegetation integrity data collection	N/A
	Nocturnal call playback and amphibian searches Nocturnal call playback and spotlighting Shorebird searches on dune habitat Tree hollow inspections Giant dragonfly searches	*Burhinus grallarius* *Crinia tinnula* *Haematopus longirostris* *Hoplocephalus bitorquatus* *Litoria aurea* *Litoria brevipalmata* *Ninox connivens* *Ninox strenua* *Petalura gigantea* *Petaurus norfolcensis* *Phascolarctos cinereus* *Pteropus poliocephalus* *Tyto novaehollandiae* *Uperoleia mahonyi* *Xenus cinereus*
23 January 2019	Nocturnal call playback and amphibian searches	*Crinia tinnula* *Litoria aurea* *Litoria brevipalmata* *Uperoleia mahonyi*
21 – 22 February 2019	Nocturnal call playback and amphibian searches Koala SAT surveys Tree hollow inspections Shorebird searches on dune habitat	*Crinia tinnula* *Haematopus longirostris* *Litoria brevipalmata* *Litoria aurea* *Phascolarctos cinereus* *Uperoleia mahonyi* *Xenus cinereus*

2.3.4 Weather Conditions and Limitations

Table 2.3 outlines the weather conditions for the surveys. Data is derived from the Newcastle Nobbys Signal Station (061055) from the Bureau of Meteorology (BOM 2018).

Table 2.3 Weather Conditions for Surveys

Date	Daily Data			Monthly Data		
	Min-Max Temp. °C	Rainfall mm	Relative Humidity %	Min-Max Temp (mean)	Rainfall (total)	Relative Humidity (mean)
16 August 2018	16.3-24.4	0	64	10.0 -18.9	9.8	51
17 August 2018	9.2-19.9	0	33			
12 September 2018	13.3-26.3	0	76	12.2-19.8	100.2	67
21 September 2018	8.1-21.1	1.0	54			
19 December 2018*	21.0-24.0	0	90	19.1-25.1	39.6	75
23 January 2019	22.0-31.7	0	88	21.1-27.2	16.0	78
21 February 2019	21.1-24.2	0.2	72	21.0-27.1	11.8	77
22 February 2019	21.6-23.5	0	89			

* Heavy rain occurred on the night that this survey was completed, this rain was not captured on BOM until the following day, see detailed information below.

The surveys were influenced by seasonal factors as the surveys were conducted across three seasons.

Nocturnal call playback and amphibian searches conducted on 19 December 2018 occurred immediately prior to and during a rainfall event within the Study Area. Although **Table 2.3** indicates that no rainfall fell on this date, this was recorded by the BOM (2018) the following day (20 December 2018). In total, 17 mm of rainfall was recorded for this date. Umwelt understands that all or most of the rain fell on the evening of 19 December 2018. Furthermore, in the seven days (13 – 18 December 2018) leading up to the December amphibian survey a total of 16.8 mm of rainfall was recorded. In the seven days (16 – 22 January 2019) leading up to the January amphibian survey (23 January 2019) a total of 1.8 mm of rainfall was recorded.

Nocturnal call playback and amphibian searches on 21 February 2019 occurred subsequent to and during a rainfall event. The BOM (2018) recorded rainfall of 5.2 mm on the previous day (20 February 2019), and light showers occurred during the surveys.

3 Results

3.1 Landscape Value

The 1500m buffer area contains a range of landscape features typical of the landscapes around Fern Bay. These landscape features are shown in **Figure 1.4** and **1.5** and outlined in relation to the Development Footprint in **Table 3.1**.

Table 3.1 Landscape Features in the Development Footprint

Landscape Features	
IBRA Bioregion	NSW North Coast
IBRA Subregion	Karuah Manning
Mitchell Landscape	Sydney – Newcastle Barriers and Beaches
Rivers, Streams, Estuaries	None in the Study Area Locality - Hunter River, Hunter Estuary
Wetlands (within, adjacent to and downstream)	Beach wetlands (3.2 hectares within the Study Area but only 0.01 within Development Footprint)
Native Vegetation Cover	26.68 %
Areas of Geological Significance (including karst, caves, crevices, cliffs etc) or Soil Hazard Features	None identified
Areas of Outstanding Biodiversity Value	None identified
Cleared Areas	5.02 hectares (22 per cent) within the Development Footprint
Connectivity Features	As per paragraph 4.2.1.9 of the BAM (OEH 2017) there is connectivity of suitable habitat to the north of the Study Area that may facilitate the movement of threatened species across their range. The Worimi Regional Park forms the connectivity immediately to the north, before continuing in Worimi State Conservation Area and Worimi National Park (refer to **Section 1.4**).

3.2 Native Vegetation within the Development Footprint

3.2.1 Plant Community Types and Vegetation Zones

Surveys of the Development Footprint identified two Plant Community Types (PCTs) across five condition classes being (refer to **Figure 3.1**):

- PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
    - *Moderate (Forest)*
    - *Disturbed (Forest)*
    - *Moderate (Tea-tree – Banksia Scrub)*
    - *Cleared*
- PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast
    - *Moderate*

A description of the vegetation zones is provided below and a flora species list is included in **Appendix C**.

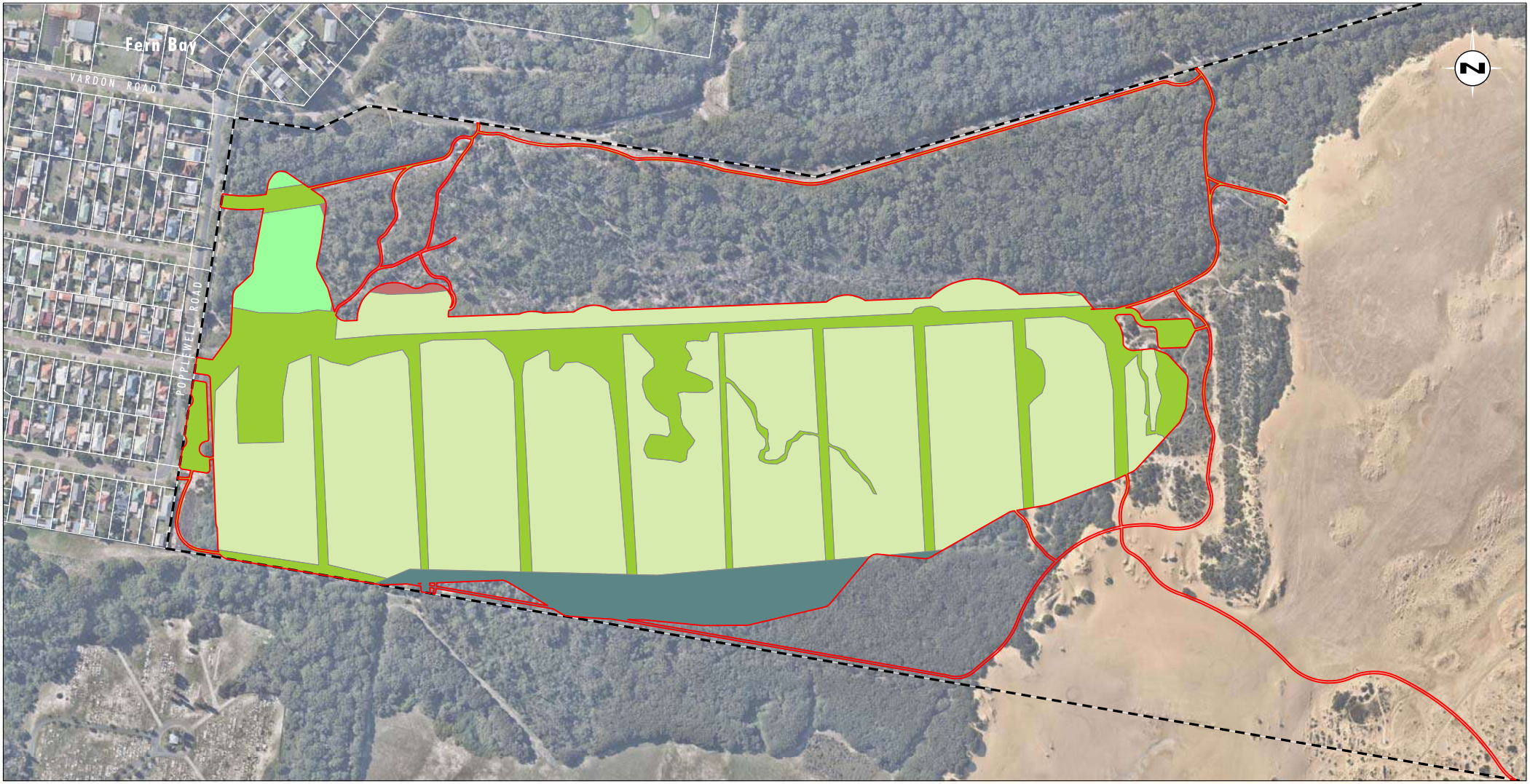

Image Source: Nearmap (Apr 2018)
Data Source: Department of Finance, Services & Innovation (2017), Architectus (2019)

0 100 200 250m
1:5 000

Legend

- Study Area
- Development Footprint
- VZ1 PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast - Moderate Forest
- VZ2 PCT1646 - Moderate (Tea Tree - Banksia Scrub)
- VZ3 PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast - Moderate
- VZ4 PCT1646 - Disturbed (Forest)
- VZ5 PCT1646 - Cleared

FIGURE 3.1

Vegetation Zones in the Development Footprint

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Vegetation Zone 1 – PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Moderate (Forest)*

PCT Name	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
Condition	Moderate (Forest)
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Class	Coastal Dune Dry Sclerophyll Forests
Percent cleared	45.00
Area in Development Footprint (ha)	0.68
Plots Required	1
Patch Size Class (ha)	101

General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. This vegetation community condition class is located primarily to the north of the Development Footprint adjoining the habitats of Worimi Regional Park.
Vegetation Structure Description	This community is a moderately open forest with a shrubby understorey. The canopy is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis*). The midstorey was dominated by old man banksia (*Banksia serrata*), Sydney golden wattle (*Acacia longifolia subsp. longifolia*) and coastal tea-tree (*Leptospermum laevigatum*), with occasional coast banksia (*B. integrifolia*), and coffee bush (*Breynia oblongifolia*). The ground cover consisted primarily of bracken fern (*Pteridium esculentum*) with spiny-headed mat-rush (*Lomandra longifolia*), raspwort (*Gonocarpus teucrioides*), blue flax lily (*Dianella caerulea*), blady grass (*Imperata cylindrica*) and kangaroo grass (*Themeda triandra*) also present. The exotic bitou bush (*Chrysanthemoides monilifera subsp. rotundata*) and lantana (*Lantana camara*) also occur in this community.
PCT Allocation	Vegetation Zone 1 was aligned with PCT1646 as it supports a number of the species and stratum specifics identified for the PCT as listed on the VIS Classification Database (OEH 2018c). The canopy is dominated by Sydney red gum/smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis),* both of which are key diagnostic species of PCT1646. Three of the four key diagnostic species listed for the PCT were found in this community. A total of 10 of the 12 diagnostic species (83%) were recorded in this vegetation zone, giving a high level of confidence to this PCT allocation. PCT1646 was determined to be the best overall fit in terms of diagnostic species and the community's location in the landscape.
BC Act Status	This vegetation community does not conform to a TEC listed under the TSC Act.
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.

Vegetation Zone 2 – PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Moderate (Tea-tree – Banksia Scrub)*

PCT Name	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
Condition	Moderate (Tea-tree – Banksia Scrub)
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Class	Coastal Dune Dry Sclerophyll Forests
Percent cleared	45.00
Area in Development Footprint (ha)	15.14
Plots Required	3
Patch Size Class (ha)	101
General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. This vegetation community condition class is likely to be derived from the Frontal Dune Blackbutt-Apple Forest that is a dominant community to the north and south of the Study Area. Historical disturbances from the former use of the Rifle Range have modified this community with groundcovers and shrubs now dominating. This community is likely to have previously conformed to the Frontal Dune Blackbutt-Apple Forest. This community occurs in the central portion of the Study Area associated with the Rifle Range footprint.
Vegetation Structure Description	This community occurs as a shrubland and is primarily dominated by coastal tea-tree (*Leptospermum laevigatum*) with occurrences of coastal wattle (*Acacia longifolia* subsp. *sophorae*), tree broom-heath (*Monotoca elliptica*) and coast banksia (*Banksia integrifolia*). The native groundcover is largely absent, and when present, consists primarily of pig face (*Carpobrotus glaucescens*) and spiny-headed mat-rush (*Lomandra longifolia*). The exotic bitou bush (*Chrysanthemoides monilifera subsp. rotundata*) and fireweed (*Senecio madagascariensis*) also occur in this community.
PCT Allocation	Vegetation Zone 2 was aligned with PCT1646 as it occurs adjacent to, or in proximity to, mainly intact vegetation which is consistent with PCT1646. This vegetation zone also contains a number of species which are consistent with this PCT. Considering the disturbed nature of this vegetation zone and the vegetation that occurs adjacent to or nearby this vegetation zone, PCT1646 was considered to be the most appropriate allocation. It is likely this area was once dominated by a more naturally-occurring and intact version of PCT1646 prior to historical disturbance.
BC Act Status	This vegetation community does not conform to a TEC listed under the TSC Act.
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.

Vegetation Zone 3 – PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast - *Moderate*

PCT Name	PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast
Condition	Moderate
Formation	Forested Wetlands
Class	Coastal Swamp Forests
Percent cleared	35.00
Area in Development Footprint (ha)	0.12
Plots Required	1
Patch Size Class (ha)	101
General Description	This vegetation community occurs on a low lying area in the north-west of the Study Area and is located either side of the Frontal Dune Blackbutt-Apple Forest resulting in ecotonal influences.
Vegetation Structure Description	This community is characterised by an open canopy of swamp mahogany (*Eucalyptus robusta*). Common midstorey species include coastal tea tree (*Leptospermum laevigatum*) and tantoon (*Leptospermum polygalifolium*)), with occasional instances of old man banksia (*Banksia serrata*) and coastal wattle (*Acacia longifolia subsp. sophorae*). The native groundcover is dominated by pomax (*Pomax umbellata*), spiny-headed mat-rush (*Lomandra longifolia*), blue flax-lily (*Dianella caerulea*), kangaroo grass (*Themeda triandra*) and bracken fern (*Pteridium esculentum*). Edge effects are present in this vegetation community due to the number of tracks through this part of the Study Area. A number of exotic species occur in the ground layer, including whiskey grass (*Andropogon virginicus*), fleabane (*Conyza bonariensis*), and bitou bush (*Chrysanthemoides monilifera subsp. rotundata*).
PCT Allocation	Vegetation Zone 3 was aligned with PCT1725 as it supports some of the species and stratum specifics identified for the PCT as listed on the VIS Classification Database (OEH 2018c). The canopy is dominated by swamp mahogany (*Eucalyptus robusta*), with a mid-storey containing tantoon (*Leptospermum polygalifolium*) both of which are diagnostic species of PCT1725. A total of 5 of the 11 diagnostic species (45%) were recorded in this vegetation zone. PCT1717, PCT1721 and PCT1724 were also considered for this vegetation community, but were ruled out due to species composition; namely, a lack of *Casuarina* and *Melaleuca* species present.
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

Vegetation Zone 4 – PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Disturbed (Forest)*

PCT Name	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	
Condition	**Disturbed (Forest)**	
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Class	Coastal Dune Dry Sclerophyll Forests	
Percent cleared	45.00	
Area in Development Footprint (ha)	1.55	
Plots Required	1	
Patch Size Class (ha)	101	
General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. This vegetation community condition class occurs in a small patch to the south of the Study Area.	
Vegetation Structure Decsription	This community is a moderately open forest with a shrubby understorey. The canopy is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis*), and a sub-canopy comprised of coastal tea-tree (*Leptospermum laevigatum*) and old man banksia (*Banksia serrata*). The midstorey was dominated by bitou bush (*Chrysanthemoides monilifera subsp. rotundata)* and lantana (*Lantana camara*), with occasional coastal wattle (*Acacia longifolia subsp. sophorae*) and tree broom-heath (*Monotoca elliptica)*. The ground cover consisted primarily of bracken fern (Pteridium esculentum) with spiny-headed mat-rush (*Lomandra longifolia*), blue flax lily (*Dianella caerulea*), blady grass (*Imperata cylindrica*) and panic veldtgrass (*Ehrhata erecta*) also present. The exotic asparagus fern (*Asparagus aethiopicus*) was also present in the ground layer.	
PCT Allocation	Vegetation Zone 4 was aligned with PCT1646 as it supports a number of the species and stratum specifics identified in Vegetation Zone 1. The canopy is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis),* both of which are key diagnostic species of PCT1646. Two of the four key diagnostic species listed for the PCT were found in this community. A total of 8 of the 12 diagnostic species (75%) were recorded in this vegetation zone, giving a high level of confidence to this PCT allocation. PCT1646 was determined to be the best overall fit in terms of diagnostic species and the community's location in the landscape.	
BC Act Status	This vegetation community does not conform to a TEC listed under the TSC Act.	
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.	

Vegetation Zone 5 – PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Cleared*

PCT Name	**PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast**
Condition	**Cleared**
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Class	Coastal Dune Dry Sclerophyll Forests
Percent cleared	45.00
Area in Development Footprint (ha)	5.02
Plots Required	3
Patch Size Class (ha)	101

General Description	This vegetation community occurs on the Holocene sands along the Port Stephens coastline where there is protection from direct coastal winds. Historical disturbances from the former use of the Rifle Range have modified this community, with large cleared areas occurring amongst scattered shrub and groundcover species. This community occurs in the central and western portions of the Study Area, and extends to the dune margins at the eastern end of the Study Area.
Vegetation Structure Description	This community occurs as a highly disturbed shrubland, with sparse vegetation cover occurring across cleared areas. Where vegetation does occur, the dominant species are coastal tea-tree (*Leptospermum laevigatum*) and tantoon (*Leptospermum polygalifolium* subsp. *cismontanum*), with occurrences of coastal wattle (*Acacia longifolia* subsp. *sophorae*) and the exotic bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*). Native groundcover is largely absent, and when present, consists primarily of tussock grass (*Poa labillardierei*) and pig face (*Carpobrotus glaucescens*). Numerous exotic groundcover species occur, particularly on the dune margins, and include red natal grass (*Melinis repens*), quaking grass (*Briza maxima*), fireweed (*Senecio madagascariensis*) and prickly pear (*Opuntia stricta*).
PCT Allocation	Vegetation Zone 5 was aligned with PCT1646 as it occurs adjacent to, or in proximity to, mainly intact vegetation which is consistent with PCT1646. This vegetation zone also contains a number of species which are consistent with this PCT. Considering the disturbed nature of this vegetation zone and the vegetation that occurs adjacent to or nearby this vegetation zone, PCT1646 was considered to be the most appropriate allocation. It is likely this area was once dominated by a more naturally-occurring and intact version of PCT1646 prior to historical disturbance.
BC Act Status	This vegetation community does not conform to a TEC listed under the TSC Act.
EPBC Act Status	This vegetation community does not conform to a TEC listed under the EPBC Act.

3.2.2 Exotic Vegetation

The Development Footprint contains a range of exotic vegetation, including woody weeds and exotic grasses (refer to **Plate 3.1**). The most abundant exotic species present include bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*), lantana (*Lantana camara*), fireweed (*Senecio madagascariensis*) and whiskey grass (*Andropogon virginicus*), which compete with the native vegetation in some areas. Other exotic species present include red natal grass (*Melinis repens*), panic veldtgrass (*Ehrharta erecta*) and fleabane (*Conyza bonariensis*). A number of weeds present in the Development Footprint are classed as High Threat Weed species under the BAM, and are identified in the flora species list in **Appendix C**.

Plate 3.1 Exotic vegetation in the Study Area

© Umwelt, 2018

3.2.3 Vegetation Integrity Score

Table 3.2 details the vegetation integrity scores for each of the vegetation zones in the Development Footprint. The vegetation integrity data for each of the vegetation zones is provided in **Appendix E**.

Table 3.2 Vegetation Zone Vegetation Integrity Scores

Veg Zone	PCT Name *Condition Class*	Composition	Structure	Function	Current Vegetation Integrity Score
1	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Forest)*	63.4	10.9	45.5	**31.5**
2	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Tea-tree – Banksia Scrub)*	32.4	46.2	14.5	**27.9**
3	PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast *Moderate*	52.8	83.8	45.7	**58.6**
4	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Disturbed (Forest)*	33.6	68.8	58.9	**51.4**
5	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Cleared*	6.6	21.7	11.1	**11.6**

3.3 Threatened Species within the Development Footprint

3.3.1 Ecosystem-credit Species

A list of the ecosystem-credit species predicted to occur by the BAM Calculator and/or the literature review and whether they are considered likely to occur in the vegetation zones within the Development Footprint is provided in **Appendix A**.

3.3.2 Species-credit Species

A list of the species-credit species predicted to occur by the BAM Calculator and/or the literature review and a discussion on their inclusion or exclusion from the calculator assessment is provided in **Appendix B**. Species-credit species recorded or assumed present are listed in **Table 3.3** and further information on the surveys undertaken for these species is provided in **Appendix B**. These records are presented in **Figure 3.2.**

Table 3.3 Species-credit Species within the Development Footprint

Species	BC Act	EPBC Act	Species Presence	Justification
Eucalyptus parramattensis* subsp. *decadens	V	V	Yes	During the Ecological Assessment (2018), an atypical eucalypt was recorded within the Study Area that appeared to be a hybrid between *Eucalyptus parramattensis* subsp. *decadens* and *Eucalyptus robusta.* Multiple samples were sent to The Royal Botanic Gardens in Sydney for formal identification, but results came back inconclusive. Under the precautionary approach, the individuals recorded in the Study Area have been aligned with *Eucalyptus parramattensis* subsp. *decadens*. These records are confined to Vegetation Zone 3, occurring towards the north of the zone near the existing easement. As the Development Footprint only impacts the southern extent of this vegetation zone, along the existing access track, no species credits are required for this species as individuals of this tree do no occur within the Development Footprint.

Species	BC Act	EPBC Act	Species Presence	Justification
grey-headed flying-fox *Pteropus poliocephalus*	V	V	Yes	Numerous individuals of this species were recorded flying over the Development Footprint at dusk during the species' foraging period. These individuals were likely to have dispersed from the nearby breeding camp at Carrington mangroves approximately 5 km to the south west, where between 500 – 2,499 individuals are estimated to occur (DoEE 2018c). There are also known camps at Raymond Terrace or Blackbutt Nature Reserve. The Development Footprint occurs well within the species' optimal foraging range of 20 km (OEH 2018b). While the species may utilise areas within the Development Footprint for foraging, this is a species-credit species based on breeding habitat. As no breeding camps are present within the Development Footprint, no impact on breeding habitat for the species will occur as a result of the Project. This species does not require species credits.
koala *Phascolarctos cinereus*	V	V	Yes (assumed)	Multiple records of this species occur in the locality, with the closest one occurring approximately 300 m away from the Development Footprint (OEH 2018a). Forested areas in moderate condition within the Development Footprint contain swamp mahogany (*Eucalyptus robusta*) which is listed as a primary feed tree for the species (OEH 2018b). Targeted surveys have been undertaken for this species, and identified that suitable foraging habitat for the koala occurs. Furthermore, the Koala Habitat Planning Map that has been prepared as part of the Port Stephens Council Comprehensive Koala Plan of Management identifies Supplementary Habitat directly adjacent to the Study in the form of the Worimi Regional Park (Port Stephens LGA, 2002). As no activity or breeding has been confirmed in the Development Footprint, no impact on breeding habitat for the species will occur as a result of the Project. Therefore this species does not require species credits.
white-bellied sea-eagle *Haliaeetus leucogaster*	V	-	Yes	One individual of this species was tentatively recorded above the Development Footprint during field surveys. While the species may utilise areas within the Development Footprint for foraging, this is a species-credit species based on breeding habitat. As no stick nests or evidence of breeding are present within the Development Footprint, no impact on breeding habitat for the species will occur as a result of the Project. This species does not require species credits.

3.3.3 Species Habitat Polygons and Biodiversity Risk Weighting

No species habitat polygons have been assessed within the Development Footprint.

A list of all other fauna species recorded within the Development Footprint is provided in **Appendix D**.

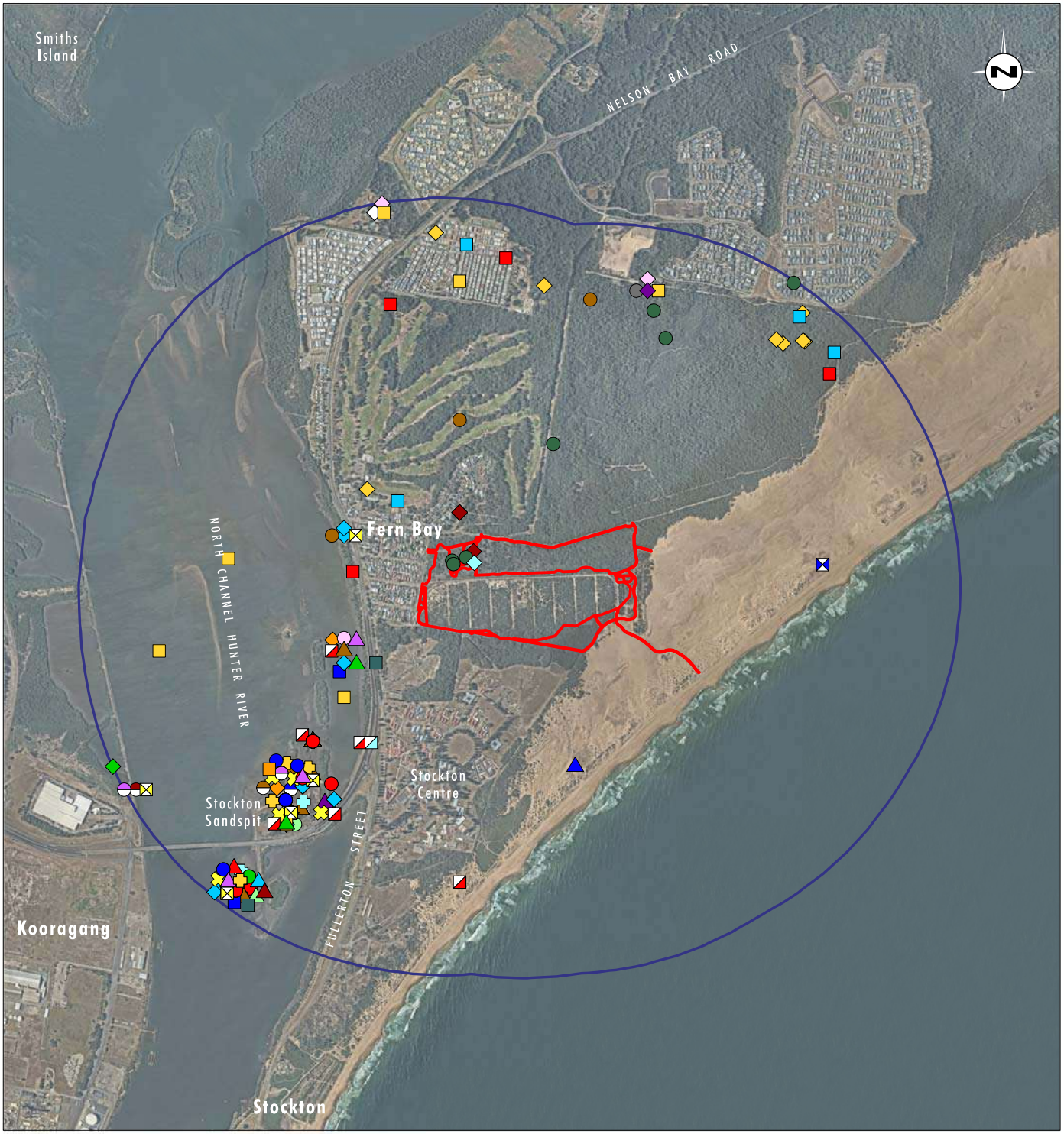

Image Source:Nearmap (Jan 2019)
Data Source: ATLAS (2019)

0 0.25 0.5 1.0km
1:25 000

Legend

- Development Footprint
- 1500m Buffer Area
- Asian Dowitcher
- Bar-tailed Godwit
- Black-tailed Godwit
- Broad-billed Sandpiper
- Bush Stone-curlew
- Caspian Tern
- Cattle Egret
- Common Greenshank
- Common Sandpiper
- Curlew Sandpiper
- Eastern Bent-wing-bat
- Eastern Bent-wing-bat Foraging
- Eastern Curlew
- Eastern False Pipistrelle
- Eastern Osprey
- Fork-tailed Swift
- Great Knot
- Greater Broad-nosed Bat
- Grey-headed Flying-fox
- Grey-tailed Tattler
- Gull-billed Tern
- Humpback Whale
- Koala
- Lesser Sand-plover
- Little Bentwing bat Foraging
- Little Bentwing-bat
- Little Tern
- Masked Owl
- Oriental Plover
- Pacific Golden Plover
- Pectoral Sandpiper
- Pied Oystercatcher
- Powerful Owl
- Red Knot
- Red-necked Stint
- Ruddy Turnstone
- Sharp-tailed Sandpiper
- Sooty Oystercatcher
- Southern Myotis
- Squirrel Glider
- Terek Sandpiper
- Whimbrel
- White-bellied Sea-Eagle
- White-fronted Chat
- *Eucalyptus parramattensis* subsp *decadens*

FIGURE 3.2

Threatened Species within the Development Footprint

File Name (A4): R08/3764_065.dgn
20190326 11.54

4 Avoidance and Minimisation of Impacts

4.1 Avoidance of Native Vegetation and Habitat

The Master Plan proposed as part of the Rifle Range Residential Development has been prepared through careful consideration of the ecological values and heavily disturbed portions of the Study Area that have been identified through a long history of site investigations spanning some 18 years (2002 – 2019). The Development Footprint has almost entirely avoided the most intact stands of native vegetation (Vegetation Zone 1) within the Study Area through prioritisation of development within the highly disturbed central portion of the Study Area. The area of impact to this vegetation is limited to the outermost extent of the development to provide for Asset Protection Zones and Stormwater Detention Basins as well as a small number of Cluster Homes.

Importantly, the Development Footprint has been planned to ensure a natural corridor of native vegetation and suitable threatened species habitat and buffer area remains between the Development Footprint and the Worimi Conservation Area to the north.

As identified in **Table 2.1**, and previously in the Ecological Assessment (Umwelt, 2018), there are two communities within the Study Area that comprise native vegetation that have not been aligned with PCTs, being Beach Wetlands and Sand Dunes. There are no equivalent PCTs for the vegetation that occurs in either of these communities. These communities occur along the eastern boundary of the Study Area along the foredune. Occurring within the primary dune ecosystem means that the existence, location and condition of these communities is highly variable as they are subject to change following high winds, storm events. These vegetation communities are also currently exposed to intensive off-road vehicular access from Stockton Beach. Aerial imagery identifies extensive track networks throughout these communities, disturbances that are likely to have being occurring for a long time.

Although the Master Plan (refer **Figure 1.2**) identifies that a walking track is proposed to the shoreline and that the walking track may cross through these two vegetation communities, it should be noted that the location of the track is indicative only. DHA have committed to avoiding direct impacts to the Beach Wetlands and Sand Dunes through a detailed design phase of the walking track. Avoidance will be possible through locating the track along existing vehicles track disturbances.

These avoidance actions have significantly reduced the ecological impacts of the proposed development.

4.2 Avoidance of Prescribed Impacts

The following impacts are considered ‘prescribed impacts’ under the BC Regulation:

- impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other geological features of significance, rocks, human-made structures or non-native vegetation
- impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- impacts on movement of threatened species that maintains their life cycle
- impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

- impacts of wind turbine strikes on protected animals
- impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

As outlined in **Section 4.1**, DHA has sought to avoid and minimise the potential impacts on the ecological values of the project primarily through the careful selection of the location of the Development Footprint. The Development Footprint has been primarily located in areas of existing disturbance or lower condition vegetation that are less likely to support suitable habitat of threatened species.

Further detail on the assessment of prescribed impacts is outlined in **Section 5.2**.

4.3 Minimisation Measures

The careful consideration of ecological values and heavily disturbed portions of the Study Area during the design of the Masterplan, minimises the impacts of the proposed Rifle Range Residential Development. Although Vegetation Zones 1, 3 and 4 could not be avoided completely, their impacts have been substantially minimised, with just a small number of lots occurring within Vegetation Zone 1 and 4, and access tracks planned in areas of existing tracks. The majority of impacts to these vegetation zones is a result of peripheral development activities such as Asset Protection Zones (APZ) and Stormwater Detention Basins.

DHA has committed to the design and implementation of a comprehensive biodiversity mitigation strategy to mitigate the unavoidable impacts of the Proposed Development. The following specific control measures are considered to be integral to the mitigation of impacts on the biodiversity features of the Development Footprint and surrounds. Control measures include:

- demarcation of approved clearance boundaries
- weed management
- pest animal control
- fencing and access control
- bushfire management
- providing appropriate environmental management measures as part of construction to minimise the potential for indirect impacts including:
    - water management systems that seek to minimise the potential for damage to flora and fauna habitats from erosion and unnatural flooding events
    - erosion and sedimentation control
    - noise control mechanisms (i.e. work limited to particular time of the day)
    - traffic control and speed limits
    - dust control measures
    - lighting controls.

Each of these control measures will contribute to the maintenance of habitat quality adjacent to the Development Footprint outside existing approved disturbance.

Furthermore, the assessment has identified that in the outer protection area of the APZ, i.e. where it occurs outside of direct impacts from the proposed development at the hazard interface, existing vegetation will be partially impacted. Specifically, in these areas, Umwelt understand that the existing ground layer and mid-storey will be entirely removed, while the existing canopy layer will be thinned to approximately 30 per cent of what is currently present to provide canopy separation. This approach presents an additional minimisation measure employed by DHA. The specific details of changes that were made within the online BAM calculator are presented in **Table 4.1**. These management zones are identified in **Figure 4.1**.

Table 4.1 Impacts associated with Management Zones

Vegetation Zone	Management Zone	PCT and Condition	Description of Impacts
1	Full	**1646** - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast_Moderate_Forest	Full removal of canopy, mid and ground layers (including all composition, structure and function scores.
	Partial		Partial removal of canopy layer, with approximately 30 per cent of current cover remaining following the proposed development. Mid and ground layers will be fully removed.
2	Full	**1646** - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast_Moderate_TeaTree	Full removal of canopy, mid and ground layers (including all composition, structure and function scores.
	Partial		Partial removal of canopy layer, with approximately 30 per cent of current cover remaining following the proposed development. Mid and ground layers will be fully removed.
3	Full	**1725** - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast_Moderate	Full removal of canopy, mid and ground layers (including all composition, structure and function scores.
	Partial		Partial removal of canopy layer, with approximately 30 per cent of current cover remaining following the proposed development. Mid and ground layers will be fully removed.

Vegetation Zone	Management Zone	PCT and Condition	Description of Impacts
4	Full	**1646** - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast_Disturbed_Forest	Full removal of canopy, mid and ground layers (including all composition, structure and function scores.
	Partial		Partial removal of canopy layer, with approximately 30 per cent of current cover remaining following the proposed development. Mid and ground layers will be fully removed.
5	Full	**1646** - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast_Cleared	Full removal of canopy, mid and ground layers (including all composition, structure and function scores.
	Partial		Partial removal of canopy layer, with approximately 30 per cent of current cover remaining following the proposed development. Mid and ground layers will be fully removed.

4.4 Summary of Measures

Table 4.2 outlines the avoidance and minimisation measures proposed for the Proposed Development including the timing, action, outcome and responsibility of these measures.

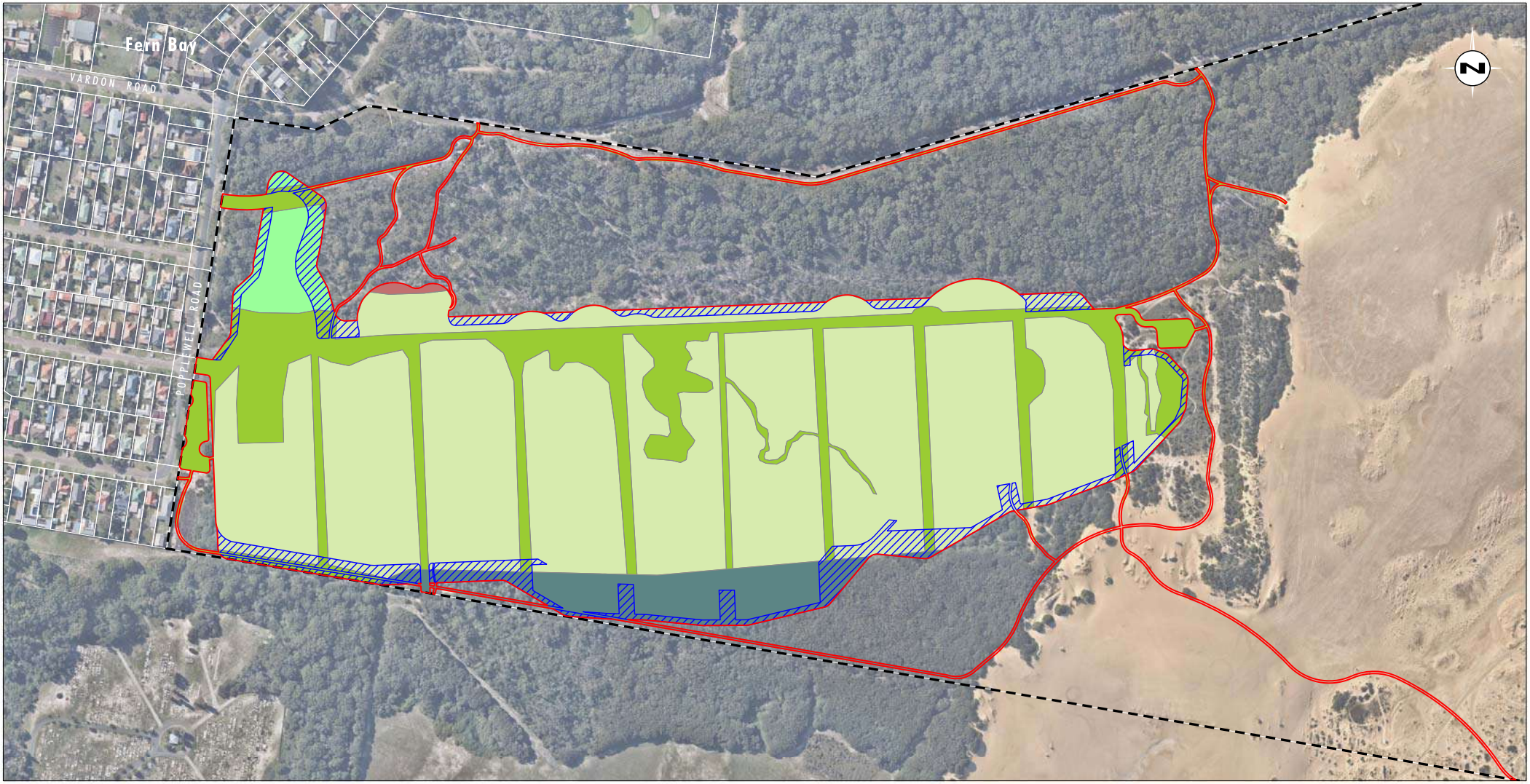

Image Source: Nearmap (Apr 2018)
Data Source: Department of Finance, Services & Innovation (2017), Architectus (2019)

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Legend

- Study Area
- Development Footprint
- VZ1 PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast - Moderate Forest
- VZ2 PCT1646 - Moderate (Tea Tree - Banksia Scrub)
- VZ3 PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast - Moderate
- VZ4 PCT1646 - Disturbed (Forest)
- VZ5 PCT1646 - Cleared
- Partial Clearing

FIGURE 4.1

Management Zone in Development Footprint

File Name (A4): R08/3764_059.dgn
20190326 11.51

Table 4.2 Avoidance and Minimisation Measures

Measure	Timing	Responsibility	Proposed Techniques	Outcome
Preliminary ecological site inspection	Pre-project design	N/A	N/A	• Preliminary assessment of areas of avoidance to inform project design.
Location and design of stockpiles and facilities in existing disturbed areas.	Pre-project design	N/A	N/A	• Priority use of disturbed areas and vegetation of lower ecological value for the proposed development.
Allocation of walking tracks within existing tracks	Project design	N/A	N/A	• Avoiding the need to create new walking tracks through intact vegetation. Ecological impacts have been reduced through prioritisation of existing tracks throughout the Study Area.
Demarcation of approved clearance boundaries	Prior to clearance and during clearance activities	Site Manager	• Establish construction fencing or marking tape around areas not proposed for clearance.	• Minimisation of unnecessary impacts to surrounding vegetation and habitats.
Weed management	Construction and operation	Site Manager	• Chemical and physical removal of invasive weed species in accordance with the *New South Wales Weed Control Handbook* (DPI 2018). • Vehicle and machinery washing before entering and exiting the Development Footprint.	• Minimisation of environmental and noxious weeds in the Study Area. • Minimisation of weed spread from and into the wider locality.

Measure	Timing	Responsibility	Proposed Techniques	Outcome
Pest animal control	Operation	Site Manager	• Regular monitoring to be undertaken to assess the level of impact by feral animals. • Feral animal control works to be undertaken as required to provide for the suppression of feral animals. If possible, liaison with WCL Board of Management will be sought to seek coordinated control measures.	• Minimise potential for pest animals in the Development Footprint and the locality. • Minimise potential impacts to native fauna species from out-competition and/or preying of pest or feral animal species.
Fencing and access control	Construction and operation	Site Manager	• Fencing will not include barbed wire on the top line of the fence. Avoiding impacts on native fauna. • Consider use of bollards to limit recreational vehicle access • Provide defined pedestrian walking tracks	• Provides for access control to avoid unwanted human interference and disturbance to non-operational areas. • Minimise illegal access to the beach for recreational vehicles and limit paths to defined tracks to minimise impact to vegetation and minimise erosion • Minimisation of impacts to native fauna species from the use of barbed-wire fences.
Bushfire management	Construction and operation	Site Manager	• Bushfire management will consider asset protections and the consideration of the sensitivities of threatened species and threatened ecological communities.	• Protect life and property, while supporting appropriate conditions for the existing ecological features.

5 Assessment of impacts

5.1 Impacts on native vegetation and habitat

5.1.1 Direct impacts

The proposed development will result in direct impacts on biodiversity values. Direct impacts include the loss of vegetation and fauna habitats as a result of clearance works and subsequent facility operations.

As mentioned in **Section 4.3**, in the outer boundary of the APZ existing vegetation will be partially impacted. Specifically, in these areas, Umwelt understand that the existing ground layer and mid-storey will be entirely removed, while the existing canopy layer will be thinned to approximately 30 per cent of what is currently present. This approach presents an additional minimisation measure employed by DHA.

Table 5.1 outlines the direct impacts on native vegetation, including complete and partial impacts, which totals 22.65 hectares. The final Development Footprint is shown in **Figure 5.1**. Avoidance and mitigation measures associated with minimising the impacts of these direct impacts are discussed in **Section 4.0**.

Table 5.1 Direct Impacts of the Proposed Modification on Biodiversity Features

Biodiversity Features		Area within the Development Footprint (ha)
Vegetation Zone	Plant Community Type	
1	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Forest)*	0.68
2	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Tea-tree – Banksia scrub)*	15.14
3	PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast *Moderate*	0.12
4	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Disturbed (Forest)*	1.55
5	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Cleared*	5.02
N/A	Beach Wetlands	0.01
N/A	Sand Dunes	0.13

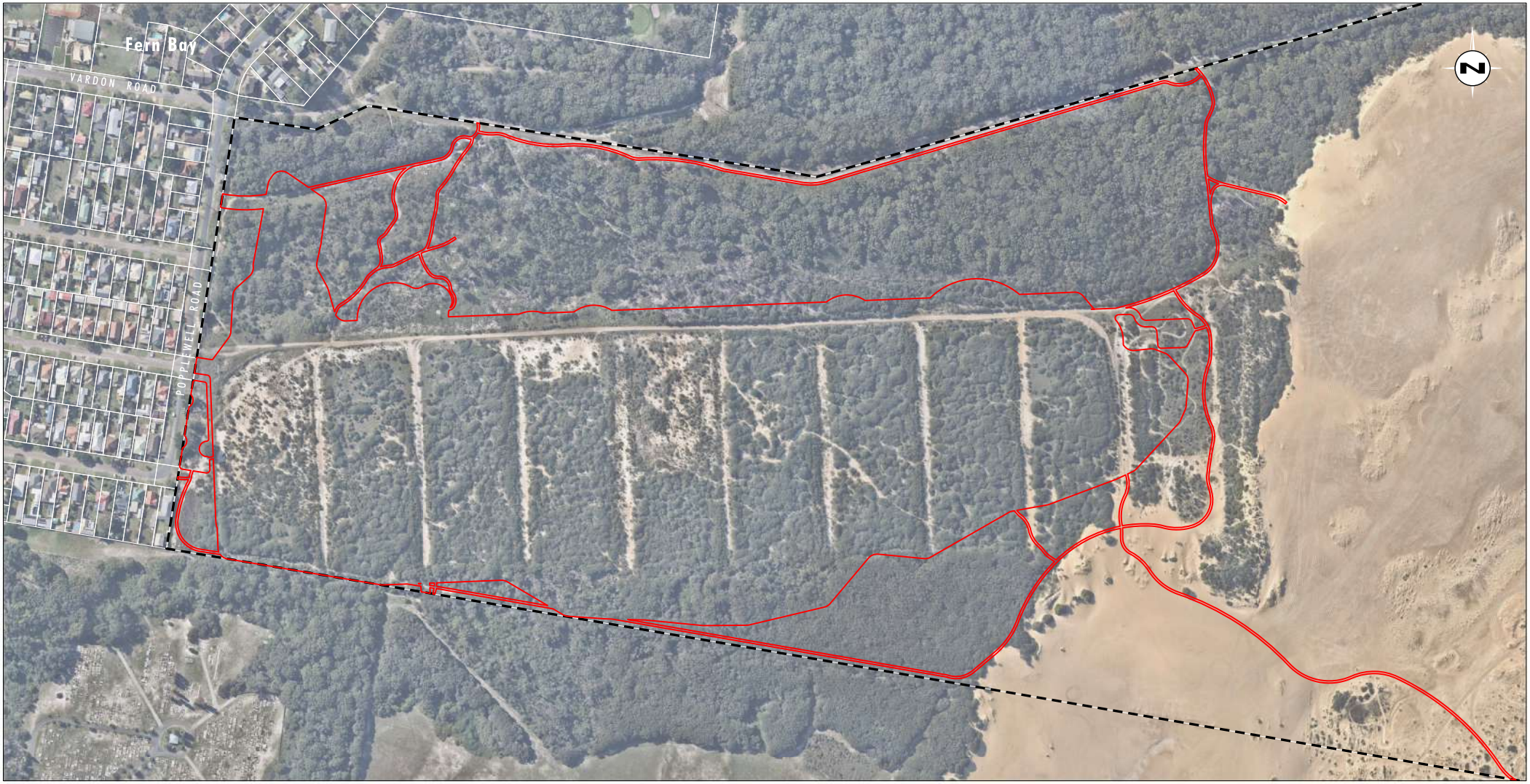

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2017), Architectus (2019)

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Legend
Study Area
Development Footprint

FIGURE 5.1

Final Footprint of Proposed Development

File Name (A4): R08/3764_060.dgn
20190620 12.15

5.1.2 Indirect Impacts

The proposed Development is not expected to result in any additional indirect impacts on the biodiversity values of surrounding lands. No substantial indirect impacts are expected to occur in relation to connectivity, corridors, habitat fragmentation or light emissions beyond minimal encroachment from the Development Footprint. However, some minor indirect impacts associated with water runoff, noise, dust, weeds and feral animals may occur during the construction phase and through use of the residential development following completion of construction. These are discussed below.

No indirect impact zones have been identified for the Rifle Range Residential Development.

5.1.2.1 Downstream Impacts of Stormwater Detention Basins

The proposed Rifle Range Residential Development requires the development of a series of Stormwater Detention Basins, occurring along the northern and western edges of the development footprint. The impacts associated with the construction of these basins have been considered in the Direct Impacts presented above in **Section 5.1.1**.

The construction of these detention basins will substantially reduce all downstream impacts in regards to waterflow and availability. Any remaining downstream impacts are assumed to be nominal.

5.1.2.2 Noise Impacts

Noise impacts have the potential to adversely impact native species. Potential impacts include:

- noise disturbing the roosting and foraging behaviour of fauna species
- noise reducing the occupancy of areas of suitable habitat.

Noise impacts will only be applicable during the construction phase of this project. Upon completion of construction, the occurrence of this residential development will not have increased noise impacts to the local area beyond what is existing from the adjoining community of Fern Bay.

In regard to potential impacts on biodiversity, there will be no substantial change to noise impacts given that the proposed extension is part of, and adjacent to, an existing operation with existing impacts. Noise from proposed operations is not expected to be of any level of significance in relation to threatened species, populations and communities. Although considerable noise will be generated through the construction of the residential development, this is not considered likely to negatively impact on biodiversity values of the remaining Study Area or adjacent vegetation/habitat.

5.1.2.3 Dust Impacts

Dust emissions have the potential to adversely impact native species during ground disturbing works of the construction phase for the project. Potential impacts include dust covering vegetation thereby potentially reducing vegetation health and growth. The design of the Proposed Modification will include measures to minimise the potential for adverse dust impacts. These include:

- progressive rehabilitation and stabilisation of disturbed land
- dust suppression on haul roads and other operational areas to reduce vehicle generated dust emissions
- a range of other dust control measures as discussed in the main text of the EIS.

Any impacts resulting from dust during construction are not expected to be of any level of significance in relation to threatened species, populations and communities. There are not considered to be any dust impacts following completion of the construction of the project.

5.1.2.4 Weed and Feral Animal Encroachment

Weed species could be inadvertently brought into the Development Footprint with imported materials, or could invade naturally through removal of native vegetation. The presence of weed species within the Development Footprint has the potential to decrease the value of extant vegetation to native species. Mitigation measures outlined in **Section 4** will be implemented to minimise the potential for weed encroachment into areas surrounding the Development Footprint. Umwelt note that the Study Area already has a high presence of weed species however the location of the Development Footprint in the already disturbed portions of the Study Area increases the likelihood of weed and feral animal encroachment into the adjoining vegetation of higher ecological value.

Populations of feral fauna species such as foxes, rabbits and cats can increase and quickly populate new areas as a result of disturbance. Clearing, thinning of vegetation and the creation of tracks have the ability to assist the establishment and spread of feral fauna species. Mitigation measures outlined in **Section 4** will minimise the potential for feral animal spread and impacts into surrounding areas around the Development Footprint.

There will be no substantial change to impacts from weeds or feral animals, given that the proposed development is within a Study Area that already is highly disturbed and supports a high presence of weed species and feral animals. Any additional impacts resulting from weeds or feral animals are not expected to be of any level of significance in relation to threatened species, populations and communities. However as noted above, there could be encroachment into new areas of the Study Area.

5.2 Prescribed Impacts

No impacts are expected to occur to threatened species or community habitat associated with karst, caves, crevices, cliffs and other geological features of significance, rocks or human-made structures as these do not occur within the Development Footprint. None of these features occur in the Development Footprint or adjoining lands.

Corridors that provide important habitat connectivity for fauna movement are unlikely to be substantially impacted by the proposed Development as the proposal is concentrated in an area of already highly disturbed vegetation. Furthermore, the development is proposed at the southern end of a corridor of vegetation along the Stockton Bight. The proposed development also provides a buffer of natural vegetation between the Development Footprint and the adjoining WCL.

Although the development will directly impact on a small area of foraging habitat for the koala in the local area, no breeding habitat was identified for the species. These impacts are unlikely to sever any major movement corridors given the lack of suitable to the south, east or west of the Study Area. Therefore the loss of connectivity in the wider landscape or movement important for threatened species to maintain their life cycle is considered to be minimal.

No impacts on water quality or hydrological processes that sustain threatened species and threatened ecological communities are likely to occur.

The proposed Rifle Range Residential Development will introduce new road and traffic conditions to the Study Area. Currently it only supports sand and gravel tracks, while following development it will support a small network of residential roads. The speed limits of these roads will not exceed the existing roads of Fern Bay which adjoins Study Area.

Although the roads that will be developed as part of the proposed Rifle Range Residential Development will be new, it is unlikely that any threatened species or animals that are part of a TEC would be adversely impacted by the increase in vehicle movement in the Development Footprint given the network of similar roads adjacent to the Study Area.

The impacts of wind turbines are not applicable to the proposed Rifle Range Residential Development.

5.2.1 Uncertain Prescribed Impacts

Uncertain impacts are those that are unable to be reliably predicted during the assessment process or are infrequent in nature. These usually refer to impacts associated with caves, cliffs, mine subsidence and wind turbine strikes and increased vehicle strikes. Indirect impacts associated with the interruption of ecosystem processes are also complex and difficult to quantify.

The proposed Rifle Range Residential Development is unlikely to result in any uncertain prescribed impacts.

5.3 Serious and Irreversible Impacts

Under the BC Act, a determination of whether an impact is a serious and irreversible impact (SAII) must be made in accordance with the principles prescribed in Clause 6.7 of the BC Regulation. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These are impacts that:

- will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
- impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

No threatened species that generate biodiversity credits for the proposed Rifle Range Residential Development are nominated as candidate SAII entities in the *Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact* (OEH 2017b).

Therefore no species or ecological community components listed as SAII entities are likely to occur within the Development Footprint and no further assessment of SAII is required.

6 Biodiversity Credit Impact Summary

6.1 Impacts Not Requiring Assessment

Under the BAM, impacts to areas of land without native vegetation do not require further assessment. The Development Footprint does not contain any such land. The highly disturbed vegetation that is predominantly cleared and dominated by introduced flora species, does comprise some native flora species and is therefore further assessment of the need for biodiversity offsets is required.

6.2 Impacts Not Requiring Offset

Impacts on native vegetation not requiring offsets under the BAM include native vegetation that has a vegetation integrity score of less than 20 (where it is not associated with ecosystem-credit species habitat or a TEC), less than 17 (where it is associated with ecosystem-credit habitat or a VEC) or less than 15 (where it is representative of a EEC or CEEC).

Vegetation Zone 5 (PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – Cleared) calculated a vegetation integrity score of 11.6, below the offsetting threshold. Therefore, this area does not require offsetting.

Figure 6.1 identifies the area in the Development Footprint that does not require offset.

6.3 Impacts Requiring Offset

Two PCTs (over four condition zones) have been determined to require offsetting in accordance with the BAM (OEH 2017a). **Table 6.1** summarises this outcome.

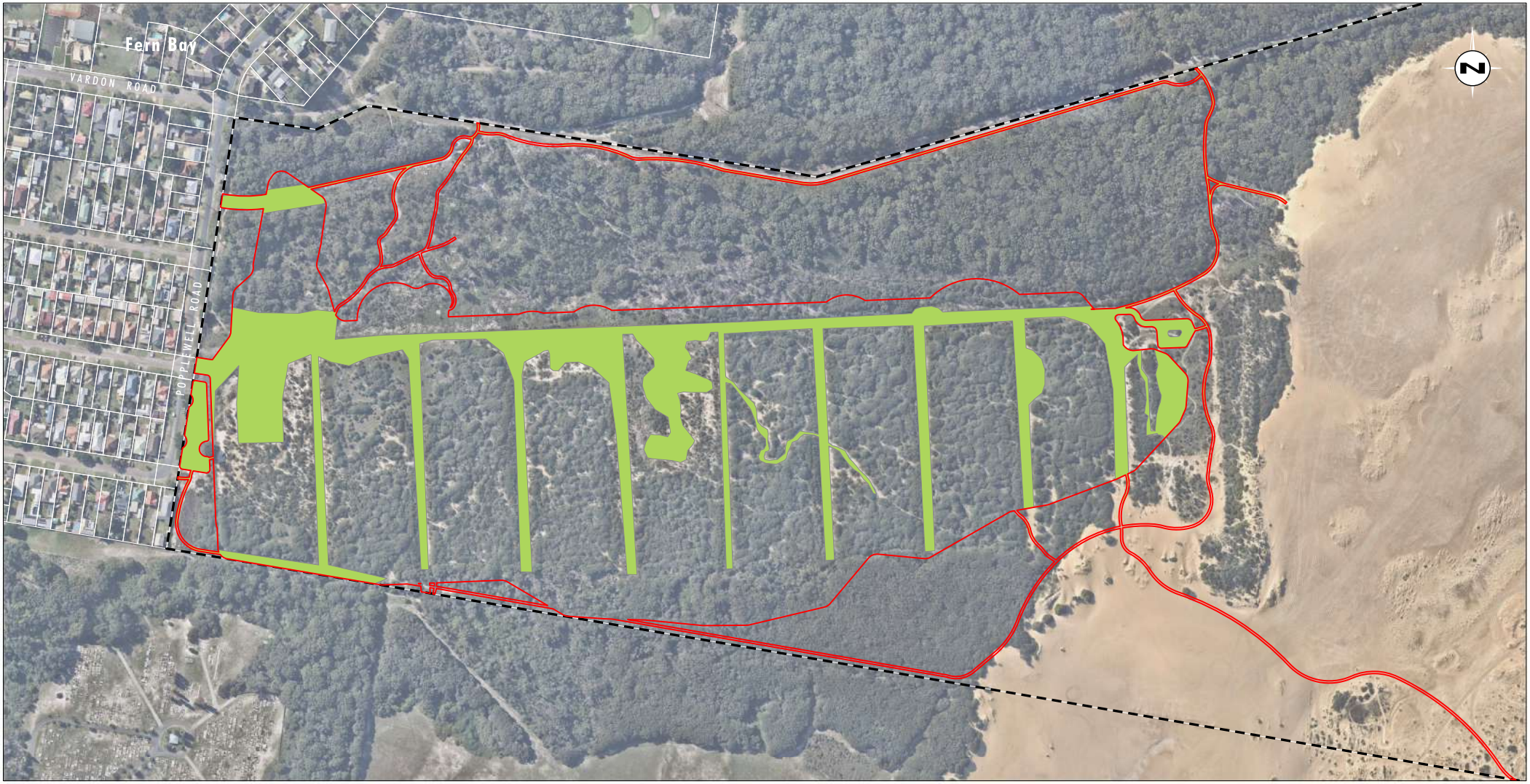

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2017), Architectus (2019)

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Legend

- Study Area
- Development Footprint
- Area not requiring further assessment, area not required to be offset

FIGURE 6.1

Area Not Requiring Offset

Table 6.1 Impacts Requiring Offset

Veg Zone	PCT/Species-credit	Management Zone	Vegetation Integrity Score			Area (ha)	Credits Required
			Current	Future	Change		
1	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Forest)*	Full	31.5	0.0	-31.5	0.4	**8**
		Partial	31.5	1.8	-29.8	0.28	
2	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Moderate (Tea-tree – Banksia Scrub)*	Full	27.9	0.0	-27.9	14.24	**158**
		Partial	27.9	0.1	-27.8	0.9	
3	PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast *Moderate*	Full	58.6	0.0	-58.6	0.11	**3**
		Partial	58.6	1.7	-56.8	0.01	
4	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Disturbed (Forest)*	Full	51.4	0.0	-51.4	1.09	**30**
		Partial	51.4	2.1	-49.3	0.46	
5	PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast *Cleared*	Full	11.6	0.0	-11.6	4.67	**0**
		Partial	11.6	0	-11.6	0.35	

7 Biodiversity Credit Report

A full Biodiversity Credit Report is included in **Appendix F**.

A summary of the key outcomes in provided in **Table 7.1**.

Table 7.1 Credits Required to Offset the Proposed Development

PCT/Species-credit	Credits Required
Ecosystem Credits	
1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	196
1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast	3
Total	**199**

8 Biodiversity Offset Strategy

DHA is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of biodiversity values as a result of the Proposed Residential Development under the BC Act and *Biodiversity Conservation Regulation 2017*. Firstly, DHA has, where possible, altered the proposed Rifle Range Residential Development to avoid and minimise biodiversity impacts in the project planning stage, and a range of impact mitigation strategies to mitigate the impact on ecological values (refer to **Section 4.0**) prior to the consideration of offsetting requirements.

Fulfilling offset requirements under the BC Act can be undertaken using one or a combination of the following offset strategies:

- In-perpetuity conservation through the establishment of a Stewardship site/s and the retirement of credits
- Securing required credits through the open credit market
- Payments to the Biodiversity Conservation Fund and/or
- Funding a Biodiversity Conservation Action (if applicable).

DHA are considering setting up a Biodiversity Stewardship Site within the Study Area not impacted by the Development Footprint (**Figure 8.1**). This would use the native vegetation to the north of the Development Footprint to generate credits to offset the impacts of the proposed residential development. This area would generate ecosystem credits consistent with those required for the impacts presented in this BDAR.

Any remaining deficit in ecosystem credits will either be sought through the open market or payment into the Biodiversity Conservation Fund will be considered.

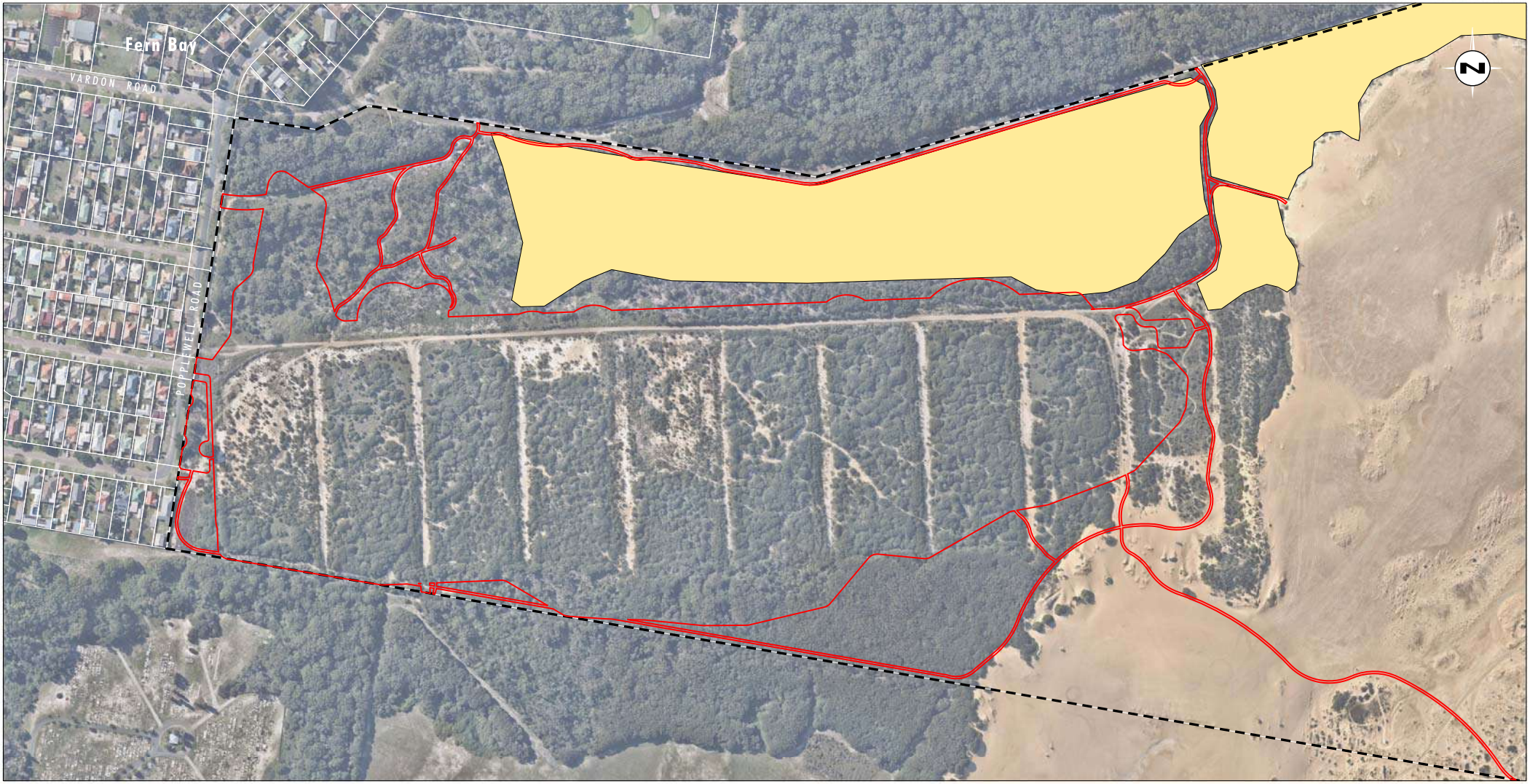

Image Source: Nearmap (Apr 2018)
Data Source: LPI NSW (2017), Architectus (2019)

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Legend

- Study Area
- Development Footprint
- Potential Offset Area

FIGURE 8.1

Potential Offset Area

9 References

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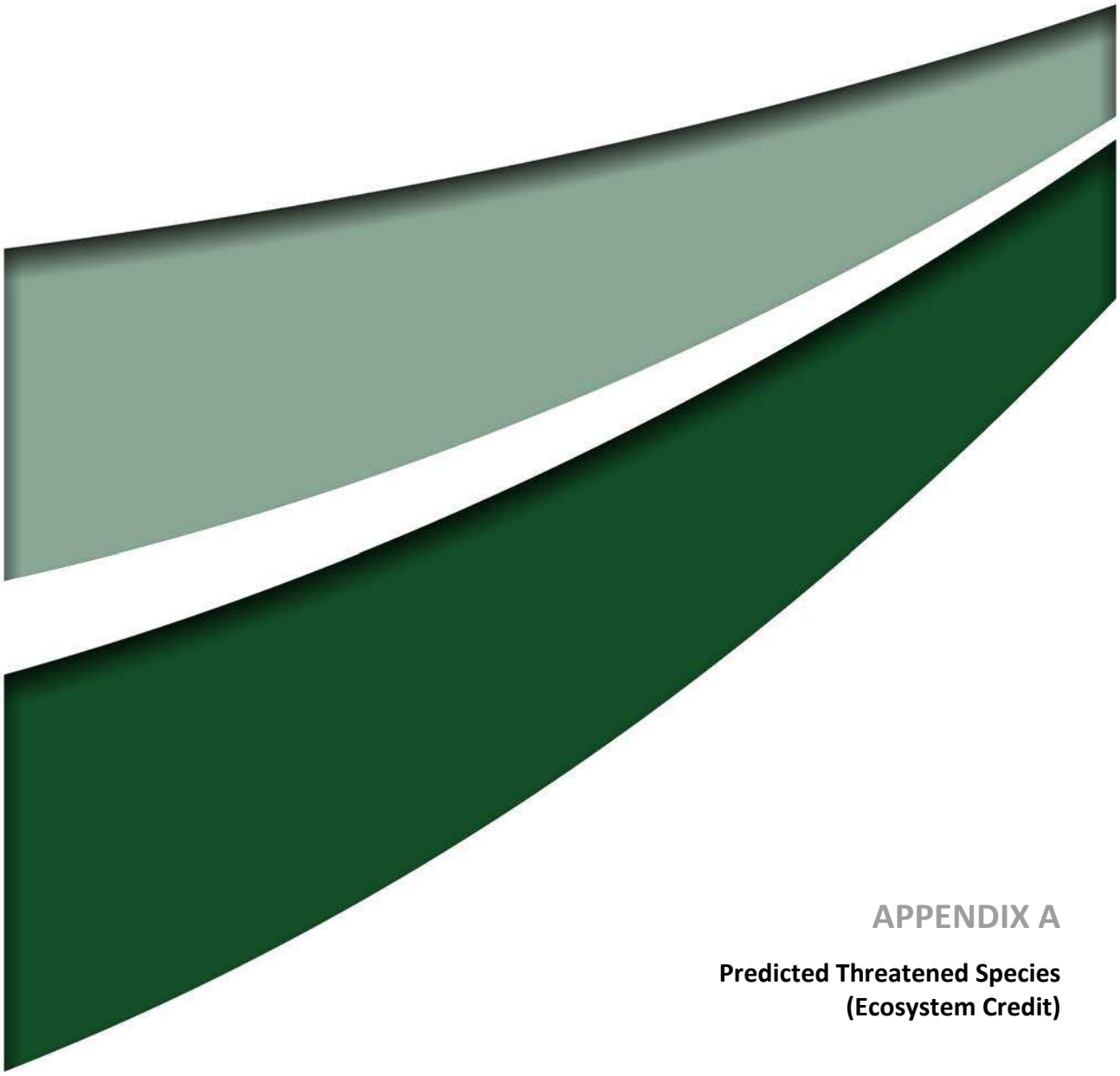


APPENDIX A

Predicted Threatened Species (Ecosystem Credit)

Predicted Threatened Species (Ecosystem Credit)

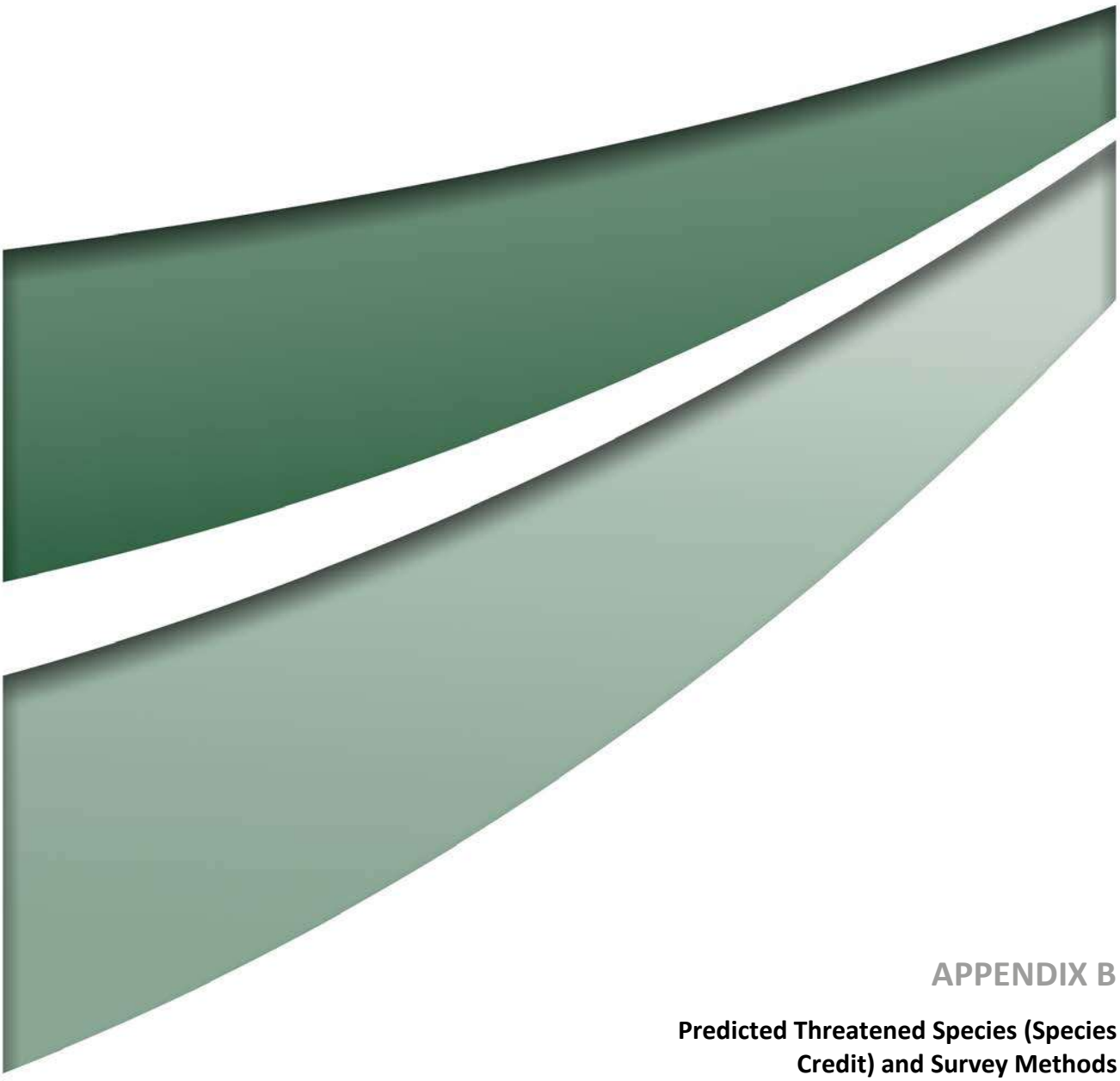
Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Vegetation Zone Prediction
Barking Owl ***Ninox connivens*** **(Foraging)**	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Scrub) 1646 – Cleared 1725 – Moderate
Black Bittern ***Ixobrychus flavicollis***	V	-	Moderate	Waterbodies, land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation.	None
Black-chinned Honeyeater (eastern subspecies) ***Melithreptus gularis gularis***	V	-	Moderate	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Scrub)
Black-necked Stork ***Ephippiorhynchus asiaticus***	E	-	Moderate	Swamps; shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300 m of swamps. Waterbodies; shallow lakes, lake margins and estuaries within 300 m of these waterbodies.	None
Eastern Bentwing-bat ***Miniopterus schreibersii oceanensis*** **(Foraging)**	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared 1725 – Moderate

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Vegetation Zone Prediction
Eastern Freetail-bat ***Mormopterus norfolkensis***	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared 1725 – Moderate
Eastern Osprey ***Pandion cristatus***	V	-	Moderate	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Scrub) 1646 – Cleared 1725 – Moderate
Gang-gang Cockatoo ***Callocephalon fimbriatum*** **(Foraging)**	V	-	Moderate	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1725 – Moderate
Glossy Black-Cockatoo ***Calyptorhynchus lathami*** **(Foraging)**	V	-	High	Presence of *Allocasuarina* and *Casuarina* species.	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1725 – Moderate
Grey-crowned Babbler (eastern subspecies) ***Pomatostomus temporalis temporalis***	V	-	Moderate	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Scrub)
Grey-headed Flying-fox ***Pteropus poliocephalus*** **(Foraging)**	V	V	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1725 – Moderate
Koala ***Phascolarctos cinereus*** **(Foraging)**	V	V	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1725 – Moderate

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Vegetation Zone Prediction
Little Bentwing-bat ***Miniopterus australis*** **(Foraging)**	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared 1725 – Moderate
Little Eagle ***Hieraaetus morphnoides*** **(Foraging)**	V	-	Moderate	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared 1725 – Moderate
Little Lorikeet ***Glossopsitta pusilla***	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1725 – Moderate
Masked Owl ***Tyto novaehollandiae*** **(Foraging)**	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared
Powerful Owl ***Ninox strenua*** **(Foraging)**	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared
Regent Honeyeater ***Anthochaera phrygia*** **(Foraging)**	CE	CE	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1725 – Moderate

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Vegetation Zone Prediction
Speckled Warbler *Chthonicola sagittata*	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree)
Spotted-tailed Quoll *Dasyurus maculatus*	V	E	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1725 – Moderate
Square-tailed Kite *Lophoictinia isura* (Foraging)	V	-	Moderate	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared
Swift Parrot *Lathamus discolor* (Foraging)	E	CE	Moderate	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1725 – Moderate
Turquoise Parrot *Neophema pulchella*	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree)
Varied Sittella *Daphoenositta chrysoptera*	V	-	Moderate	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1725 – Moderate
White-bellied Sea-Eagle *Haliaeetus leucogaster* (Foraging)	V	-	High	Within 1km of a river, lakes, large dams or creeks, wetlands and coastlines.	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared 1725 – Moderate

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Vegetation Zone Prediction
Yellow-bellied Sheathtail-bat ***Saccolaimus flaviventris***	V	-	High	-	1646 – Moderate (Forest) 1646 – Disturbed (Forest) 1646 – Moderate (Tea Tree) 1646 – Cleared 1725 – Moderate



APPENDIX B

Predicted Threatened Species (Species Credit) and Survey Methods

Predicted Threatened Species (Species Credit) and Survey Methods

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Flora Species						
Austral Toadflax ***Thesium australe***	V	V	Nov - Feb	-	No	**No further survey required**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). The Development Footprint does not contain the suitable habitat associations (i.e. kangaroo grass (*Themeda australis*)) required for the species (OEH 2018a). Targeted surveys for the species were not required.
Biconvex Paperbark ***Melaleuca biconvexa***	V	V	All year	Swamps and swamp margins or creek edges (the Development Footprint does not support these habitat constraints)	No	**Not present**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). The Development Footprint was comprehensively surveyed for this assessment in August and September 2018, and this species was not recorded in the Development Footprint as part of these surveys. This species is not present in the Development Footprint.
Black-eyed Susan ***Tetratheca juncea***	V	V	Jul - Dec	-	No	**Not present**. One record of this species from 2007 occurs approximately 5 km south west of the Development footprint (OEH 2018a). The Development Footprint was comprehensively surveyed in August and September 2018. This species is readily detected during the known flowering period and it was not recorded during targeted transect surveys. This species is not present in the Development Footprint.
Camfield's Stringybark ***Eucalyptus camfieldii***	V	V	All year	-	No	**Not present**. This species has been previously recorded in abundance approximately 6 km north of the Development Footprint (OEH 2018a), however it was not recorded in the Development Footprint as part of these surveys. The Development Footprint was comprehensively surveyed for this assessment in August and September 2018 and this species is highly detectable. This species is not present in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Charmhaven Apple ***Angophora inopina***	V	V	All year	South of Wootton, NSW (the Development Footprint is south of this Geographic location)	N/A	**Not present**. This species has been previously recorded in abundance approximately 9 km north of the Development Footprint (OEH 2018a), however it was not recorded in the Development Footprint as part of these surveys. The Development Footprint was comprehensively surveyed for this assessment in August and September 2018 and this species is highly detectable. This species is not present in the Development Footprint.
Dwarf Heath Casuarina ***Allocasuarina defungens***	E	E	All year	North of Bulahdelah, NSW (the Development Site is south of this geographic location.	No	**No further survey required**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). Furthermore the Development Footprint does not match the geographic constraint for the species. This species is not present in the Development Footprint.
Parramatta Red Gum ***Eucalyptus parramattensis* subsp. *decadens***	V	V	All year	-	No	**Present**. Records of this species from 2006 occur approximately 500 m north of the Development footprint (OEH 2018a), which is likely to be the same hybrid species recorded by Umwelt. There are an additional eight records of the species within 10 km of the Development footprint (OEH 2018a). In 2016 Umwelt recorded three trees that were identified as potential hybrids of Parramatta red gum and swamp mahogany (*Eucalyptus parramattensis* subsp. *decadens* x *robusta*). A number of these hybrids have been recorded in Worimi Regional Park immediately to the north of the Study Area. The Development Footprint was comprehensively surveyed for this assessment in August and September 2018 and this species is highly detectable, no additional trees were recorded. None of the three trees occur in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
***Eucalyptus seeana* population in the Greater Taree local government area**	EP	-	All year	Within Greater Taree LGA (the Development Footprint is not in this Geographic location)	No	**No further survey required**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). Furthermore, the Development Footprint does not occur in the Geographic constraint for this species. This species is not present in the Development Footprint.
Eastern Australian Underground Orchid *Rhizanthella slateri*	V	E	Sep - Nov	-	Yes	**Not present**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). The Development Footprint was comprehensively surveyed for this assessment in August and September 2018, and this species was not recorded in the Development Footprint as part of these surveys. This species is not present in the Development Footprint.
Grove's Paperbark *Melaleuca groveana*	V	-	All year	-	No	**Not present**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). The Development Footprint was comprehensively surveyed for this assessment in August and September 2018, and this species was not recorded in the Development Footprint as part of these surveys. This species is not present in the Development Footprint.
Heath Wrinklewort^ *Rutidosis heterogama*	V	E	All year	-	No	**Not present**. There is one record approximately 5km south west of the Development Footprint (OEH 2018a), however it was not recorded in the Development Footprint during extensive surveys. The Development Footprint was comprehensively surveyed for this assessment in August and September 2018. This species is not present in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Leafless Tongue Orchid ***Cryptostylis hunteriana***	V	V	Nov - Jan	-	No	**Not present**. The nearest record of this species occurs approximately 26 km north east of the Study Area at Tanilba Bay (OEH 2018a). The Development Footprint was comprehensively surveyed for this assessment in August and September 2018, and no habitat considered suitable for the species was recorded. Furthermore, ecological surveys completed in November 2016, December 2018 and January 2019 did not identify this species. Targeted surveys for the species are not considered required.
Nabiac Casuarina ***Allocasuarina simulans***	V	V	All year	Within 25 km of Forster (the Development Footprint is more than 25 km from this Geographic Location).	Yes	**No further survey required**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). Furthermore, the Development Footprint does not occur in the Geographic constraint for this species. This species is not present in the Development Footprint.
Netted Bottle Brush ***Callistemon linearifolius***	V	-	Sept - Mar	-	No	**Not present**. This species has been previously recorded in abundance approximately 9 km north of the Development Footprint (OEH 2018a), however it was not recorded in the Development Footprint as part of these surveys. The Development Footprint was comprehensively surveyed for this assessment in August and September 2018 and this species is highly detectable. This species is not present in the Development Footprint.
Noah's False Chickweed ***Lindernia alsinoides***	E	-	Nov – Feb	-	Yes	**No further survey required**. While some records of this species occur in the wider locality approximately 9 km north of the Development Footprint (OEH 2018a) the Development Footprint does not contain the suitable habitat (i.e. swamp forests and wetlands along creek lines) required for the species (OEH 2018a). Targeted surveys for the species are not considered required in the November – February survey period.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Red Helmet Orchid *Corybas dowlingii*	E	-	Jun - Aug	-	No	**Not present**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). The Development Footprint was comprehensively surveyed for this assessment in August and September 2018, and this species was not recorded in the Development Footprint as part of these surveys. This species is not present in the Development Footprint.
Rough Doubletail *Diuris praecox*	V	V	Jul – Sep	-	No	**Not present**. This species has been previously recorded in abundance approximately 9 km north east of the Development Footprint (OEH 2018a), including in Fern Bay estate and Boral Pty Ltd land. However it was not recorded in the Development Footprint as part of these surveys. The Development Footprint was comprehensively surveyed for this assessment in August and September 2018 during known flowering period. The species was confirmed flowering prior to completing targeted surveys. This species is not present in the Development Footprint.
Sand Doubletail *Diuris arenaria*	E	-	Aug - Sep	South from Soldiers Point, NSW (the Development Footprint is south of this Geographic location.	Yes	**Not present**. This species has been previously recorded in abundance approximately 9 km north east of the Development Footprint (OEH 2018a), however it was not recorded in the Development Footprint as part of these surveys. The Development Footprint was comprehensively surveyed for this assessment in August and September 2018 during known flowering events. The species was confirmed flowering prior to completing targeted surveys. This species is not present in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Small-flower Grevillea ***Grevillea parviflora*** **subsp. *parviflora***	V	V	All year	-	No	**Not present**. This species has been previously recorded in abundance approximately 7 km north of the Development Footprint (OEH 2018a), however it was not recorded in the Development Footprint as part of these surveys. The Development Footprint was comprehensively surveyed for this assessment in August and September 2018 and this species is highly detectable. This species is not present in the Development Footprint.
Tall Knotweed ***Persicaria elatior***	V	V	Dec – May	Within 50 m of semi-permanent/ephemeral wet areas, swamps, waterbodies or wetlands (the Development Footprint does not support these Habitat constraints).	No	**No further survey required**. While some records of this species occur in the wider locality approximately 7 km north of the Development Footprint (OEH 2018a) the Development Footprint does not contain suitable swamp or wetland habitat required for the species (OEH 2018a). Targeted surveys for the species were not required.
Trailing Woodruff ***Asperula asthenes***	V	V	Oct – Mar	-	No	**No further survey required**. No records of this species occur within 10 km of the Development Footprint (OEH 2018a). The Development Footprint does not contain the suitable habitat (i.e. damp sites along river banks) required for the species (OEH 2018a). Targeted surveys for the species were not required.
Villous Mint-bush ***Prostanthera densa***	V	V	All year	-	No	**Not present**. No records occur within 10 km of the Development Footprint (OEH 2018a). The Development Footprint was comprehensively surveyed for this assessment in August and September 2018, and this species was not recorded in the Development Footprint as part of these surveys. This species is not present in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Zannichellia palustris^	E	-	Mar-Nov	Land containing freshwater bodies (the Development Footprint does not support such habitat constraints)	No	**No further survey required**. There are two records of this species approximately 5km south west of the Development Footprint (OEH 2018a). The Development Footprint does not support any freshwater bodies required for this species. Targeted surveys for the species were not required.
Fauna Species						
Barking Owl ***Ninox connivens***	V	-	May-Dec	Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground (the Development Footprint does not support such habitat constraints.	No	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No living trees or stags with suitable hollows for the species were recorded. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights (December 2018, January 2019 and February 2019). This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Brush-tailed Phascogale ***Phascogale tapoatafa***	V	-	All year	Hollow bearing trees	No	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Suitable hollow bearing trees were recorded. Hollows were inspected for occupants or signs of use in December 2018 using a Signet Explorer Premium wireless inspection camera. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights (December 2018, January 2019 and February 2019). This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Brush-tailed Rock-wallaby ***Petrogale penicillata***	E	V	All year	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines (the Development Footprint	Yes	**No further survey required**. There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No suitable rocky habitat was recorded within or nearby the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
				does not support such habitat constraints.		Despite no habitat for this species, Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in quick succession when movement was detected.
Bush Stone-curlew ***Burhinus grallarius***	E	-	All year	Fallen/standing dead timber including logs (the Development Footprint supports such habitat constraints).	No	There are two records within 10 km of the Development Footprint, the closest being approximately 600 m to the south. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Areas containing fallen timber were inspected. Targeted call playback surveys were undertaken across the Development Footprint in three locations in December 2018. These sessions began with a period of quiet listening for approximately 5 minutes. Bush stone-curlew calls were played using a 15 watt directional loud hailer for approximately four minutes, followed by a listening period of five minutes between species calls. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights (December 2018, January 2019 and February 2019). This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						butter, honey and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Common Planigale ***Planigale maculata***	V	-	All year	-	No	There is one record approximately 2.5 km to the north of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Hollow logs, crevices and rocks were inspected. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights (December 2018, January 2019 and February 2019). This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Eastern Bentwing-bat ***Miniopterus schreibersii oceanensis***	V	-	Nov-Feb	Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding (the Development Footprint does not support such habitat constraints).	Yes	There are nine records of this species within 10 km of the Development Footprint, including a record by Umwelt during previous surveys in 2016. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No suitable breeding habitat was recorded within or nearby the Development Footprint. While the Development Footprint may contain foraging habitat for this species, this is a species-credit species based on breeding habitat. As none of the breeding habitat features listed are present, no impact on breeding habitat for the species will occur as a result of the Project.
Eastern Cave Bat ***Vespadelus troughtoni***	V	-	Nov-Jan	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds (the Development Footprint does not support such habitat constraints).	Yes	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No suitable breeding habitat was recorded within or nearby the Development Footprint. While the Development Footprint may contain foraging habitat for this species, this is a species-credit species based on breeding habitat. As none of the breeding habitat features listed are present, no impact on breeding habitat for the species will occur as a result of the Project.
Eastern Osprey ***Pandion cristatus***	V	-	Apr-Nov	Living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting.	No	There are seven records of this species within 10 km of the Development Footprint, the closest being almost 1.5 km to the south west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No nesting activity was recorded within the Development Footprint. Diurnal bird surveys were conducted in August 2018 at three locations across the Development Footprint. Surveys were

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						conducted at each site for a minimum of 30 minutes. This involved walking a meandering transect and recording the number of any bird species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. A total of three person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Eastern Pygmy-possum ***Cercartetus nanus***	V	-	Oct-Mar	-	No	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Suitable hollow bearing trees were recorded. Hollows were inspected for occupants or signs of use in December 2018 using a Signet Explorer Premium wireless inspection camera. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights (December 2018, January 2019 and February 2019). This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in quick succession when movement was detected.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area *Dromaius novaehollandiae* - endangered population	EP	-	All year	-	No	There are no records of the emu within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This population was not recorded in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Gang-gang Cockatoo ***Callocephalon fimbriatum***	V	-	Oct-Jan	Eucalypt tree species with hollows greater than 9 cm diameter (the Development Footprint supports such habitat constraints).	No	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Suitable hollow bearing trees were recorded. Hollows were inspected for occupants or signs of use in December 2018 using a Signet Explorer Premium wireless inspection camera. Diurnal bird surveys were conducted in August 2018 at three locations across the Development Footprint. Surveys were conducted at each site for a minimum of 30 minutes. This involved walking a meandering transect and recording the number of any bird species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. A total of three person hours of survey were conducted across the Development Footprint. In addition to this, surveys in December 2018 and January 2019 commenced in late afternoon when it families of this species would be active if present. The species was not recorded through visual or audible identification. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Giant Dragonfly ***Petalura gigantea***	E	-	Dec-Jan	Within 500 m of swamps (the Development Footprint does not support such habitat constraints).	Yes	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. While no suitable swamp habitat was recorded within or nearby the Development Footprint, meandering transect searches for the species were conducted in damp areas of the site in December 2018 for a total of one person hour. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						recorded in the Development Footprint.
Glossy Black-Cockatoo ***Calyptorhynchus lathami***	V	-	Mar-Aug	Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground (the Development Footprint supports such habitat constraints).	No	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Suitable hollow bearing trees were recorded. Hollows were inspected for occupants or signs of use in December 2018 using a Signet Explorer Premium wireless inspection camera. Diurnal bird surveys were conducted in August 2018 at three locations across the Development Footprint. Surveys were conducted at each site for a minimum of 30 minutes. This involved walking a meandering transect and recording the number of any bird species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. A total of three person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Green and Golden Bell Frog ***Litoria aurea***	E	V	Nov-Mar	Semi-permanent/ephemeral wet areas and within 1km of swamps and waterbodies (the Development Footprint is within 1km of such habitat constraints).	No	There are ten records of this species within 10 km of the Development Footprint, the closest being more than 2 km to the south west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Targeted call playback surveys were undertaken across the Development Footprint in five locations in December 2018, January 2019 and February 2019. These sessions began with a period of quiet listening for approximately 5 minutes. Green and golden bell frog calls were played using a 15 watt directional loud hailer for approximately four minutes, followed by a listening period of five minutes between species calls. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Green-thighed Frog ***Litoria brevipalmata***	V	-	Oct-Mar	-	No	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Targeted call playback surveys were undertaken across the Development Footprint in four locations in December 2018, January 2019 and February 2019. These sessions began with a period of

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						quiet listening for approximately 5 minutes. Green-thighed frog calls were played using a 15 watt directional loud hailer for approximately four minutes, followed by a listening period of five minutes between species calls. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Grey-headed Flying-fox ***Pteropus poliocephalus***	V	V	Oct-Dec	Breeding camps.	No	There are 20 records of this species within 10 km of the Development Footprint, the closest known camp is approximately 5 km to the south west in Carrington, NSW. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No breeding camps were observed. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						survey periods outlined in **Section 2** above. Numerous individuals of this species were recorded flying over the Development Footprint at dusk during their foraging period. These individuals were likely to have dispersed from breeding camps at either Carrington, Raymond Terrace or Blackbutt Nature Reserve, all of which occur within the species' optimal foraging range of 20 km (OEH 2018b).
Koala ***Phascolarctos cinereus***	V	V	All year	Important habitat only^	No	There are 21 records of this species within 10 km of the Development Footprint, the closest being approximately 300 m to the west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Spot Assessment Technique (SAT) surveys were undertaken at two locations within the Development Footprint in February 2019. These surveys involved searching a one metre radius around the trunk of at least 30 trees for koala scats or other evidence of koala presence (e.g. trunk scratchings). Scat presence was recorded along with the species of origin. Key feed species (*Eucalyptus robusta* and *Eucalyptus pilularis*) were targeted, along with other eucalypts within the vicinity with no Koala scats detected during SAT surveys. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						quick succession when movement was detected. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. Despite the extensive surveys throughout the Development Footprint, the species was not recorded. Therefore, breeding habitat for this species is not considered to be present in the Development Footprint.
Koala, Hawks Nest and Tea Gardens population *Phascolarctos cinereus* - endangered population	EP	-	All year	Important habitat only^	No	There are 21 records of this species within 10 km of the Development Footprint, the closest being approximately 300 m to the west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Spot Assessment Technique (SAT) surveys were undertaken at two locations within the Development Footprint in February 2019. These surveys involved searching a one metre radius around the trunk of at least 30 trees for koala scats or other evidence of koala presence (e.g. trunk scratchings). Scat presence was recorded along with the species of origin. Key feed species (*Eucalyptus robusta* and *Eucalyptus pilularis*) were targeted, along with other eucalypts within the vicinity with no Koala scats detected during SAT surveys. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						quick succession when movement was detected. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This population occurs north of the Development Footprint.
Large-eared Pied Bat ***Chalinolobus dwyeri***	V	V	Sep-Mar	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels (the Development Footprint does not support such habitat constraints).	Yes	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No suitable breeding habitat was recorded within or nearby the Development Footprint. While the Development Footprint may contain foraging habitat for this species, this is a species-credit species based on breeding habitat. As none of the breeding habitat features listed are present, no impact on breeding habitat for the species will occur as a result of the Project.
Little Bentwing-bat ***Miniopterus australis***	V	-	Dec-Feb	Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding (the Development Footprint does not support such habitat constraints).	Yes	There are eight records of this species within 10 km of the Development Footprint, including a record by Umwelt during previous surveys in 2016. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No suitable breeding habitat was recorded within or nearby the Development Footprint. While the Development Footprint may contain foraging habitat for this species, this is a species-credit species based on breeding habitat. As none of the breeding habitat features listed are present, no impact on breeding habitat for the species will occur as a result of the Project.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Little Eagle ***Hieraaetus morphnoides***	V	-	Aug-Oct	Nest trees - live (occasionally dead) large old trees within vegetation.	No	There are two records of this species within 10 km of the Development Footprint, both almost 5 km to the west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No nesting activity was recorded within the Development Footprint. Diurnal bird surveys were conducted in August 2018 at three locations across the Development Footprint. Surveys were conducted at each site for a minimum of 30 minutes. This involved walking a meandering transect and recording the number of any bird species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. A total of three person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Mahony's Toadlet ***Uperoleia mahonyi***	E					There is one record of this species within 10 km of the Development Footprint, approximately 6 km to the north west. However, another closer record is known approximately 1 km to the north west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Targeted call playback surveys were undertaken across the Development Footprint in four locations in December 2018, January 2019 and February 2019. Call playback surveys were undertaken during or following periods of rainfall as outlined in the threatened species survey and assessment guidelines (DECC 2009). Refer to Table 2.3 for the weather conditions for these surveys. These sessions began with a period of quiet listening for approximately 5 minutes. Mahony's toadlet calls were played using a 15 watt directional loud hailer for approximately four minutes, followed by a listening period of five minutes between species calls.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Masked Owl ***Tyto novaehollandiae***	V	-	May-Aug	Living or dead trees with hollows greater than 20cm diameter (the Development Footprint does not support such habitat constraints).	No	There are three records of this species within 10 km of the Development Footprint, the closest being more than 1 km to the north. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No living trees or stags with suitable hollows for the species were recorded. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights (December 2018, January 2019 and February 2019). This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Pale-headed Snake ***Hoplocephalus bitorquatus***	V	-	Nov-Mar	-	No	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Suitable hollow bearing trees were recorded. Hollows were inspected for occupants or signs of use in December 2018 using a Signet Explorer Premium wireless inspection camera. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights (December 2018, January 2019 and February 2019). This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Pied Oystercatcher ^ ***Haematopus longirostris***	E	-	All year.	Within 100m of estuarine areas and the ocean.	No	There are 30 records of this species within 10 km of the Development Footprint, mainly occurring within the arm of the Hunter River to the west of the Development Footprint. Targeted surveys for the species were completed in December 2018 in the eastern portion of the Development Footprint to confirm lack of suitable habitat. An additional survey was completed in February 2019 along the shoreline. No individuals were recorded. No impacts have been calculated for the species as the proposed walking track will avoid all suitable habitat for the species.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Powerful Owl ***Ninox strenua***	V	-	May-Aug	Living or dead trees with hollow greater than 20cm diameter (the Development Footprint does not support such habitat constraints).	No	There are six records of this species within 10 km of the Development Footprint, the closest being 400 m to the west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No living trees or stags with suitable hollows for the species were recorded. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Regent Honeyeater ***Anthochaera phrygia***	CE	CE	Sep-Dec	Important habitat only^	Yes	There are no records of this species within 10 km of the Development Footprint. Targeted winter bird surveys were undertaken across the Development Footprint in three locations in August 2018. As part of our application of the online BAM calculator, August surveys cannot be selected for this species, September was recorded to account for the August survey. These sessions began with a period of quiet listening for approximately 5 minutes. Regent honeyeater calls were played using a 15 watt directional loud hailer for approximately four minutes, followed by a listening period of five minutes between species calls. Following call playback sessions, bird surveys were conducted at each site for 15- 30 minutes. This involved walking a meandering transect and recording the number of any bird species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						The winter bird surveys targeted areas of quality habitat and flowering resources for the regent honeyeater and were timed to coincide with the known presence of the species in the Lower Hunter Region of NSW. A total of three person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Southern Myotis ***Myotis macropus***	V	-	Nov-Mar	Hollow bearing trees within 200 m of riparian zone. Bridges, caves or artificial structures within 200 m of riparian zone (the Development Footprint does not support such habitat constraints).	No	There are seven records of this species within 10 km of the Development Footprint, the closest being more than 1 km to the north. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No suitable breeding habitat was recorded within or nearby the Development Footprint. While the Development Footprint may contain foraging habitat for this species, this is a species-credit species based on breeding habitat. As none of the breeding habitat features listed are present, no impact on breeding habitat for species will occur as a result of the Project.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Square-tailed Kite *Lophoictinia isura*	V	-	Sept-Jan	Nest trees.	No	There are no records of this species within 10 km of the Development Footprint. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No nesting activity was recorded within the Development Footprint. Diurnal bird surveys were conducted in August 2018 at three locations across the Development Footprint. Surveys were conducted at each site for a minimum of 30 minutes. This involved walking a meandering transect and recording the number of any bird species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. A total of three person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Squirrel Glider *Petaurus norfolcensis*	V	-	All year	-	No	There are 17 records of this species within 10 km of the Development Footprint, the closest being less than 400 m to the north west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Suitable hollow bearing trees were recorded. Hollows were inspected for occupants or signs of use in December 2018 using a Signet Explorer Premium wireless inspection camera. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights

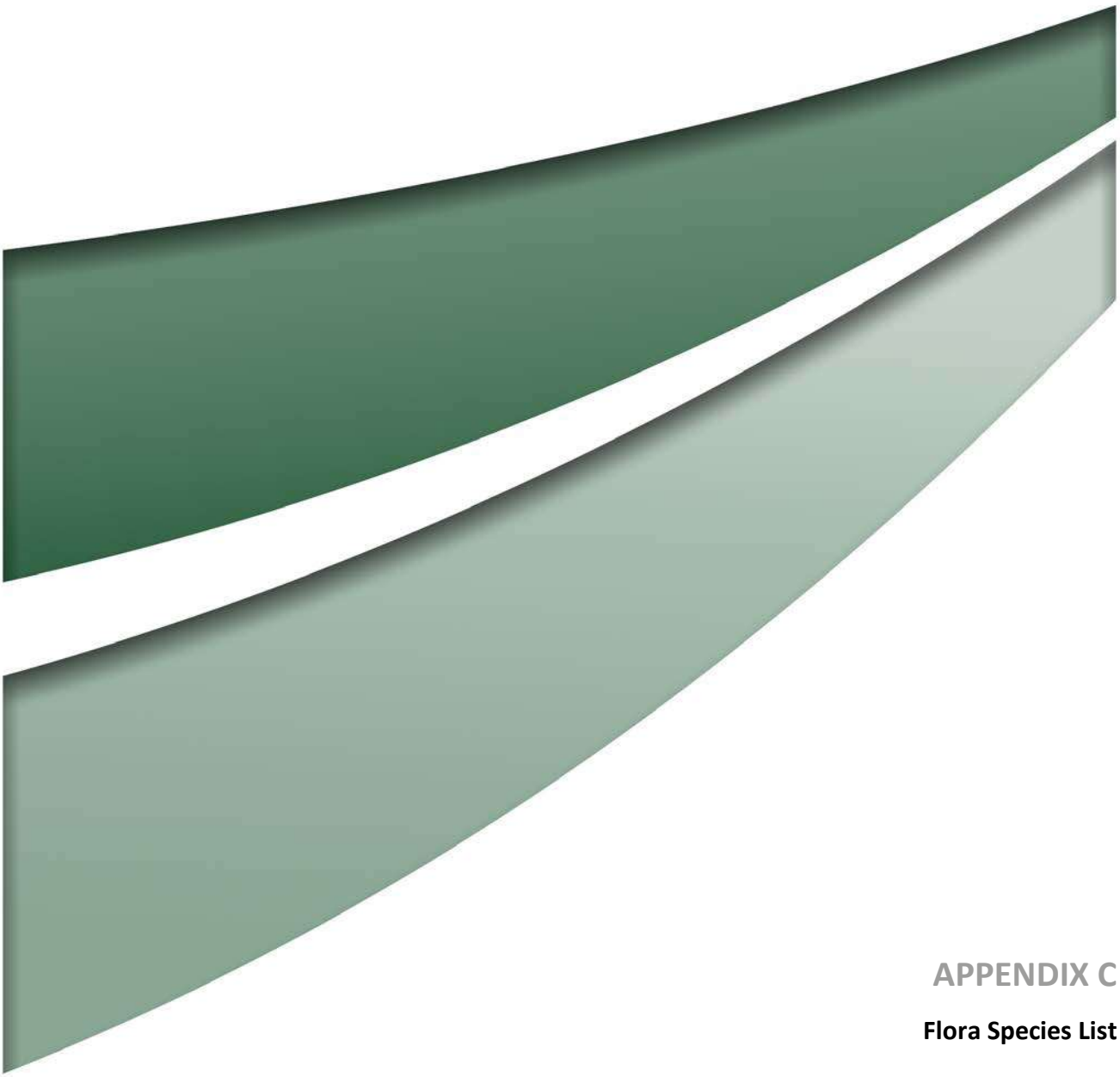
Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 17 August 2018 to 19 December 2018 (124 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and tuna. Cameras were set to take three photos in quick succession when movement was detected. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Swift Parrot ***Lathamus discolor***	E	CE	May-Aug	Important habitat only^	Yes	There is one record of this species within 10 km of the Development Footprint, the closest being almost 4 km to the south west. Targeted winter bird surveys were undertaken across the Development Footprint in three locations in August 2018. These sessions began with a period of quiet listening for approximately 5 minutes. Swift parrot calls were played using a 15 watt directional loud hailer for approximately four minutes, followed by a listening period of five minutes between species calls. Following call playback sessions, bird surveys were conducted at each site for 15- 30 minutes. This involved walking a meandering transect and recording the number of any bird species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. The winter bird surveys targeted areas of quality habitat and flowering resources for the swift parrot and were timed to coincide with the known presence of the species in the Lower Hunter Region of NSW. A total of three person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
Terek Sandpiper ^ ***Xenus cinereus***	V	V	Sep - Mar	-	No	There are more than 200 records of this species within 10 km of the Development Footprint, occurring within the arm of the Hunter River to the west of the Development Footprint. Targeted surveys for the species were completed in December 2018 in the eastern portion of the Development Footprint to confirm lack of suitable habitat. An additional survey was completed in February 2019 along the shoreline. No individuals were recorded. No impacts have been calculated for the species as the proposed walking track will avoid all suitable habitat for the species.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
Wallum Froglet *Crinia tinnula*	V	-	All year	-	No	There is one record of this species within 10 km of the Development Footprint, being almost 6 km to the north. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. Targeted call playback surveys were undertaken across the Development Footprint in four locations in December 2018, January 2019 and February 2019. These sessions began with a period of quiet listening for approximately 5 minutes. Wallum froglet calls were played using a 15 watt directional loud hailer for approximately four minutes, followed by a listening period of five minutes between species calls. Nocturnal spotlighting searches were undertaken within the Development Footprint over three nights in December 2018, January 2019 and February 2019. This involved walking a meandering transect and recording any fauna species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. Surveys were conducted between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. A total of 4.5 person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was not recorded in the Development Footprint.
White-bellied Sea-Eagle *Haliaeetus leucogaster*	V	-	Jul-Dec	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	No	There are some 42 records of this species within 10 km of the Development Footprint, the closest being less than 500 m to the south west. Habitat assessments were undertaken in August, September and December 2018 to identify potential habitat available for the species across the Development Footprint. No nesting activity was recorded within the Development Footprint. Diurnal bird surveys were conducted in August 2018 at three locations across the Development Footprint. Surveys were

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint / Geographic Constraint	SAII Entity	Survey Method and Justification
						conducted at each site for a minimum of 30 minutes. This involved walking a meandering transect and recording the number of any bird species seen or heard calling. Species were visually identified using 10 x 40 magnification binoculars or by call recognition. A total of three person hours of survey were conducted across the Development Footprint. Opportunistic observations were completed throughout all Umwelt survey periods outlined in **Section 2** above. This species was tentatively recorded flying above the Development Footprint.

^Added to the BAM calculator manually following literature review.



APPENDIX C

Flora Species List

Flora Species List

The following list was developed from the floristic plot surveys of the Development Footprint. It includes all species of vascular plants observed during these surveys. It is acknowledged that the list is not comprehensive, as not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp.	specimens that are identified to genus level only.

The following abbreviations or symbols are used in the list:

AA	denotes abundance rating according to BAM
PC	cover measure according to BAM
asterisk (*)	denotes species non-native species
double asterisk (**)	denotes High Threat Weed species under the BAM
subsp.	subspecies and
var.	variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002) and Wheeler *et al.* (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2018), the on-line plant name database maintained by the National Herbarium of New South Wales.

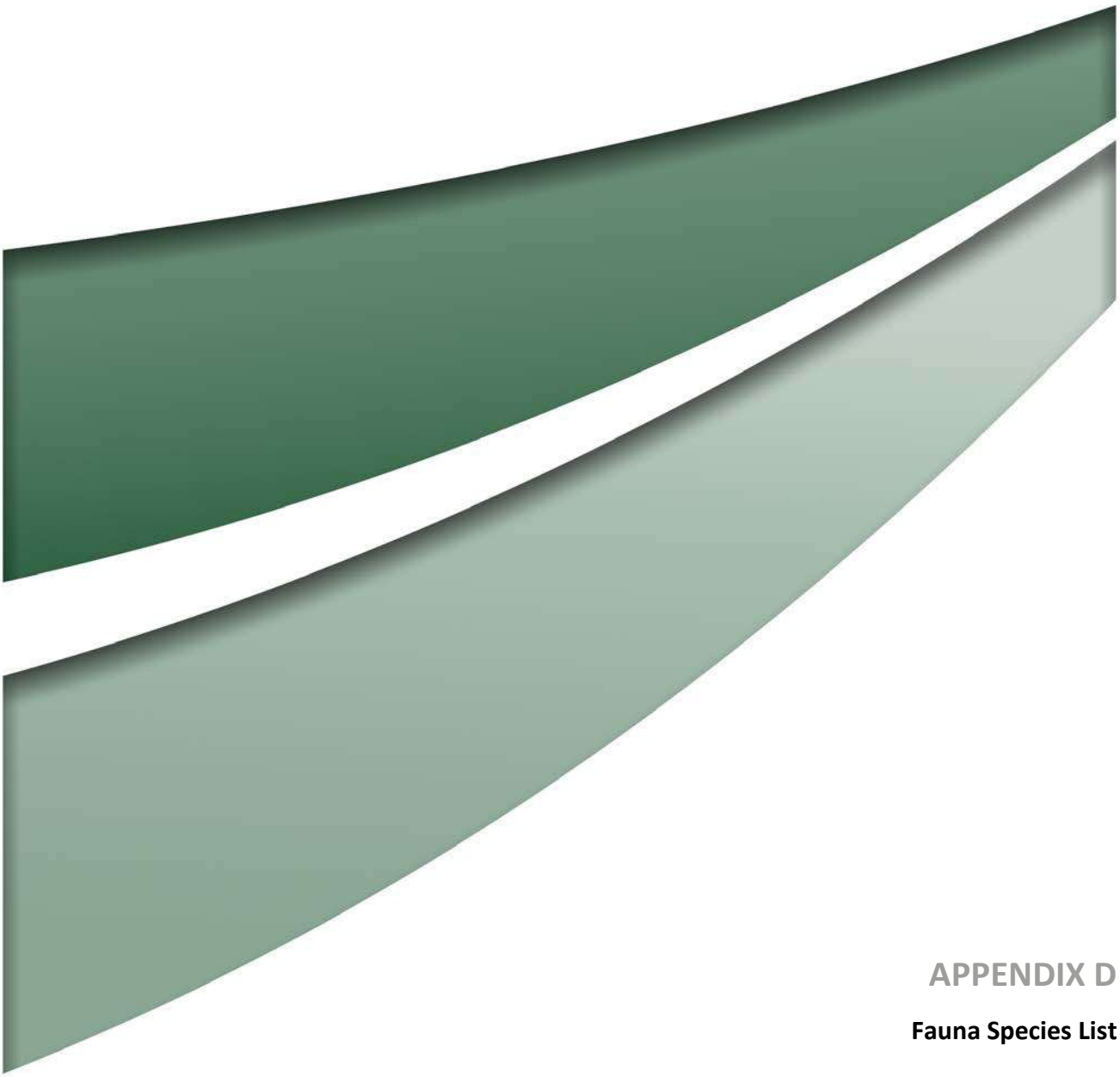
Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Family Name	Scientific Name	Common Name	VZ1		VZ2						VZ3		VZ4		VZ5					
			PCT 1646 – Moderate (Forest)		*PCT 1646 – Moderate (Tea-tree)*						*PCT 1725 - Moderate*		*PCT 1646 – Disturbed (Forest)*		*PCT 1646 – Cleared*					
			Q12		Q01		Q04		Q05		Q08		Q06		Q02		Q13		Q14	
			AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
Cycadopsida																				
Zamiaceae	*Macrozamia communis*	burrawang	1	0.2																
Filicopsida																				
Adiantaceae	*Cheilanthes distans*	bristly cloak fern			20	0.4														
Dennstaedtiaceae	*Pteridium esculentum*	bracken	500	1	1	0.4	5	0.4			50	0.5	10	1						
Magnoliopsida – Liliidae (Monocots)																				
Asparagaceae	***Asparagus aethiopicus*	asparagus fern	10	0.1																
Commelinaceae	*Commelina cyanea*	native wandering jew	10	0.1													10	1		
Cyperaceae	*Carex appressa*	tall sedge															50	0.2		
Cyperaceae	*Cyperus* sp.		5	0.1																
Lomandraceae	*Lomandra filiformis*										100	0.1								
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush	500	3	20	2					2000	70	20	2						
Orchidaceae	*Caladenia* sp.				2	0.4			1	0.4	1	0.1								
Orchidaceae	*Pterostylis* sp.	greenhood			1000	1														
Phormiaceae	*Dianella caerulea* var. *caerulea*		500	1									20	2						
Phormiaceae	*Dianella caerulea* var. *producta*										200	0.5								
Poaceae	***Andropogon virginicus*	whisky grass									50	0.1					50	1		
Poaceae	***Chloris gayana*	Rhodes grass																	20	3
Poaceae	***Ehrharta erecta*	panic veldtgrass											50	5						
Poaceae	***Megathyrsus maximus*	guinea grass															100	20	50	20
Poaceae	**Briza maxima*	quaking grass																	1000	5
Poaceae	**Bromus catharticus*	prairie grass																	50	1
Poaceae	**Cenchrus incertus*	spiny burr grass															50	2		
Poaceae	**Eragrostis* sp.	a lovegrass									100	0.2								
Poaceae	**Holcus lanatus*	Yorkshire fog															20	3		
Poaceae	**Melinis repens*	red natal grass													50	10	500	20	100	5
Poaceae	**Setaria parviflora*																		50	0.5
Poaceae	*Cynodon dactylon*	common couch									500	0.5							50	1
Poaceae	*Entolasia stricta*	wiry panic	1000	0.2																
Poaceae	*Imperata cylindrica*	blady grass	1000	2	50	5			50	2	25	0.1								

Family Name	Scientific Name	Common Name	VZ1		VZ2						VZ3		VZ4		VZ5					
			PCT 1646 – Moderate (Forest)		*PCT 1646 – Moderate (Tea-tree)*						*PCT 1725 - Moderate*		*PCT 1646 – Disturbed (Forest)*		*PCT 1646 – Cleared*					
			Q12		Q01		Q04		Q05		Q08		Q06		Q02		Q13		Q14	
			AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass							20	1			10	0.8						
Poaceae	*Panicum* sp.	panicum	1000	0.5																
Poaceae	*Paspalidium distans*												50	2						
Poaceae	*Poa labillardierei* var. *labillardierei*	tussock grass			500	15	20	3	50	3	20	0.1	20	1	100	15	200	8	100	10
Poaceae	*Themeda australis*		1000	0.2																
Magnoliopsida – Magnoliidae (dicots)																				
Aizoaceae	***Galenia pubescens*	galenia																	10	3
Aizoaceae	**Carpobrotus edulis*	glaucous pigface															10	2	20	5
Aizoaceae	*Carpobrotus glaucescens*	pigface					20	4	50	10					5	5				
Apiaceae	**Daucus carota*	wild carrot									20	0.1								
Apiaceae	*Platysace lanceolata*	shrubby platysace	1	0.1																
Apocynaceae	**Gomphocarpus fruticosus*	narrow-leaved cotton bush									1	0.1								
Apocynaceae	**Nerium oleander*	oleander																	50	3
Apocynaceae	*Parsonsia straminea*	common silkpod	1	0.1																
Asteraceae	***Bidens pilosa*	cobbler's pegs																	20	0.6
Asteraceae	***Chrysanthemoides monilifera*				20	5	5	3	10	5	10	0.2	50	15	20	5				
Asteraceae	***Chrysanthemoides monilifera* subsp. *rotundata*	bitou bush	15	0.2													20	10		
Asteraceae	***Senecio madagascariensis*	fireweed			3	0.4					1	0.1			5	0.4	10	0.1	20	0.5
Asteraceae	***Senecio* sp.	groundsel; fireweed									3	0.1								
Asteraceae	**Ambrosia artemisiifolia*	annual ragweed																	500	5
Asteraceae	**Aster subulatus*	wild aster													10	0.4	20	1	50	2
Asteraceae	**Conyza bonariensis*	flaxleaf fleabane	3	0.1							10	0.1					20	1	50	2
Asteraceae	**Heterotheca grandiflora*	telegraph weed													20	4	50	0.8		
Asteraceae	**Hypochaeris radicata*	catsear																	5	0.1
Asteraceae	**Sonchus oleraceus*	common sowthistle																	2	0.1
Bignoniaceae	*Pandorea pandorana*	wonga wonga vine											3	1						
Cactaceae	***Opuntia stricta*	common prickly pear; smooth pest pear			1	0.4														
Caryophyllaceae	**Polycarpon tetraphyllum*	four-leaved allseed															100	0.1		
Caryophyllaceae	**Stellaria media*	common chickweed													50	2	50	1		

Family Name	Scientific Name	Common Name	VZ1		VZ2						VZ3		VZ4		VZ5					
			PCT 1646 – Moderate (Forest)		*PCT 1646 – Moderate (Tea-tree)*						*PCT 1725 - Moderate*		*PCT 1646 – Disturbed (Forest)*		*PCT 1646 – Cleared*					
			Q12		Q01		Q04		Q05		Q08		Q06		Q02		Q13		Q14	
			AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
Convolvulaceae	*Dichondra repens*	kidney weed															10	0.01		
Crassulaceae	***Bryophyllum delagoense*	mother of millions													20	5				
Dilleniaceae	*Hibbertia* sp.						2	0.4												
Ericaceae	*Astroloma pinifolium*	pine heath					20	5												
Ericaceae	*Brachyloma daphnoides*	daphne heath							1	0.4			5	1						
Ericaceae	*Leucopogon muticus*	blunt beard-heath							1	0.4										
Ericaceae	*Monotoca elliptica*	tree broom-heath	1	0.1	2	0.4	50	10	50	25										
Fabaceae (Faboideae)	*Aotus ericoides*						7	2												
Fabaceae (Faboideae)	*Bossiaea ensata*	sword bossiaea					10	2												
Fabaceae (Faboideae)	*Bossiaea heterophylla*	variable bossiaea			1	0.4	4	0.4	2	0.8										
Fabaceae (Faboideae)	*Bossiaea rhombifolia*						10	5												
Fabaceae (Faboideae)	*Glycine* sp.		1	0.1																
Fabaceae (Faboideae)	*Glycine tabacina*	variable glycine																		
Fabaceae (Faboideae)	*Kennedia rubicunda*	dusky coral pea									1	0.1								
Fabaceae (Mimosoideae)	*Acacia longifolia*						20	10			1	0.5			10	5	4	1		
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *longifolia*	Sydney golden wattle			20	3														
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *sophorae*	coastal wattle	2	0.1					20	10			5	2						
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	prickly moses					2	0.4												
Loranthaceae	*Amyema* sp.	mistletoe											2	0.6						
Malvaceae	**Sida rhombifolia*	paddy's lucerne																	20	1
Malvaceae	*Sida corrugata*	corrugated sida													1	0.4				
Myrsinaceae	**Anagallis arvensis*	scarlet pimpernel													1	0.4	50	0.2	20	0.2
Myrtaceae	*Eucalyptus pilularis*	blackbutt	2	5									2	10						
Myrtaceae	*Eucalyptus robusta*	swamp mahogany									15	15								
Myrtaceae	*Leptospermum laevigatum*	coast teatree	8	0.2	50	70	50	35	500	70	30	10	100	70	50	35				
Myrtaceae	*Leptospermum polygalifolium*		15	0.5																
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*																20	10		
Ochnaceae	***Ochna serrulata*	mickey mouse plant	2	0.1																
Onagraceae	**Oenothera mollissima*																50	7	50	0.8

Family Name	Scientific Name	Common Name	VZ1		VZ2						VZ3		VZ4		VZ5					
			PCT 1646 – Moderate (Forest)		*PCT 1646 – Moderate (Tea-tree)*						*PCT 1725 - Moderate*		*PCT 1646 – Disturbed (Forest)*		*PCT 1646 – Cleared*					
			Q12		Q01		Q04		Q05		Q08		Q06		Q02		Q13		Q14	
			AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
Oxalidaceae	**Oxalis pes-caprae*	soursob													5	0.4			10	0.1
Phyllanthaceae	*Breynia oblongifolia*	coffee bush	100	1							1	0.1	3	0.4						
Pittosporaceae	*Pittosporum revolutum*	rough fruit pittosporum	1	0.1																
Plantaginaceae	**Plantago lanceolata*	lamb's tongues																	50	0.8
Proteaceae	*Banksia serrata*	old-man banksia	1	5					1	5	1	2	20	20						
Proteaceae	*Persoonia lanceolata*	lance leaf geebung			3	0.4	10	3	10	4					10	1				
Proteaceae	*Persoonia levis*	broad-leaved geebung					3	0.4												
Ranunculaceae	*Clematis* sp.												10	0.5						
Rubiaceae	**Richardia brasiliensis*	Mexican clover															20	0.1		
Rubiaceae	*Asperula conferta*	common woodruff													5	0.4				
Rubiaceae	*Pomax umbellata*	pomax	20	0.1							100	0.2								
Sapindaceae	*Cupaniopsis anacardioides*	tuckeroo	1	0.1																
Selaginaceae	**Hebenstretia dentata*														20	1	100	1	50	1
Solanaceae	**Solanum nigrum*	black-berry nightshade															1	0.1	20	0.8
Verbenaceae	***Lantana camara*	lantana	1	0.1									20	5					10	1
Verbenaceae	**Verbena bonariensis*	purpletop													2	0.4				
Vitaceae	*Cayratia clematidea*	native grape																	5	20



APPENDIX D

Fauna Species List

Fauna Species List

The following list was developed from surveys of the Development Footprint undertaken by Umwelt in 2018 and 2019. All species recorded during targeted surveys or opportunistically during other survey periods were included.

The following abbreviations are used in the list:

asterisk (*)	Denotes species not indigenous to Mount Owen Complex
subsp.	Subspecies
MIG	Listed migratory species under the EPBC Act
MAR	Listed marine species under the EPBC Act
V	Vulnerable under Schedule 2 of the Biodiversity Conservation Act 2016 (BC Act);
E	Endangered under Schedule 1 of the BC Act.

Birds recorded were identified using descriptions in Slater *et al.* (2009) and the scientific and common name nomenclature of BirdLife International Taxonomic Checklist (2017) (formerly Birds Australia). Reptiles recorded were identified using keys and descriptions in Cogger (2014), Swan *et al.* (2004), Weigel (1990) and Wilson and Swan (2003) and the scientific and common name nomenclature of Cogger (2014).

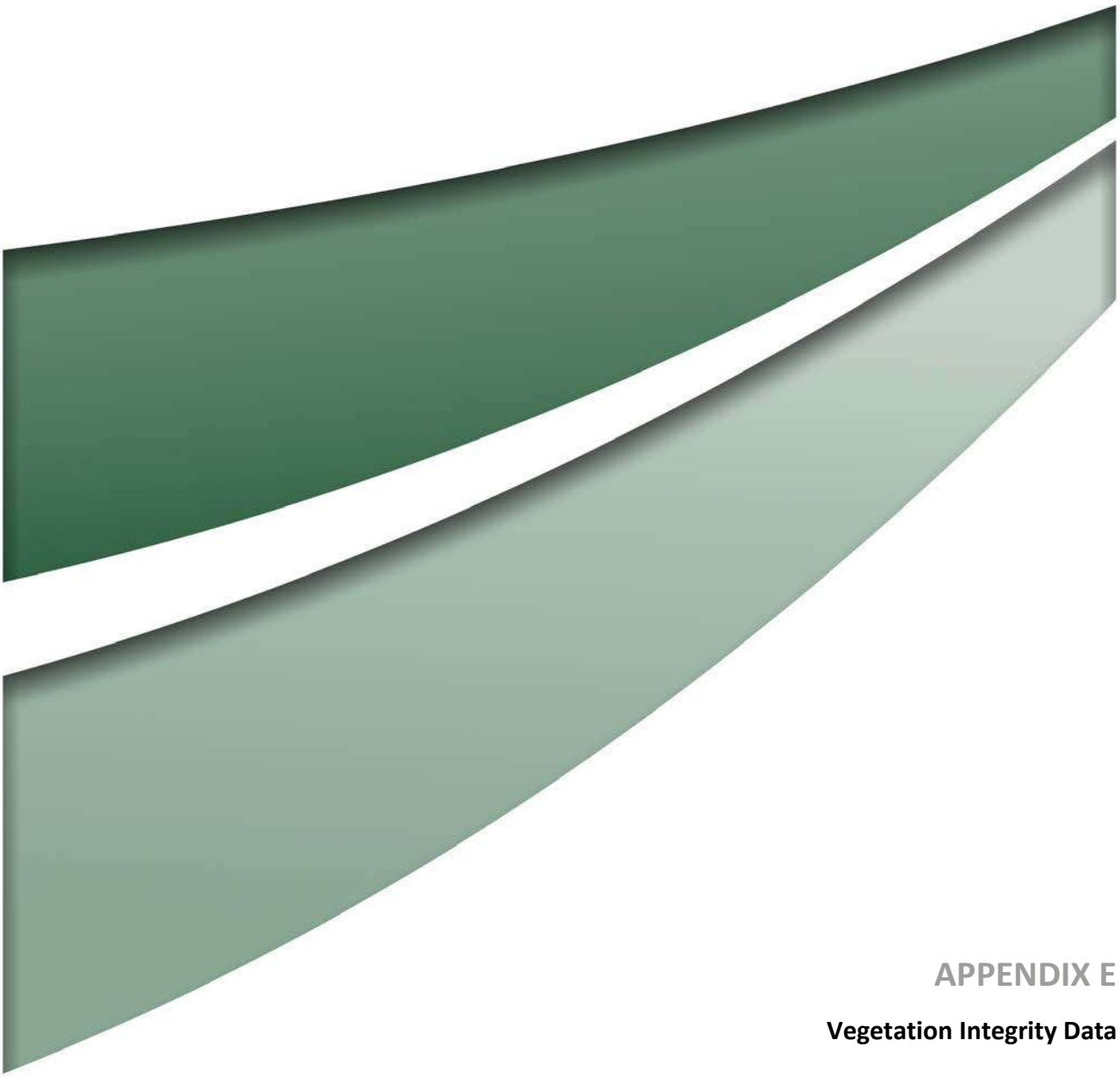
Amphibians recorded were identified using keys and descriptions in Cogger (2014), Robinson (1998), Anstis (2013) and Barker *et al.* (1995) and the scientific and common name nomenclature of Cogger (2014). Mammals recorded were identified using keys and descriptions in Strahan (2002), Van Dyck, D. and Strahan, R. (2008) and Menkhorst and Knight (2010) and the scientific and common name nomenclature of Strahan (2002) and Van Dyck, D. and Strahan, R. (2008) for non-bat species. Bat species recorded were identified using keys and descriptions in Churchill (1998) and ecological information was obtained from Churchill (2008).

Scientific Name	Common Name	Conservation Status	
		BC Act	EPBC Act
BIRDS			
Accipitridae			
Accipiter cirrhocephalus	collared sparrowhawk	-	-
Haliaeetus leucogaster	white-bellied sea-eagle	V	-
Falconidae			
Falco longipennis	Australian hobby	-	-
Turnicidae			
Turnix varia	painted button-quail	-	-
Columbidae			
Geopelia humeralis	bar-shouldered dove	-	-
Phaps elegans	brush bronzewing	-	-
**Streptopelia chinensis*	spotted turtle-dove	-	-
Cacatuidae			
Calyptorhynchus funereus	yellow-tailed black cockatoo	-	-
Cacatua galerita	sulphur-crested cockatoo	-	-
Eolophus roseicapilla	galah	-	-
Psittacidae			
Platycercus eximius	eastern rosella	-	-
Trichoglossus haematodus	rainbow lorikeet	-	-
Cuculidae			
Cacomantis flabelliformis	fan-tailed cuckoo	-	-
Chalcites lucidus	shining bronze-cuckoo	-	-
Eudynamys orientalis	eastern koel	-	-
Aegothelidae			
Aegotheles cristatus	Australian owlet-nightjar	-	-
Apodidae			
Apus pacificus	fork-tailed swift	-	MAR, MIG
Halcyonidae			
Dacelo novaeguineae	laughing kookaburra	-	-
Todiramphus sanctus	sacred kingfisher	-	-
Meropidae			
Merops ornatus	rainbow bee-eater	-	MAR
Coraciidae			
Eurystomus orientalis	dollarbird	-	-

Scientific Name	Common Name	Conservation Status	
		BC Act	EPBC Act
Maluridae			
Malurus cyaneus	superb fairy-wren	-	-
Pardalotidae			
Pardalotus punctatus	spotted pardalote	-	-
Acanthizidae			
Acanthiza chrysorrhoa	yellow-rumped thornbill	-	-
Acanthiza nana	yellow thornbill	-	-
Acanthiza pusilla	brown thornbill	-	-
Sericornis frontalis	white-browed scrubwren	-	-
Meliphagidae			
Acanthorhynchus tenuirostris	eastern spinebill	-	-
Anthochaera carunculata	red wattlebird	-	-
Anthochaera chrysoptera	little wattlebird	-	-
Lichenostomus chrysops	yellow-faced honeyeater	-	-
Lichenostomus penicillatus	white-plumed honeyeater	-	-
Manorina melanocephala	noisy miner	-	-
Meliphaga lewinii	Lewins honeyeater	-	-
Phylidonyris nigra	white-cheeked honeyeater	-	-
Phylidonyris novaehollandiae	New Holland honeyeater	-	-
Petroicidae			
Eopsaltria australis	eastern yellow robin	-	-
Eupetidae			
Psophodes olivaceus	eastern whipbird	-	-
Pachycephalidae			
Colluricincla harmonica	grey shrike-thrush	-	-
Pachycephala pectoralis	golden whistler	-	-
Pachycephala rufiventris	rufous whistler	-	-
Dicruridae			
Myiagra rubecula	leaden flycatcher	-	-
Rhipidura fuliginosa	grey fantail	-	-
Rhipidura rufifrons	rufous fantail	-	MAR, MIG
Campephagidae			
Coracina novaehollandiae	black-faced cuckoo-shrike	-	-
Artamidae			

Scientific Name	Common Name	Conservation Status	
		BC Act	EPBC Act
Artamus leucorynchus	white-breasted woodswallow	-	-
Cracticus nigrogularis	pied butcherbird	-	-
Cracticus torquatus	grey butcherbird	-	-
Gymnorhina tibicen	Australian magpie	-	-
Corvidae			
Corvus coronoides	Australian raven	-	-
Estrildidae			
Neochmia temporalis	red-browed finch	-	-
Zosteropidae			
Zosterops lateralis	silvereye	-	-
Laridae			
Chroicocephalus novaehollandiae	silver gull	-	MAR
Sterna hirundo	common tern	-	MAR, MIG
REPTILES			
Varanidae			
Varanus varius	lace monitor	-	-
Agamidae			
Amphibolurus muricatus	jacky lizard	-	-
Scincidae			
Ctenotus robustus	striped skink, robust ctenotus	-	-
Elapidae			
Demansia psammophis	yellow-faced whip snake	-	-
AMPHIBIANS			
Myobatrachidae			
Limnodynastes ornatus	ornate burrowing frog	-	-
MAMMALS			
Pseudocheiridae			
Pseudocheirus peregrinus	common ringtail possum	-	-
Tachyglossidae			
Tachyglossus aculeatus	short-beaked echidna	-	-
Macropodidae			
Macropus giganteus	eastern grey kangaroo	-	-
Macropus rufogriseus	red-necked wallaby	-	-
Pteropodidae			

Scientific Name	Common Name	Conservation Status	
		BC Act	EPBC Act
Pteropus poliocephalus	grey-headed flying-fox	V	V
Muridae			
**Mus musculus*	house mouse	-	-
Rattus fuscipes	bush rat	-	-
**Rattus rattus*	black rat	-	-
Canidae			
**Canis familiaris*	dog	-	-
**Vulpes vulpes*	fox	-	-
Felidae			-
**Felis catus*	cat	-	-
Leporidae			
**Lepus capensis*	brown hare	-	-
**Oryctolagus cuniculus*	rabbit	-	-



APPENDIX E

Vegetation Integrity Data

Vegetation Integrity Data

The following vegetation integrity data was collected from surveys of the Development Footprint. It includes the composition, structure and function attributes that are recorded in each BAM plot. This data is assessed against benchmark data for PCTs and entered into the BAM Calculator to assess the condition of each PCT in the Development Footprint.

The following abbreviations are used in the table below:

Tr	Tree (growth form)
Sh	Shrub (growth form)
Gr	Grass (growth form)
Fb	Forb (growth form)
Fn	Fern (growth form)
Ot	Other (growth form)

Plot	COMPOSITION						STRUCTURE						FUNCTION										
	Tr	Sh	Gr	Fb	Fn	Ot	Tr	Sh	Gr	Fb	Fn	Ot	Regen	Stem Classes (cm)					No. Large Trees	No. Hollow Trees	Litter (%)	Fallen Logs (m)	High Threat Weeds
													<5	5-10	10-20	20-30	30-50	50-80					
VZ1 – PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Moderate (Forest)*																							
Q12	4	7	6	3	1	3	15.1	2.1	6	1.2	1	0.4	1	0	1	1	1	0	0	0	97.0	5	0.5
VZ2 – PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Moderate (Tea-tree – Banksia Scrub)*																							
Q01	0	5	3	2	2	0	0	74.2	22	1.4	0.8	0	0	0	0	0	0	0	0	0	48.0	2	5.8
Q04	0	12	1	1	1	0	0	73.6	3	4	0.4	0	0	0	0	0	0	0	0	0	46.0	0	3
Q05	1	7	3	2	0	0	5	110.6	6	10.4	0	0	0	0	1	0	0	0	0	0	53.6	0	5
VZ3 – PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast – *Moderate*																							
Q08	2	3	6	4	1	1	17	10.6	71	0.9	0.5	0.1	1	1	1	1	1	0	0	0	57.0	6	0.4
VZ4 – PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast –*Disturbed (Forest)*																							
Q06	2	4	4	1	1	3	30	73.4	5.8	2	1	2.1	1	1	1	1	1	1	0	1	91.6	14	25
VZ5 – PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast – *Cleared*																							
Q02	0	3	1	3	0	0	0	41	15	5.8	0	0	0	0	0	0	0	0	0	0	26.4	0	10.4
Q13	0	2	2	2	0	0	0	11	8.2	1.01	0	0	0	0	0	0	0	0	0	0	36.4	0	16.1
Q14	0	0	2	0	0	1	0	0	11	0	0	20	0	0	0	0	0	0	0	0	43.0	0	8.1

APPENDIX F

Biodiversity Credit Report

BAM Credit Summary Report

Proposal Details

Assessment Id

00013113/BAAS17068/19/00013114

Proposal Name

Rifle Range BAM

BAM data last updated *

12/06/2019

Assessor Name

Bill Wallach

Report Created

18/06/2019

BAM Data version *

11

Assessor Number

BAAS17068

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

Revision No

2

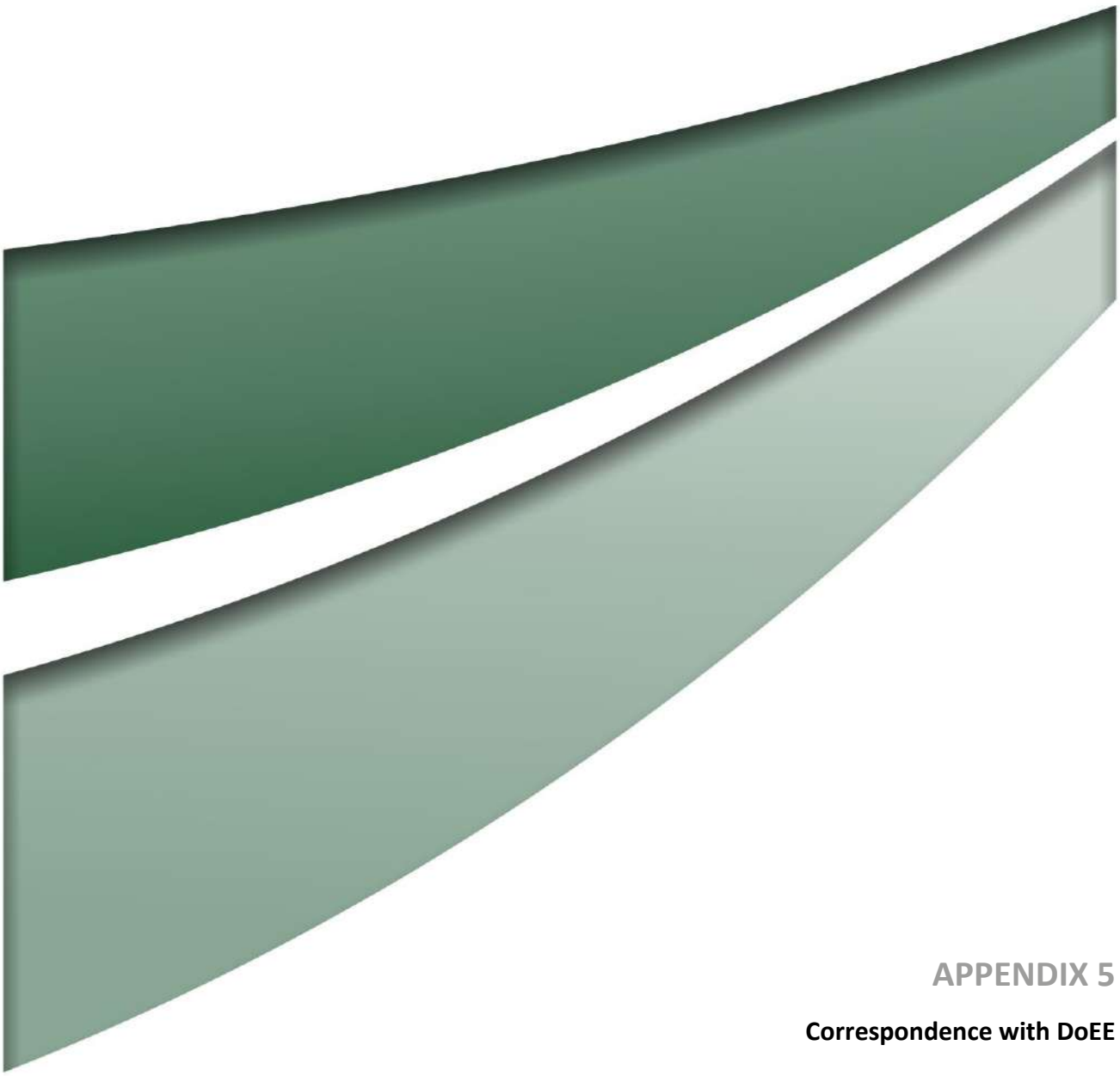
Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast								
1	1646_Moderate_Forest	30.8	0.7	0.25	High Sensitivity to Potential Gain	1.50		8

2	1646_Moderate_TeaTree	27.9	15.1	0.25	High Sensitivity to Potential Gain	1.50		158
4	1646_Disturbed_Forest	50.8	1.6	0.25	High Sensitivity to Potential Gain	1.50		30
5	1646_Cleared	11.6	5.0	0.25	High Sensitivity to Potential Gain	1.50		0
							Subtotal	**196**
Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast								
3	1725_Moderate	58.4	0.1	0.25	High Sensitivity to Potential Gain	1.50		3
							Subtotal	**3**
							Total	**199**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits



APPENDIX 5

Correspondence with DoEE

Briefing Note

To: Martin Paull (DoEE), Yin Phyu (DoEE)
cc: Gully Coote (DHA)
Author: Kate Connolly (Umwelt)
Date: 21 September 2017
Subject: Response to DoEE Koala and Grey-headed Flying-fox Assessment

Purpose

This briefing note presents DHA's response to the Commonwealth Department of Environment and Energy's (DoEE) controlled action assessment for the koala (*Phascolarctos cinereus*) and grey-headed flying-fox (*Pteropus poliocephalus*) for the Rifle Range Master Plan proposal. It provides further information in relation to the available data and habitat descriptions in the locality to refine the assessment of critical habitat for these species and their recovery in the region.

Outcomes/Key messages

Umwelt does not consider the Coastal Tea-tree – Banksia Scrub within the Referral Area to conform to the definition of koala habitat as per the Commonwealth Referral Guidelines for the Vulnerable Koala (DoE 2014).

Furthermore, the foraging resources in the Coastal Tea-tree – Banksia Scrub within the Referral Area should not be considered to be of suitable density or condition to be defined as foraging habitat critical to the survival of the grey-headed flying-fox.

In this document

1.0 Introduction 2
2.0 Koala (*Phascolarctos cinereus*) 2
- **2.1 Definition of Koala Habitat** 2
- **2.2 Importance of Habitat in the Referral Area** 4
- **2.3 Substantial Interference with the Recovery of the Koala** 4
- **2.4 Conclusion** 5

3.0 Grey-headed Flying-fox (*Pteropus poliocephalus*) 6
- **3.1 Definition of Foraging Habitat Critical to the Survival of the Grey-headed Flying-fox** 6
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Attachments

1. Port Stephens CKPoM, Koala Habitat Mapping and Lunney *et al.* (1998)

Inspired People.
Dedicated Team.
Quality Outcomes.

Newcastle
75 York Street
Teralba NSW 2284
Ph. 02 4950 5322

Perth
PO Box 783
West Perth WA 6872
First Floor
9 Havelock Street
West Perth WA 6005
Ph. 08 6260 0700

Canberra
PO Box 6135
56 Bluebell Street
O'Connor ACT 2602
Ph. 02 6262 9484

Sydney
Level 3
50 York Street
Sydney NSW 2000
Ph. 1300 793 267

Brisbane
Level 11
500 Queen Street
Brisbane QLD 4000
Ph. 1300 793 267

www.umwelt.com.au

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1.0 Introduction

An EPBC Referral was submitted for the proposed Master Plan residential development (the proposed action) at the Rifle Range, Stockton, NSW on behalf of Defence Housing Australia (DHA) (the proponent). The Commonwealth Department of Environment and Energy (DoEE) has concluded that the proposed action is a Controlled action for the following controlling provisions:

- Listed threatened species and communities (section 18 and section 18A):
    - Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) – vulnerable, and
    - Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable, and
- The environment because the proposal is a Commonwealth action (section 28).

The Referral documentation and assessments of significance concluded no significant impacts on these species based on:

- impacts to 0.8 hectares of vegetation containing known koala feed trees for the Port Stephens important population and avoidance of approximately 19.9 hectares of preferred and supplementary habitat for the species across the site and
- impacts to 0.8 hectares of mature foraging habitat for the grey-headed flying-fox and avoidance of 19.9 hectares of forest foraging habitat for the species across the site.

Following a phone conference on 12 September 2017, DoEE has provided further information in relation to their assessment of significant impacts on the koala and the grey-headed flying-fox including the impacts relating to shrubland as habitat critical to the survival of these species.

This briefing note presents DHA's response to this assessment and provides further information in relation to the available data and habitat descriptions for these species and populations in the locality to refine the assessment of critical habitat for the species recovery in the region.

2.0 Koala (*Phascolarctos cinereus*)

2.1 Definition of Koala Habitat

As per the Commonwealth Referral Guidelines for the Vulnerable Koala (DoE 2014) koala habitat includes:

> *"any forest or woodland containing species that are known koala food trees, or **shrubland with emergent food trees**"* (bold emphasis added).

DoEE has proposed that the Coastal Tea-tree – Banksia Scrub within the Referral Area conforms to the definition of koala habitat due to the presence of coastal tea-tree (*Leptospermum laevigatum*) being a food tree in a shrubland as per the above definition. This conclusion is derived from the EPBC Act listing advice for the koala (TSSC 2012) that states that the species:

> *"may also consume foliage of related genera, including Corymbia, Angophora and Lophostemon and at times supplement its diet with other species, including species from the genera **Leptospermum** and Melaleuca (Martin and Handasyde 1999; Moore and Foley 2000)."* (bold emphasis added).

The reference to supplementary feeding by koalas on *Leptospermum* species is derived from Martin and Handasyde (1999) which describes an introduced island population of koala on Chinaman Island in Western Port, Victoria. The information is as follows:

> *"After a few months it became apparent that they [koalas] were spending an inordinate amount of time in the coast tea-tree (Leptospermum laevigatum) and swamp paper-bark (Melaleuca ericifolia)* ***that proliferated on the island****. A subsequent analysis of their faecal pellets showed that while* ***the bulk of the diet*** *of most animals was* ***coastal manna gum (Eucalyptus pryoriana)****, they were taking a surprising amount of foliage from the tea-tree and some paper-bark."* (bold emphasis added).

It is acknowledged that the Coastal Tea-tree – Banksia Scrub within the Referral Area is dominated by coastal tea-tree (*Leptospermum laevigatum*). The example above from Martin and Handasyde (1999) indicates an island population of koala (in Victoria) that did not have much of an alternative than to supplement their diet with the dominant plant species in a restricted island environment.

In these cases, it would be expected that the koala would seek other non-key species as food resources when other resources are limited. This is not the case in the Port Stephens population of koala, with identified food trees and preferred habitat occurring in contiguous habitat north of the Referral Area associated with the Worimi Conservation Lands that extend along the Stockton Bight to the north to Nelson Bay.

Port Stephens Council has undertaken detailed koala habitat mapping in the Port Stephens Local Government Area (LGA). This is presented in the Comprehensive Koala Plan of Management (CKPoM) and Koala Habitat Planning Map (refer to **Figure 1**), which shows a small area of supplementary habitat in the Referral Area within the areas proposed to be entirely avoided. The Assessment of Koala Habitat in Attachment E of the Referral documentation took a precautionary approach in assessing the koala habitat in the Referral Area by analysing the on-ground presence of koala food trees in accordance with the CKPoM and Lunney *et al* (1998) (refer to **Attachment 1**). The CKPoM outlines the specific koala food trees that occur in the Port Stephens LGA. These include swamp mahogany (*Eucalyptus robusta*), Earps gum (*Eucalyptus parramattensis* subsp. *decadens*) and forest red gum (*Eucalyptus tereticornis*) and other supplementary trees.

These local studies do not reference coastal tea-tree (*Leptospermum laevigatum*) to be preferred or supplementary feeding resources for the koala in the Port Stephens locality. This local information is important to consider in the assessment of suitable koala habitat in the Referral Area as the glossary on page 5 of the Referral Guidelines (DoE 2014) notes that:

> *"food tree species may vary spatially and temporally and information specific to the local area is likely to be most accurate."*

The Referral Guidelines (DoE 2014) continue on to reference listed koala food tree species in the NSW Recovery Plan for the Koala (DECC 2008) and the NSW Office of Environment and Heritage (OEH) koala habitat webpage (http://www.environment.nsw.gov.au/animals/koalahabitat.htm). Furthermore, the recently proposed updates to the NSW State Environmental Planning Policy (SEPP) No. 44 – Koala Habitat Protection lists 65 feed species for the koala in NSW. None of these resources references coastal tea-tree (*Leptospermum laevigatum*) or any shrub species as a known koala food species in NSW or the relevant koala management area (KMA).

Based on the information above, Umwelt does not consider the Coastal Tea-tree – Banksia Scrub within the Referral Area to conform to the definition of koala habitat as per the Referral Guidelines (DoE 2014) for the important population of koala in the Port Stephens area.

2.2 Importance of Habitat in the Referral Area

DoEE's assessment determined that the proposed action would impact 15.3 hectares of habitat critical to the survival of the koala.

As per the Referral Guidelines (DoE 2014) habitat critical to the survival of the koala is defined as:

> *"**koala habitat** that is considered to be important for the species' long-term survival and recovery."* (bold emphasis added).

It is understood that DoEE's assessment has taken into account a range of factors in determining whether the vegetation in the Referral Area is important for the survival and recovery of the koala (such as recovery value, habitat connectivity and existing threats), however as per **Section 2.1** above, the Coastal Tea-tree – Banksia Scrub (accounting for 14.5 hectares of impact) within the Referral Area is highly unlikely to conform to the definition of koala habitat for the important Port Stephens population of koala. Therefore it cannot be habitat critical to the survival of the koala as per the definition in the Referral Guidelines (DoE 2014).

2.3 Substantial Interference with the Recovery of the Koala

DoEE's assessment also determined that the proposed action would substantially interfere with the recovery of the koala due to predicted increases in koala fatalities and the introduction or spread of disease or pathogens such as *Chlamydia* or *Phytophthora cinnamomi*. While it is acknowledged that these impacts may occur as a result of the proposed action, it is considered unlikely that they would occur in any substantial way.

As shown in **Figure 2**, the Port Stephens koala population has not been recorded south of the Worimi Regional Park. It is evident from the koala records in the region that the core habitat areas for the species occurs within the sheltered woodland and forest habitat within the Tilligerry State Conservation Area and around Heatherbrae, Raymond Terrace, Medowie, Tanilba Bay and Taylors Beach. Movement and dispersal habitat for the species is highly restricted to the south of the Referral Area. The Port Stephens koala population is known to be commonly impacted by vehicle strikes and dog attack. In recognition of this, DHA has proposed substantial minimisation and mitigation measures as part of the proposed action including:

- traffic control measures/speed limits/signage.
- exclusion fencing to restrict koala from the developed areas of the site.
- provisions for suitability fenced yards, management of vegetation adjacent to fencing and dog ownership covenants.

As the Referral Area occurs on the edge of the southern-most extent of the Port Stephens koala population and the population is not known to disperse south into Stockton from the northern Worimi Conservation Lands, the potential for koala mortalities associated with vehicle strikes and dog attack are considered to be much lower in the Referral Area than other areas in the Port Stephens LGA. Noting this, the small area of impact on intact koala habitat and the proposed mitigation measures above, Umwelt considers it unlikely that the proposed action would substantially interfere with the recovery of the koala as a result of koala mortalities.

The koala is known to contract strains of *Chlamydia* and the koala retrovirus. Chlamydial disease and the koala retrovirus are common in populations in eastern Australia and are known to be present in the Port Stephens koala population (NSWSC 2017). It is estimated that up to 100 per cent of koala populations in Queensland and New South Wales have the koala retrovirus (TSSC 2012). Based on

the small number of individuals predicted in the Port Stephens koala population it is likely that these diseases are already prevalent and the proposed action is unlikely to further facilitate the spread or introduce these diseases in the locality.

Phytophthora cinnamomi is a soil-borne pathogen belonging to the water mould group (Oomycetes) (NSWSC 2002) that attacks the roots and stems of plants. In some circumstances, it may contribute to plant death where there are other stresses present (e.g. waterlogging, drought, and wildfire). This pathogen is considered to be 'largely unknown' in the Lower Hunter region (PB 2013) and therefore the proposed action is unlikely to facilitate the spread of this pathogen to an extent that would substantially interfere with the recovery of the koala. Furthermore, vehicle and equipment cleaning during the construction of the proposed action will be implemented to minimise the risk of pathogen spread.

2.4 Conclusion

As the Coastal Tea-tree – Banksia Scrub within the Referral Area does not conform to the definition of koala habitat the Referral Guidelines (DoE 2014) and this area does not provide suitable movement or dispersal habitat for the species, the proposed action is considered to impact a maximum of 0.8 hectares of habitat containing koala feed trees and 1.9 hectares of preferred and supplementary habitat (as per Lunney *et al* 1998) critical to the survival of the koala. The Referral Guidelines (DoE 2014) state that:

*"Loss of habitat that is not habitat critical to the survival of the species is **highly unlikely** to have a significant impact on the koala for the purposes of the EPBC Act."* (bold emphasis added)

and

*"The loss of between 2 and 20 ha of habitat critical to the survival **may** have a significant impact on the koala for the purposes of the EPBC Act."* (bold emphasis added).

As this impact falls under this threshold, and noting the lack of utilisation of the Referral Area by the species, Umwelt considers that it is unlikely that the proposed action would significantly impact the Port Stephens important population of koala.

DHA acknowledges the importance of koala habitat in the locality and has sought to specifically avoid the high quality habitats resulting in the retention of up to approximately 19.9 hectares of preferred and supplementary koala habitat in the north of the Referral Area. A Preliminary Koala Plan of Management has also been prepared for the site. As recommended in the Referral Guidelines (DoE 2014), DHA has proposed substantial minimisation measures including:

- traffic control measures/speed limits/signage
- fencing to restrict koala from developed areas of the site
- detailed pre-clearing surveys and tree-felling procedures
- dog management including provisions for suitability fenced yards, management of vegetation adjacent to fencing and dog ownership covenants
- targeted koala feed tree planting such as swamp mahogany and Earps gum.

As outlined in the Referral Guidelines (DoE 2014), DHA have sought to avoid impacts to habitat critical to the survival of the koala and implement the mitigation measures to reduce the risk of a significant impact on the species.

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

3.1 Definition of Foraging Habitat Critical to the Survival of the Grey-headed Flying-fox

As per the Draft National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus* (DECCW 2009) foraging habitat critical to the survival of the species includes habitat that is:

> *"1. productive during winter and spring, when food bottlenecks have been identified*
>
> *2. known to support populations of > 30 000 individuals within an area of 50 km radius*
>
> *3. productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May)*
>
> *4. productive during the final stages of fruit development and ripening in commercial crops affected by grey-headed flying-foxes (months vary between regions)*
>
> *5. known to support a continuously occupied camp."*

It is acknowledged that the Referral Area contains areas of intact forest vegetation that conforms to the definition of foraging habitat critical to the survival of the grey-headed flying-fox as outlined in the Draft National Recovery Plan (DECCW 2009) with productive foraging resources including mature smooth-barked apple (*Angophora costata*), blackbutt (*Eucalyptus pilularis*), swamp mahogany (*Eucalyptus robusta*) and coast banksia (*Banksia intergrifolia*) occurring in the Frontal Dune Blackbutt-Apple Forest and Mahogany-Baloskion Swamp Forest. The impacts to these habitats as a result of the proposed action is 0.8 hectares.

DoEE, however, has also included the Coastal Tea-tree – Banksia Scrub in their assessment of foraging habitat critical to the survival of the grey-headed flying-fox based on the presence of coast banksia which is known to provide foraging resources for the species in winter and spring (DECCW 2009). It should be noted that the coast banksia (*Banksia intergrifolia*) in the Coastal Tea-tree – Banksia Scrub is not dominant or even co-dominant in this community (despite the name of the community). The communities in the Referral Area were aligned with the communities listed in the *Vegetation of the Worimi Conservation Lands* by Bell and Driscoll (2010) and the name of the community is not an accurate reflection of the dominance of the particular plant species within some areas in Port Stephens.

As outlined in the Ecological Assessment for the Rifle Range (Umwelt 2017), the Coastal Tea-tree – Banksia Scrub is dominated by coastal tea-tree (*Leptospermum laevigatum*) with some occurrences of coastal wattle (*Acacia longifolia* subsp. *sophorae*), tree broom-heath (*Monotoca elliptica*) and coast banksia (*Banksia intergrifolia*). The Coastal Tea-tree – Banksia Scrub has been subject to ongoing disturbances over the decades which have modified this community resulting in a relatively young coastal tea-tree-dominated landscape. Historic aerial photography shows that this community was majority cleared and sparse in 2004 (only 13 years ago) (refer to **Figure 3**). As outlined in Bell and Driscoll (2010), areas of Coastal Tea-tree – Banksia Scrub that have been previously cleared (such as within old sand mine areas) are often dominated by coastal tea-tree (*Leptospermum laevigatum*).

While it is acknowledged that there are some occurrences of coast banksia (*Banksia intergrifolia*) in the Coastal Tea-tree – Banksia Scrub, Umwelt does not consider the low densities and immature condition of these potential resources are of suitable quality and density to be classified as foraging habitat ***critical for the survival*** of the grey-headed flying-fox. The grey-headed flying-fox individuals recorded foraging in coastal banksia at the Fort Wallace site (approximately 2 km to the south of the Referral Area) were recorded in mature banksias within areas mapped as Frontal Dune Blackbutt-

Apple Forest, not Coastal Tea-tree – Banksia Scrub. Mature coastal banksia are much more likely to be productive and provide suitable foraging resources for the grey-headed flying-fox.

The five nationally-important active grey-headed flying-fox camps within 50 km of the Referral Area have been most recently (February 2017) estimated to support collectively between 8,500 and 32,000 individuals (minimum and maximum estimates from the National Flying-Fox Monitoring Viewer) (DoEE 2017). While one-way commutes of approximately 50 km have been recorded between camps and foraging areas, the Draft National Recovery Plan (DECCW 2009) acknowledges that commuting distances are more often less than 20 km. It is unlikely that the Coastal Tea-tree – Banksia Scrub could provide support to up to 30,000 grey-headed flying-fox individuals. The young and disturbed shrubland habitats of the Referral Area are highly unlikely to be depended on by local grey-headed flying-fox colonies.

As outlined in the Draft National Recovery Plan (DECCW 2009), grey-headed flying-foxes require a continuous sequence of productive foraging habitats, the migration corridors or stopover habitats that link them, and suitable roosting habitat within nightly commuting distance of foraging areas. The Coastal Tea-tree – Banksia Scrub in the Referral Area is adjacent to extensive areas of higher quality forest foraging habitat for the species in the Worimi Conservation Lands. The availability of this higher quality and productive forest habitat will not be altered as a result of the proposed action (refer to **Section 3.2** for discussion on indirect impacts).

Based on the information above, Umwelt does not consider the Coastal Tea-tree – Banksia Scrub within the Referral Area to be foraging habitat critical for the survival of the grey-headed flying-fox in the locality. Furthermore, as the impacts on areas considered to be quality foraging habitat critical for the survival of the species are minimal (0.8 hectares) and the likelihood for substantial indirect impacts on the nationally-important population of the species is low, the proposed action is considered highly unlikely to result in a significant impact on the grey-headed flying-fox.

3.2 Indirect Impacts to the Grey-headed Flying-fox

DoEE's assessment also determined that the proposed action would impact the grey-headed flying-fox through indirect impacts associated with the degradation of surrounding grey-headed flying-fox foraging habitat by the introduction and spread of *Phytophthora cinnamomi* and myrtle rust (*Puccinia psidii*) during vegetation clearance and rehabilitation works. DoEE also notes that there is potential for edge effects and disturbance to habitat during construction and following the establishment of the residential development. While it is acknowledged that there is always potential for these impacts with any vegetation clearance projects, it is considered unlikely that they would occur in any substantial way that would impact the grey-headed flying-fox.

As outlined in **Section 2.3** above, *Phytophthora cinnamomi* is a soil-borne pathogen that attacks the roots and stems of plants (NSWSC 2002). This pathogen is considered to be 'largely unknown' in the Lower Hunter region (PB 2013) and therefore the proposed action is unlikely to facilitate the spread of this pathogen to an extent that would substantially interfere with the recovery of the grey-headed flying-fox. Furthermore, this pathogen was not identified as a threat for the grey-headed flying-fox in the Draft National Recovery Plan (DECCW 2009). Vehicle and equipment cleaning during the construction of the proposed action will be implemented to minimise the risk of pathogen spread.

Myrtle rust (*Puccinia psidii*) is a fungal disease which infects plants in the Myrtaceae family (DPI 2015). The disease is widespread along the east coast of Australia from southern NSW to far north Queensland (DPI 2015). Myrtle rust spreads naturally by wind, water, insects and animals (DPI 2015). The short term impact of myrtle rust on mature trees is minimal, however continued infection of new seedlings and young trees over time may hinder the regeneration of susceptible species in natural forests (DPI 2015). The presence or otherwise of myrtle rust in the Port Stephens and

Newcastle locality is not well understood or documented. Vehicle and equipment cleaning during the construction of the proposed action will be implemented to minimise the risk of disease spread. The proposed action is unlikely to facilitate the spread of this disease to an extent that would substantially interfere with the recovery of the grey-headed flying-fox.

DHA has sought to specifically avoid the high quality habitats resulting in the retention of up to approximately 19.9 hectares of grey-headed flying-fox foraging habitat in the north of the Referral Area. No substantial edge effects or degradation of surrounding habitats are expected to occur as the following minimisation and mitigation measures have been proposed:

- vehicle and equipment cleaning during the construction
- clear demarcation of impact areas
- weed control measures
- restricted vehicle and controlled pedestrian access in retained vegetation
- buffer zones between the development and Worimi Regional Park
- detailed pre-clearing surveys and tree-felling procedures.

3.3 Conclusion

Umwelt considers that the Coastal Tea-tree – Banksia Scrub within the Referral Area should not be defined as foraging habitat critical to the survival of the grey-headed flying-fox. The proposed action will impact a maximum of 0.8 hectares of habitat containing suitably productive foraging trees that would be considered foraging habitat critical to the survival of the grey-headed flying-fox. No roosting habitat critical to the survival of the species occurs in the Referral Area.

Considering the large range of habitats available in the locality that are known to be utilised by the grey-headed flying-fox, an impact on 0.8 hectares on quality foraging habitat critical to the survival of the grey-headed flying-fox is unlikely to result in a significant impact on the species.

DHA has sought to specifically avoid the high quality habitats resulting in the retention of up to approximately 19.9 hectares of grey-headed flying-fox foraging habitat in the north of the Referral Area.

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BIGHT

STOCKTON

GRAHAMSTOWN DAM

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TILLIGERRY CREEK

Glen Oak
Duns Creek
Butterwick
East Seaham
Seaham
Woodville
Brandy Hill
Eagleton
Wallalong
Hinton
Osterley
Nelsons Plains
Twelve Mile Creek
Balickera
Ferodale
Karuah
Swan Bay
Oyster Cove
Soldiers Point
Tanilba Bay
Mallabula
Lemon Tree Passage
Salamander Bay
Corlette
Nelson Bay
Shoal Bay
Fingal Bay
Fishermans Bay
Raymond Terrace
Heatherbrae
Williamtown
Tomago

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DISCLAIMER

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NOTE

MORE DETAILED INFORMATION CAN BE FOUND ON SHEET 2 RELATING TO MEDOWIE AND TILLIGERRY PENINSULA.

LEGEND

KOALA HABITAT PLANNING MAP

Koala Plan of Management adopted by Council - June 2001.

- Preferred
- Supplementary
- Marginal
- Unknown Quality
- Mainly Cleared
- Other Vegetation
- 50m Buffer over Supplementary
- 50m Buffer over Marginal
- 50m Buffer over Other
- 50m Buffer over Cleared
- 50m Buffer over Unknown
- Link over Supplementary
- Link over Marginal
- Link over Other
- Link over Unknown
- Link over Cleared
- BACKGROUND

Port Stephens Local Government Area

KOALA HABITAT PLANNING MAP

Map prepared by Land Use Planning, Sustainable Planning Group.
Printed February, 2007

Image Source: Nearmap (May2016)
Data Source: LPI NSW (2009), ATLAS (2017)
Note: It should be noted that the koala record located near the northwest corner of the Referral Area was recorded in 1992 and has an accuracy of 1km and is noted to be located around Fern Bay. It is unlikely this record actually occurred on the sand dunes.

0 2 4 6km
1:140 000

Legend

- Referral Area
- National Parks and Conservation Areas
- Koala

FIGURE 2

Koala Locations

File Name (A4): 3764_049.dgn
20170921 15.37

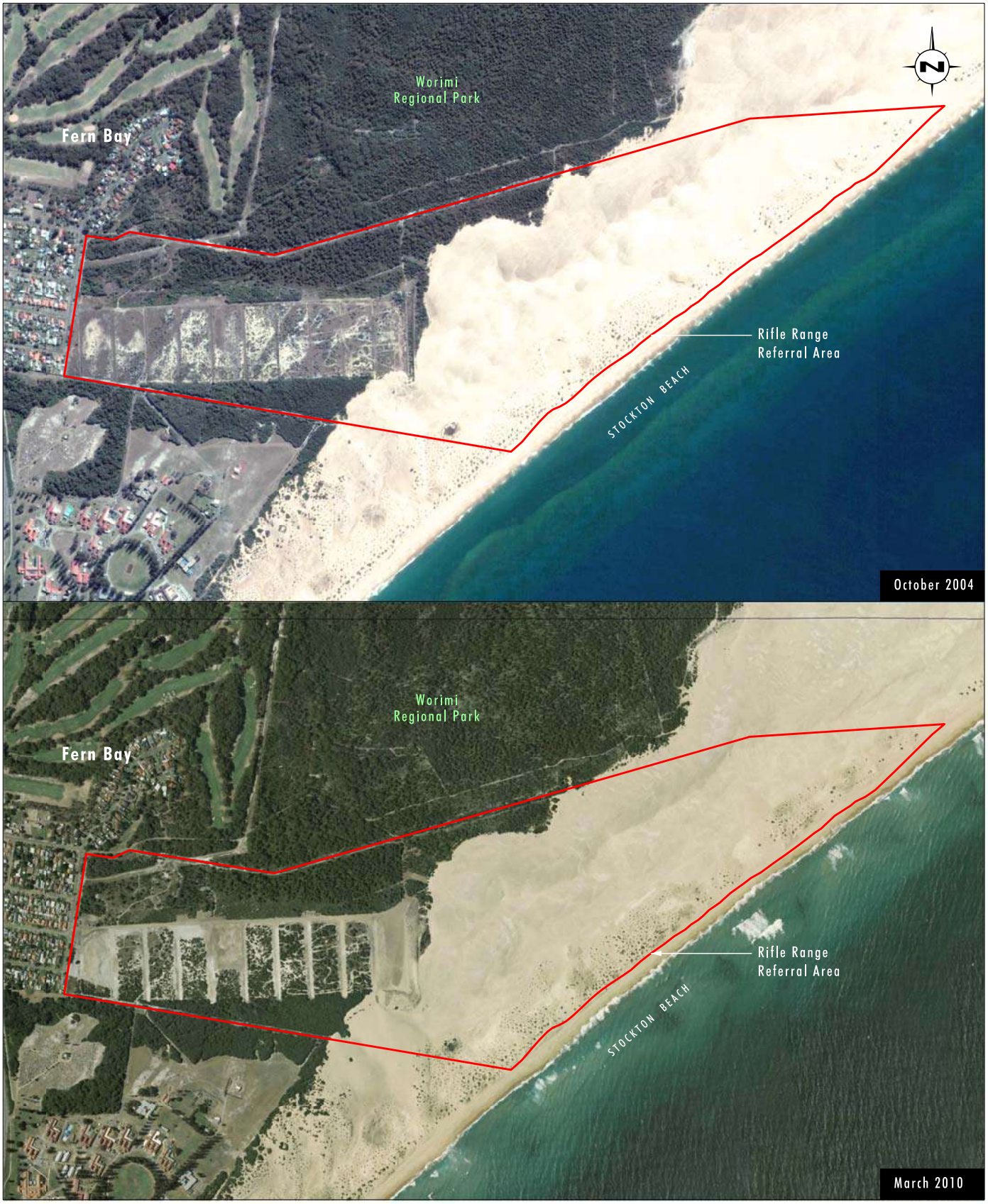

Image Source: Google Earth (Mar 2010), Google Earth (Oct 2004)
Data Source: LPI NSW (2009)

0 250 500 750m
1:15 000

Legend
Referral Area

FIGURE 3

Historical Disturbance within Referral Area

File Name (A4): 3764_051.dgn
20170921 15.49

ATTACHMENT 1

PORT STEPHENS COUNCIL
COMPREHENSIVE KOALA PLAN OF MANAGEMENT
(CKPoM)

Prepared by Port Stephens Council
with the Australian Koala Foundation

June 2002

Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) – June 2002

This document is to be cited as:

Port Stephens Council (2002). *Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) – June 2002.* Prepared by Port Stephens Council with the Australian Koala Foundation.

Enquiries should be directed to:

Port Stephens Council
PO Box 42
RAYMOND TERRACE NSW 2324
PH: (02) 4980 0255 FAX: (02) 4987 3612
EMAIL: council@portstephens.nsw.gov.au

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Figure 4. **Guidelines for Koala Habitat Assessment**

Appendices

Appendix 1. **Justification for rezoning of selected areas of public land to Environmental Protection**

Appendix 2. **Performance criteria for rezoning proposals**

Appendix 3. **Proposed amending clause of the Port Stephens LEP**

Appendix 4. **Performance criteria for development applications**

Appendix 5. **Performance Criteria for Development Applications proposing agricultural activities.**

Appendix 6. **Guidelines for Koala Habitat Assessments**

Appendix 7. **Guidelines / Principles for the effective design and construction of koala underpasses / overpasses**

Appendix 8. **Tree species that may be important to koalas in the Port Stephens Local Government Area as identified by anecdotal evidence**

Appendix 9. **Ecological Criteria for the determination of Habitat Buffers for Preferred Koala Habitat**

Appendix 10. **Principles for managing fires and koala habitat**

1. Introduction

The Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) has been prepared for Port Stephens Council by Port Stephens Council and the Australian Koala Foundation (AKF). The NSW National Parks and Wildlife Service (NPWS) assisted these organisations in preparing the CKPoM. The CKPoM Consultative Committee consisting of 12 community members, three Councillors, an Independent Chair, and 1 technical adviser each from the NPWS and AKF, reviewed the Draft CKPoM 1999 and made a series of recommendations which have been included within the document. The CKPoM is also accompanied by the CKPoM Resource Document. The Port Stephens Council CKPoM contains a brief discussion of issues relating to the management of koalas and koala habitat in the Port Stephens Local Government Area (LGA) and the recommended actions to address these issues. The CKPoM Resource Document provides a more detailed discussion of these issues and the rationale for the recommendations proposed in the Port Stephens Council CKPoM.

The Port Stephens Council CKPoM and CKPoM Resource Document were preceded by the Draft 1994 Port Stephens Koala Management Plan (Callaghan *et al*. 1994), which was prepared by the NSW National Parks and Wildlife Service, Port Stephens Council and the Hunter Koala Preservation Society, and the Port Stephens Koala Habitat Atlas (Phillips *et al*. 1996), prepared by the Australian Koala Foundation. The history of the development of the Port Stephens Council CKPoM is detailed in Chapter 1 of the CKPoM Resource Document.

The Port Stephens Council CKPoM is consistent with the National Koala Strategy (ANZECC 1998), in that it seeks to conserve koalas in their existing habitat by identifying and protecting koala habitat and incorporating koala conservation into local government planning processes (Lunney *et al*. 1998).

The Port Stephens Council CKPoM has been prepared in accordance with State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44). The principal aim of this CKPoM is identical to that of SEPP 44:

"…to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline."

When the Port Stephens Council CKPoM is approved by both Council and the Director General of Urban Affairs and Planning, it will supersede the requirements of SEPP 44 for the investigation of potential and core koala habitat and the requirement for the preparation of Individual Koala Plans of Management. Effectively, compliance with the Port Stephens Council CKPoM will constitute compliance with SEPP 44 for relevant matters in the Port Stephens LGA. However, where an Individual Koala Plan of Management prepared to accompany a development application has already been approved by both Council and the Director General of Urban Affairs and Planning and it conflicts with the provisions of the Port Stephens Council CKPoM, the provisions of the Individual Koala Plan of Management shall prevail.

1.1 CKPoM Objectives

The principal objectives of the Port Stephens Council Comprehensive Koala Plan of Management are to:

- *Evaluate and rank koala habitat throughout the Port Stephens LGA;*
- *Identify priority conservation areas and strategies to protect significant koala habitat and populations;*
- *Identify threats that impact on koalas and koala habitat;*
- *Provide for the long-term survival of koala populations by devising conservation strategies to effectively address each of the threats impacting on koalas and koala habitat;*
- *Provide for the restoration of degraded koala habitat areas;*
- *Ensure that adequate detail is provided with Development Applications in order to assess, minimise and ameliorate likely impacts on koala habitat;*
- *Provide guidelines and development standards to protect koalas and koala habitat;*
- *Provide for effective public awareness and education programs concerning koala conservation issues;*
- *Encourage appropriate eco-tourism programs;*
- *Provide a formal approach for the assessment, retrieval, rehabilitation and release of sick, injured, orphaned or distressed koalas;*
- *Identify potential funding sources for implementation of the CKPoM;*
- *Facilitate targeted koala conservation and management-oriented research projects within the Port Stephens LGA; and*
- *Provide for the effective implementation and monitoring of the CKPoM.*

These objectives will be achieved through co-operation with the community as a whole.

1.2 Performance indicators

It is necessary to establish performance indicators against which the success of each of the recommended actions in the CKPoM can be assessed and, if necessary, refined. The performance indicators consist of a number of specific conservation goals. These conservation goals are:

- Loss of koala habitat within areas identified as Preferred and Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas is:

i) minimised and restricted to that permissible in accordance with the performance criteria for development applications (see the Development Assessment chapter of the CKPoM Resource Document and the performance criteria for development applications in Appendices 4 and 5 of this CKPoM); and

ii) reduced in each successive year over the next five years (initially).

- Annual koala population assessments undertaken at designated monitoring sites indicate that the majority of the surveyed koala populations, including urban populations, are stable or increasing (determined on the basis of activity levels, evidence of successful breeding, signs of disease, mortality and survivorship, and population estimates) within 5 years from the adoption of the Port Stephens Council CKPoM.

- Annual statistics indicate a decrease in koala mortality due to collisions with motor vehicles, in conjunction with stable or increasing koala population estimates in the vicinity of identified black spot areas.

- Annual statistics indicate a decrease in koala mortality due to dog attacks, in conjunction with stable or increasing koala population estimates in the vicinity of identified high risk dog-attack areas.

- A minimum of 20 hectares of koala habitat per year is replanted (and successfully maintained in subsequent years) throughout the LGA in areas identified as a high priority for restoration according to the criteria outlined in the Habitat Restoration chapter.

In addition to the conservation outcomes listed above, the Port Stephens Council CKPoM should be assessed in terms of implementation of each of the proposed actions. For instance, the success of the habitat conservation strategy should be assessed initially by determining whether each of the proposed habitat conservation measures have been implemented on schedule.

See sections 17.1 and 17.2 of this CKPoM and Chapter 17 (Monitoring) of the CKPoM Resource Document for further discussion of how these performance indicators are to be used to monitor the success, and where necessary, to update and refine the Port Stephens Council CKPoM.

2. Koala Habitat Identification

2.1 Synopsis

The accurate identification of koala habitat in a given area is a crucial component of any efforts to conserve koalas in that area. The work of Lunney *et al*. (1998) to identify koala habitat in the Port Stephens LGA provides the necessary basis to prepare a strategy to conserve koala habitat and koala populations in the LGA.

The identification of koala habitat within the Port Stephens LGA (Lunney *et al*. 1998) involved the combination of both field-based survey and community-based survey data, interpreted in the context of a detailed vegetation map. The resulting combined Koala Habitat Map identified and ranked koala habitat as Preferred, Supplementary and Marginal. From this combined map, a Koala Habitat Planning Map (Figure 1), which identified Habitat Buffers on all Preferred Koala Habitat and Habitat Linking Areas, was prepared. The Koala Habitat Planning Map provides the basis for identifying the areas that are considered to warrant the highest level of habitat protection. These areas include all Preferred Koala Habitat and Habitat Buffers. Supplementary Koala Habitat and Habitat Linking Areas also require protection. The CKPoM Consultative Committee recommended that the width of Habitat Buffers should be determined on a case-by-case basis using ecological criteria. These ecological criteria are detailed in Appendix 9.

The field-based survey, the Australian Koala Foundation's Port Stephens Koala Habitat Atlas (Phillips *et al.* 1996), confirmed the following tree species as being preferentially utilised by koalas within the Port Stephens LGA: *Eucalyptus robusta* (Swamp Mahogany) and *E. parramattensis* (Parramatta Red Gum) on all substrates where they occur; and *E. tereticornis* (Forest Red Gum) where it occurs on soils derived from Quaternary alluvials and volcanics. It is also recognised that hybrids of any of these species are likely to be Preferred Koala Food Trees.

The procedure undertaken to identify koala habitat in the Port Stephens LGA is detailed in Chapter 2 of the CKPoM Resource Document. The work of Lunney *et al*. (1998) is also reproduced in that chapter.

3. Ecological History

3.1 Synopsis

Research into the ecological history of koala habitat in the Port Stephens LGA (Knott *et al*. 1998) has substantially contributed to the preparation of the Port Stephens Council CKPoM. The outcomes of this research have provided an important perspective on the historical distribution of koala populations and koala habitat throughout the period of European settlement in the Lower Hunter. It complements the field and community koala surveys undertaken in the LGA. It also provides a detailed history of European settlement and subsequent land use in the Port Stephens LGA and Lower Hunter. Additionally, this research provides an explanation for the current absence or substantial decline of koala populations in the western areas of the LGA.

The ecological history research will help identify areas that are suitable for koala habitat restoration projects and provide guidance regarding the likely pre-European vegetation of areas which have since been predominantly cleared.

The ecological history research (Knott *et al*. 1998) is presented in Chapter 3 of the CKPoM Resource Document.

4. Habitat Conservation Measures

4.1 Synopsis

An effective strategy to conserve koala habitat is essential to provide for the long term survival of the koala within the Port Stephens LGA. Such a strategy will need to involve the integration of a number of different conservation measures, including regulatory (legislative) and incentives-based approaches, in conjunction with an education program.

Chapter 4 (Habitat Conservation Measures) of the CKPoM Resource Document details the range of conservation measures proposed for the Port Stephens LGA. Proposed regulatory measures include: the rezoning of koala habitat on public land to Environmental Protection; the adoption of performance criteria for the assessment of rezoning requests and development applications that apply to land containing koala habitat, the latter via the implementation of an amending clause of the relevant Port Stephens Local Environment Plan and performance criteria for the assessment of development applications; and amendments to Council's Tree Management Policy.

Incentives-based habitat conservation measures that are considered for possible implementation include: Voluntary Conservation Agreements, Voluntary Conservation Zones, Property Agreements, Management Agreements and Wildlife Refuges. Possible incentives schemes that could be employed to encourage landholders to conserve koala habitat include those based on: management grants (eg. for fencing and replanting), rate rebates, a levy based `Trust' or `Conservation Program', development incentives and transferable development rights.

There are several land management agencies that have large land holdings in the Port Stephens LGA, including Port Stephens Council, the Department of Land and Water Conservation, the NSW National Parks and Wildlife Service, State Forests of NSW, the Hunter Water Corporation and the Defence Estate Organisation, which manages land owned by the Commonwealth Department of Defence. The potential role of each of these organisations in the management of koala habitat is discussed in Chapter 4 of the CKPoM Resource Document.

Council has recently exhibited a Draft Local Environmental Plan amending the Port Stephens LEP 1987 (known as Draft LEP 1999) that includes the following provisions:

- An Environment Protection 7(a) Zone that applies to land currently zoned 7(a), 7(j) and 7(k);
- Mining and silica sand extraction not be permitted in the 7(a) zone;
- Vegetation clearing be formally defined within Draft LEP 1999 and be permitted only with the consent of Council.

4.2 Actions

The recommended habitat conservation measures for the Port Stephens LGA are listed below.

4.2.1 Port Stephens Council

Rezoning of koala habitat on public land

i) Consult with public authorities with a view to rezoning public lands not zoned 7c containing Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Buffer Areas and Habitat Linking Areas to Environmental Protection 7a: and

ii) Seek the agreement of relevant public authorities to manage their land for conservation of koalas

Performance Criteria for Rezoning Requests and Development Applications

i) Council resolve to amend its LEP Amendment Policy to include the performance criteria for rezoning requests that are outlined in Appendix 2 of this CKPoM;

ii) Council resolve to prepare a Draft Local Environmental Plan, so as to include a clause that activates the provisions of the Port Stephens Council CKPoM including the criteria to be used for the assessment of any development proposals within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas, as per the proposed clause in Appendix 3 of this CKPoM;

iii) Council implement the performance criteria for development applications contained in Appendices 4 and 5 of this CKPoM and which are activated via the amending clause of the LEP specified in Appendix 3;

Other Measures

i) For the purposes of the Urban Settlement Strategy, the following categories of koala habitat are identified as a constraint on public land outside 7c: Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Linking Areas, and Habitat Buffers.

ii) Council investigate the potential application of incentive-based measures as listed within section 4.1 of this CKPoM (and discussed in detail in section 4.6 of the CKPoM Resource Document), in conjunction with regulatory measures in order to ensure the effective conservation and management of koala habitat within the Port Stephens LGA;

iii) Council investigate options for amending its Tree Management Policy to recognise the importance of preferred koala food trees. Possible options include having them listed in Clause 2 of the Tree Preservation Order or in the significant tree register specified in Clause 12 of the Tree Management Policy. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8;

iv) When preparing Plans of Management for Council-owned community land or Crown Land of which Council is the trustee or has care, control and management, Council should incorporate the provisions of the Port Stephens Council CKPoM; and

v) Council demonstrate best-practice management of koala habitat by incorporating the principles and standards of the Port Stephens Council CKPoM into all Council developments and activities.

4.2.2. National Parks and Wildlife Service

i) The National Parks and Wildlife Service will assist with any future review of the CKPoM and assist in the preparation of future standards or guidelines;

ii) The National Parks and Wildlife Service will discuss with private landholders options for conservation of koala habitat on their lands, including offering incentive instruments such as Voluntary Conservation Agreements to assist in conservation of koala habitat;

iii) The National Parks and Wildlife Service will investigate options for the establishment of conservation reserves particularly on the Tomago Sandbeds;

iv) The National Parks and Wildlife Service continue its commitment to providing advice and assistance to other government agencies and private land holders regarding koalas, and other wildlife conservation issues;

v) The National Parks and Wildlife Service consider relevant findings and strategies from the Port Stephens Council CKPoM for incorporation into a state-wide Koala Recovery Plan in accordance with the *Threatened Species Conservation Act 1995*.

4.2.3. Hunter Water Corporation

i) The Hunter Water Corporation be requested to refer to the Port Stephens CKPoM when undertaking self-determination (Part V) assessments on Hunter Water Corporation land.

4.2.4. State Forests of NSW

i) State Forests of NSW be requested to refer to the Port Stephens Council CKPoM when undertaking koala surveys as part of the assessment of proposed logging operations.

4.2.5. Department of Land and Water Conservation

i) The Department of Land and Water Conservation be requested to refer to the Port Stephens Council CKPoM when undertaking Crown Land Assessments within the Port Stephens LGA; and

ii) The Department of Land and Water Conservation be requested to incorporate the provisions of this CKPoM in future Regional Vegetation Management Plans that include the Port Stephens LGA.

4.2.6. Commonwealth Department of Defence

i) The Commonwealth Department of Defence be requested to adopt the standards for koala habitat management contained in the Port Stephens Council CKPoM.

5. Development Assessment

5.1 Synopsis

The development assessment process refers to the procedure by which development and land use is assessed and regulated. This procedure represents an important means by which Council can regulate development to ensure the protection and effective management of koala habitat in the Port Stephens LGA. Assessment guidelines have been established to standardise the treatment of issues relating to the management of koalas and koala habitat within the development assessment process.

Preferred Koala Habitat and Habitat Buffers require the highest level of protection possible (see section 5.4 of the CKPoM Resource Document for discussion). Supplementary Koala Habitat and Habitat Linking Areas also require a high level of protection, though less than that for Preferred Koala Habitat and Habitat Buffers (see section 5.4 of the CKPoM Resource Document). Preferred koala food trees require protection wherever they occur in the Port Stephens LGA.

Performance criteria and development standards have been developed to aid the assessment of development applications that apply to land that contains or is adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, and/or preferred koala food trees. These performance criteria are outlined in Appendices 4 & 5 of this CKPoM.

Guidelines for Koala Habitat Assessments were developed to provide the information necessary to support a rezoning proposal under Part 3, or a development application under Part 4, of the *Environmental Planning and Assessment Act 1979*. The Guidelines for Koala Habitat Assessments in the Port Stephens LGA are presented in section 5.5 of the CKPoM Resource Document and Appendix 6 of this CKPoM.

5.2 Actions

- Council advertise in the local newspaper all development applications that are lodged in Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Buffers & Habitat Linking Areas

- Council expand the information provided on section 149 certificates to reflect the presence of koala habitat.

6. SWOT Analyses

6.1 Synopsis

The Port Stephens LGA exhibits great diversity in terms of land use, current distribution and nature of koala habitat and associated land management issues. However, a number of areas within the Port Stephens LGA possess distinct similarities with respect to the aforementioned features. It was subsequently considered pertinent to divide the LGA into a number of geographic areas, referred to as Koala Management Units (KMUs), on the basis of similarities in such features.

The Port Stephens LGA has been divided into nine Koala Management Units (KMUs) which are shown in Figure 2 and comprise: Tilligerry Peninsula KMU; Balickera KMU; Tomaree Peninsula KMU; Raymond Terrace KMU; Medowie KMU; Tomago Sandbeds KMU; Karuah/Ferodale KMU; Fullerton Cove/Stockton Bight KMU; and Western KMU.

Each KMU was examined through a procedure known as SWOT Analyses (Strengths, Weaknesses, Opportunities and Threats) in order to identify the range of issues associated with the conservation of koalas and their habitat and to tailor conservation strategies to the particular characteristics of each KMU. The recommended actions for each KMU are presented below, with the exception of proposed rezonings of land to Environmental Protection, which are listed in section 4.2 of this CKPoM.

See Appendix 5 of the CKPoM Resource Document for the complete SWOT analyses for each KMU.

6.2 Actions

Tilligerry Peninsula KMU

Habitat Conservation: Incentives-based measures

The following area in the Tilligerry Peninsula KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- The patch of Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas to the south east of Tanilba Bay. This patch is in close proximity to the largest patch of Preferred Koala Habitat on the Tilligerry Peninsula.

Habitat Conservation – Crown Lands assessment

- Crown Lands on the Tilligerry Peninsula are currently subject to Aboriginal land claims. The Department of Land & Water Conservation is currently awaiting the outcome of these claims, pending which assessments may be undertaken by the Department of Land and Water Conservation for areas of Crown Land on the Tilligerry Peninsula that contain koala habitat. Pending the outcome of this assessment, Crown Land which contains significant koala habitat may be reserved for Environmental Protection/Conservation. Following such reservation, it is proposed that private reserve trusts be established to manage these areas.

Habitat Restoration

RZM Pty Ltd has regenerated large areas of sand mined land along the northern foreshore of the Tilligerry Peninsula. The habitat restoration strategy for the Tilligerry Peninsula KMU should include provision for the long-term protection and management of these revegetated areas.

Other areas in the Tilligerry Peninsula KMU that should be investigated for potential habitat restoration projects include:

- the cleared areas within or adjacent to the large patch of Preferred Koala Habitat in the south of the KMU, including Habitat Buffers and Habitat Linking Areas that overlap with Mainly Cleared Land;

-
- the Tanilba Bay Golf Course, particularly in those areas that abut the large patch of Preferred Koala Habitat in the south;

- parts of the Habitat Buffer or Habitat Linking Area over Mainly Cleared Land in the north and east, including (in concert with the effective abatement of the threat posed by cars and dogs) those in and around the urban areas of Tanilba Bay, Mallabulla and Lemon Tree Passage; and

- the Habitat Buffer over Other Vegetation on and near the Tilligerry Habitat Reserve. Habitat Restoration is already being undertaken by the Tilligerry Habitat Association, and should be supported, where necessary, by this CKPoM.

Community Commitment

- Future community education, koala monitoring and habitat restoration projects in the Tilligerry Peninsula KMU should be planned in consultation with the Hunter Koala Preservation Society, the Tilligerry Habitat Association, the Native Animal Trust Fund and local Tidy Towns Associations.

Education

- Existing brochures such as those prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society should be used as a basis for educating the Tilligerry community about koala conservation issues.

- Council's Health and Environment Newsletter should also encourage responsible dog-ownership and careful driving in areas in the Tilligerry KMU that contain koala habitat, as well as providing information regarding the implementation of the CKPoM.

Traffic Management

Following consultation with the community, appropriate speed mediation, driver warning and education measures should be implemented at each of the identified Black Spots and Conflict Areas within the KMU. The potential implementation of

speed advisory signs or speed zones that apply at specific times of the day and year should be investigated for Lemon Tree Passage Road (in particular). It is recommended that speed advisory signs or speed zones should be applied in conjunction with a marketing program to promote and encourage adherence to the speed limits.

Ecotourism

Given the widespread appeal of the koala, the fact that koalas can regularly be seen in the Tilligerry Peninsula KMU and the overall natural beauty of the Tilligerry Peninsula, there are opportunities for ecotourism activities in this KMU. Such activities are already being run by organisations such as the Tilligerry Habitat Association.

Balickera KMU

Habitat Conservation: Incentives-based measures

The following areas in the Balickera KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- Preferred Koala Habitat along the Williams River floodplain, particularly the larger patches;

- Habitat Buffers and Habitat Linking Areas (including those over Mainly Cleared Land, where there is a commitment by landholders to revegetate) along the Williams River; and

- Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas along the drainage lines in the north and east of the KMU.

Habitat Restoration

The following represents the priorities (from highest to lowest) for the restoration of koala habitat in the Balickera KMU with landowner consent:

1. Enhance existing Preferred Koala Habitat along the Williams River flood plain and adjacent low lying areas. This should include supplementary planting of preferred koala food trees, such as E. tereticornis and E. robusta, as well as fencing to exclude livestock to protect such plantings and to facilitate natural regeneration. The objective is to increase the density of preferred koala food trees within remnant Preferred Koala Habitat and to ensure the long-term existence of such species in these remnants;

2. Restore koala habitat on land identified as Habitat Buffer over Mainly Cleared Land or Habitat Linking Area over Mainly Cleared Land along the Williams River flood plain and adjacent low lying areas. Again this should involve planting E. tereticornis or E. robusta where appropriate, as well as fencing to exclude livestock;

3. Restore koala habitat on land identified as Buffer over Mainly Cleared Land or Linking Area over Mainly Cleared Land in the vicinity of the Preferred Koala Habitat along drainage lines in the hills in the north and

east of the KMU. This should include planting of E. tereticornis as well as appropriate mixes of species found in nearby forest; and

4. Restore koala habitat on land identified as Mainly Cleared along the Williams River flood plain and adjacent low lying areas. Ultimately, this should be linked with the network of koala habitat restored in accordance with the priorities outlined above.

Community support

- The existing River-Care/Landcare network could be used as the basis for enlisting community support in the Balickera KMU. This will involve co-operation with the Williams River-Care Association, Clarencetown Landcare Group and the Williams River Catchment Management Committee (CMC).

Education

- Education of land holders in this KMU should be an extension of the already existing River-Care/Landcare network in this KMU. Members of the Williams River-Care Association and the Clarencetown Landcare Group, along with individual landholders that are protecting remnant vegetation and/or are undertaking revegetation works should be briefed on how to tailor their activities to further contribute to the conservation of koala habitat. The Williams River Catchment Management Committee should be approached to facilitate contact with these organisations and individuals and to integrate the activities in the Balickera KMU with those elsewhere in the Williams River catchment.

Tomaree Peninsula KMU

Habitat Conservation: Incentives-based measures

Regarding the application of incentives-based conservation measures in the Tomaree Peninsula KMU the following, in particular, should be investigated:

- Land between Anna Bay/Boat Harbour and Salamander Bay/Taylors Beach that contains Preferred Koala Habitat in particular, and/or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas; and which landholders are willing to either rezone to Environmental Protection (or put in place a Voluntary Conservation Zone, should one be established) or set aside under a Voluntary Conservation Agreement; and

- The provision of Management Grants to landholders willing to undertake koala habitat restoration on priority areas identified below. This will depend on the availability of funding, such as could be provided should Port Stephens Council's recent Natural Heritage Trust application be successful.

Habitat Conservation: Crown Land assessment

- There are several portions of Crown Land in the Tomaree Peninsula KMU. The procedure for undertaking land assessments on areas of Vacant or Reserved Crown Land on the Tilligerry Peninsula that contain koala habitat should also be considered for such land on the Tomaree Peninsula.

Habitat Restoration

Areas in the Tomaree Peninsula KMU that should be investigated for habitat restoration projects include:

- Land between Anna Bay/Boat Harbour and Salamander Bay/Taylors Beach that is identified as Habitat Buffer or Habitat Linking Area over Mainly Cleared Land. Given that there are large contiguous patches of Preferred Koala Habitat in this area, it should be of the highest priority for koala habitat restoration projects on the Tomaree Peninsula; and

- Other land in the Tomaree Peninsula KMU that is identified as Habitat Buffer or Habitat Linking Area over Mainly Cleared Land. This could include such areas located to the south of Soldiers Point and in the vicinity of Mambo Wetland and, pending due consideration of the threat to koalas posed by dogs and cars, such areas within or adjacent to the urban areas of the Tomaree Peninsula KMU.

Community commitment

- Several community groups (Eco-Network Port Stephens, the Tomaree Eco-Watch Association, the Hunter Koala Preservation Society, the Native Animal Trust Fund, and several Tidy Towns Associations) are actively in involved in koala conservation in this KMU. Future community education, koala monitoring and habitat restoration projects on the Tomaree Peninsula should integrate and expand on the existing work being done by these organisations, and projects should be planned in conjunction with these groups.

Education

- Existing education programs, such as meetings and field days being run by Eco-Network Port Stephens, and brochures such as those prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society for elsewhere in the LGA, should be used as a starting point for educating the community about koala conservation. Other organisations, such as Tidy Towns committees, precinct committees and the NSW Farmers Association should also be approached to participate in education programs.

- Council's Health and Environment Newsletter could also encourage responsible dog-ownership and careful driving in areas in the Tomaree Peninsula KMU that contain koala habitat, as well as providing information regarding the implementation of the CKPoM.

Ecotourism

- Given the widespread appeal of the koala, the fact that koalas are often seen in the Tomaree Peninsula KMU, the overall natural beauty of the Tomaree Peninsula, and the popularity of the Tomaree Peninsula as a tourist destination there are opportunities for ecotourism activities in this KMU.

Raymond Terrace KMU

Habitat Conservation

Regulation of development via the proposed amending clause of the Port Stephens LEP (Appendix 3) and the proposed performance criteria for development applications (Appendices 4 & 5) represents the most appropriate means of conserving koala habitat in this KMU, as there is limited scope for rezoning to protect koala habitat or employing incentives-based measures to protect koala habitat.

Habitat restoration

Habitat restoration activities in this KMU should focus on areas within and around the urban area where koalas are currently known to occur, including: Lakeside, Muree Golf Course, the Raymond Terrace Cemetery, Boomerang Park, Irrawang Public School and Irrawang High School. There is a need to integrate such activities with measures aimed at reducing the impact of motor vehicles and dogs on koalas.

Community commitment

- Future community education, koala monitoring and habitat restoration projects in the Raymond Terrace KMU should be planned in consultation with the Native Animal Trust Fund, the Australian Wildlife Hospital, the Hunter Koala Preservation Society, and local Tidy Towns Associations.

Education

- Given the impact of motor vehicles and dogs on koalas in this KMU, there is a real need to educate the Raymond Terrace community on how they can help ameliorate such threats. This should build on existing education programs and brochures and involve the community groups listed above.

Medowie KMU

Habitat Conservation: Incentives-based measures

The following areas in the Medowie KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- Land that has been identified as Preferred Koala Habitat and Habitat Buffer in the central and south of the KMU, particularly the two largest patches to the south of Ferodale Road and west of Medowie Road currently zoned Rural Small Holdings 1(c1) or 1(c3), the area adjacent to the tail of Moffats Swamp; and

- Land that has been identified as Preferred Koala Habitat and Habitat Buffer to the north of Ferodale Road that is currently zoned Rural Small Holdings, particularly the patch to the west of the land already zoned Environmental Protection 7a.

Habitat Conservation: Crown Lands assessment

- There are some areas of Crown Land in this KMU that contain Preferred Koala Habitat. The Department of Land and Water Conservation be requested to undertake Crown Land assessments of these areas and where appropriate, recommend them for protection.

Habitat Restoration

Areas in the Medowie KMU that should be investigated for koala habitat restoration projects include:

- degraded areas fringing Preferred and Supplementary Koala Habitat associated with Moffats Swamp including Habitat Buffer over Marginal Koala Habitat and Mainly Cleared Land. This would potentially include areas to the east of Moffats Swamp that have been subject to sand mining operations;

- Habitat Buffer over Mainly Cleared Land and Habitat Linking Areas over Mainly Cleared Land or Marginal Koala Habitat throughout the Medowie KMU, pending the effective abatement of the threat posed by dogs and traffic; and

- any areas where there is the potential to restore and or enhance habitat links between this KMU and the Tomago Sandbeds KMU in particular.

Community Commitment

- Future community education, koala monitoring and habitat restoration projects in the Medowie KMU should be planned in consultation with the Native Animal Trust Fund and the Hunter Koala Preservation Society.

Education

- Existing brochures such as those prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society should be used as a basis for educating the Medowie community about koala conservation issues.

- Council's Health and Environment Newsletter could also encourage responsible dog ownership and careful driving in areas in the Medowie KMU that contain koala habitat, as well as providing information regarding the implementation of the CKPoM.

Tomago Sandbeds KMU

Habitat Conservation: Incentives-based measures

The following areas in the Tomago Sandbeds KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- the areas of Preferred Koala Habitat, Habitat Buffer, Habitat Linking Areas and Supplementary Koala Habitat in the Salt Ash area; areas of Preferred Koala Habitat and Supplementary Koala Habitat to the north of Masonite Road (near Heatherbrae); and

- areas of Preferred Koala Habitat and Supplementary Koala Habitat to the north of Nelson Bay Road (i.e. those not recommended for rezoning to Environmental Protection).

Habitat Restoration

Habitat restoration should be promoted for all areas within the KMU where Habitat Buffers or Habitat Linking Areas occur over Mainly Cleared Land. This should involve planting E. robusta, E. parramattensis and E. tereticornis as appropriate, as well as fencing to exclude livestock where necessary.

Extensive areas of koala habitat in this KMU are at various stages of regeneration, following RZM sand-mining operations and subsequent restoration activities on the Tomago Sandbeds.

Traffic Management

Appropriate speed mediation, driver warning and education measures are required with respect to each of the identified Black Spots and Conflict Areas within the KMU. The potential implementation of speed advisory signs or speed zones that apply at specific times of the day and year should be investigated for Richardson Road, Lemon Tree Passage Road and Medowie Road in particular. It is recommended that speed advisory signs or speed zones should be applied in conjunction with a marketing program to promote and encourage adherence to the speed limits.

Dog Management

Land management agencies in conjunction with the Port Stephens Vertebrate Pest Animal Management Committee should continue to implement feral dog control measures on the Tomago Sandbeds.

Karuah/Ferodale KMU

Habitat Conservation: Incentives-based measures

The following area in the Karuah/Ferodale KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- the land east of the Pacific Highway, north east of Ringwood Road and north of Old Swan Bay Road where Preferred Koala Habitat, Habitat Buffers and Habitat Linking Areas have been identified over Rural 1a lands.

Habitat restoration

Habitat restoration should be promoted for all areas within the KMU where Habitat Buffers or Habitat Linking Areas occur over Mainly Cleared Land. This should involve planting *E. tereticornis*, *E. robusta*, *E. microcorys* and *E. propinqua* as appropriate, as well as fencing to exclude livestock. It should be noted that such habitat restoration can only be carried out with the consent of landowners.

Traffic Management

Following consultation with the community, undertake appropriate speed mediation, driver warning and education measures on the southern section of the Bucketts Way, the western section of Ringwood Road (approaching the intersection with the Pacific Highway) and Richardson Road near Finnan Park. Input should also be sought from the Roads and Traffic Authority into ameliorative measures proposed in conjunction with upgrading of the Pacific Highway.

Domestic/Feral Dogs

Feral dog management on State Forests of NSW and National Parks and Wildlife Service lands within the KMU should be addressed in conjunction with the Port Stephens Vertebrate Pest Animal Management Committee.

Fullerton Cove/Stockton Bight KMU

Habitat Conservation: Incentives-based measures

The following areas in the Fullerton Cove/Stockton Bight KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- Preferred Koala Habitat and, subject to a commitment from landholders to undertake restoration of koala habitat, associated Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land to the north of Bobs Farm; and

- Land that comprises part of the two large patches of Supplementary Koala Habitat that extend along the Stockton Bight sand dunes.

Habitat Conservation: Crown Lands assessment

There are substantial areas of Crown Land located in this KMU. This includes much of the Supplementary Koala Habitat along Stockton Bight. The procedure for undertaking land assessments (as per the *Crown Lands Act 1989*) on areas of Vacant or Reserved Crown Land on the Tilligerry Peninsula that contain koala habitat should also be considered for such land in the Fullerton Cove/Stockton Bight KMU.

Habitat restoration

Areas in the Fullerton Cove/Stockton Bight KMU that should be investigated for habitat restoration projects include:

- Land to the north of Bobs Farm that overlaps with Habitat Buffers or Habitat Linking Areas over Mainly Cleared Land;

- Other land in this KMU that is identified as Habitat Buffer or Habitat Linking Area over Mainly Cleared Land. This could include such areas located to the south of Williamtown and in the vicinity of Fern Bay; and

- Areas of Mainly Cleared Land located adjacent to the large patches of Supplementary Koala Habitat along Stockton Bight.

Community commitment

Future community education, koala monitoring and habitat restoration projects in this KMU should expand on the existing work being done by organisations such as the Native Animal Trust Fund and Hunter Koala Preservation Society, and projects should be planned in conjunction with these groups.

Education

Existing education programs, such as brochures prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society for elsewhere in the LGA, should be used as a starting point for educating the community about koala conservation. Other organisations, such as Tidy Towns committees, precinct committees and the NSW Farmers Association should also be approached to participate in education programs.

The Oakvale Wildlife Farm at Salt Ash should be approached to assist with education programs, for instance, by giving talks on koala conservation to park visitors.

Western KMU

Habitat Conservation: Incentives-based measures

The following areas in the Western KMU in particular should be investigated regarding the application of incentives-based conservation measures:

- The large patches of Preferred Koala Habitat to the south of Seaham;
- Patches of Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas (including those over Mainly Cleared Land, provided there is a commitment from landholders to revegetate) along the Williams River floodplain; and
- Preferred Koala Habitat and associated Habitat Buffers and Habitat Linking Areas to the west of Seaham.

Habitat restoration

The following represents the priorities (from highest to lowest) for the restoration of koala habitat in the Western KMU:

1. Enhance existing Preferred Koala Habitat along the Williams River flood plain and adjacent low lying areas. This should include supplementary planting of preferred koala food trees, such as E. tereticornis and E. robusta where appropriate, as well as fencing to exclude livestock to protect such plantings and to facilitate natural regeneration. The objective is to increase the density of preferred koala food trees within remnant Preferred Koala Habitat and to ensure the long-term existence of such species in these remnants;
2. Restore koala habitat on land identified as Habitat Buffer over Mainly Cleared Land or Habitat Linking Area over Mainly Cleared Land along the Williams River flood plain and adjacent low lying areas. Again this should

involve planting E. tereticornis or E. robusta where appropriate, as well as fencing to exclude livestock;

3. Restore koala habitat on land identified as Buffer over Mainly Cleared Land or Linking Area over Mainly Cleared Land in the vicinity of the Preferred Koala Habitat along drainage lines in the hills in the north and centre of the KMU. This should include planting of E. tereticornis as well as appropriate mixes of species found in nearby forest;

4. Enhance existing Preferred Koala Habitat and restore koala habitat in the associated Habitat Buffers and Habitat Linking Areas over Mainly Cleared land along the Hunter and Patterson River floodplains. This should also involve planting E. tereticornis or E. robusta where appropriate, as well as fencing to exclude livestock; and

5. Restore koala habitat on land identified as Mainly Cleared along the Williams River flood plain and adjacent low lying areas, in the first instance, followed by similar areas along the Hunter and Patterson Rivers. Ultimately, this should be linked with the network of koala habitat restored in accordance with the priorities outlined above.

Community support

The existing River-Care/Landcare network could be used as the basis for enlisting community support in the Western KMU. This will involve co-operation with the Hunter Catchment Management Trust, the Williams River Catchment Management Committee (CMC), and the Williams River-Care Association. The Hunter Catchment Management Trust should be briefed on the outcomes of the CKPoM and approached to assist with the integration of these outcomes into natural resource management in the catchment.

Education

Education of land holders in this KMU should be an extension of the already existing River-Care/Landcare network in this KMU. Members of River-Care Associations and Landcare Groups, along with individual land holders that are protecting remnant vegetation and/or are undertaking revegetation works should be briefed on how to tailor their activities to further contribute to the conservation of koala habitat. The Hunter Catchment Management Trust and Williams River Catchment Management Committee should be approached to facilitate contact with such organisations and individuals and to integrate the activities in the Western KMU with those elsewhere in the Hunter and Williams River catchments.

7. Habitat Restoration

7.1 Synopsis

Habitat restoration and revegetation programs are essential for the long-term conservation of koalas within the Port Stephens LGA. The Koala Habitat Planning Map provides a basis for the selection of areas to investigate for koala habitat restoration; Habitat Buffers and Habitat Linking Areas that overlap with Mainly Cleared Land should be targeted in particular. Recommendations concerning specific areas for potential restoration projects for each of the identified Koala Management Units have been indicated in association with the SWOT analyses undertaken for chapter 6 of the CKPoM Resource Document and are presented in section 6.2 of this CKPoM.

Weed management and control is central to the effective restoration and management of koala habitat. Where weeds invade native plant communities they can replace existing native vegetation and degrade native habitat. Under the Noxious Weeds Act 1993 there are 34 plants declared for the Port Stephens LGA, however, only nineteen of these are actually known to occur in the area. There also exists a number of other invasive plant species that, although not classified as noxious, can be classed as environmental weeds due to the impact that they may have upon natural ecosystems. Council currently employs two weed control officers who are responsible for implementing Council's noxious weed control program throughout the entire LGA. Council also contributes to noxious and environmental weed control through providing assistance to community groups undertaking weed control and vegetation management activities, as well as through management of Council's Open Space Areas.

The habitat restoration chapter of the CKPoM Resource Document details the criteria that should be considered in order to prioritise areas for habitat restoration. These criteria are listed in section 7.2 of this CKPoM. Priority should be given to those restoration projects that are likely to maximise the benefit to koala conservation. Projects that aim to restore koala habitat should include replanting of preferred koala food trees in areas where these would have occurred naturally.

7.2 Actions

i) <u>Identification and prioritisation of habitat to be restored</u>

Priority areas for koala habitat restoration should be identified on the basis of the recommendations for each Koala Management Unit (see section 6.2 of this CKPoM) together with reference to the criteria outlined in section 7.5 of the CKPoM Resource Document. These criteria are listed below:

- the intended aim of revegetation works;
- size of habitat patches;
- shape of habitat patches;
- type of koala habitat;
- size of koala populations/ presence of extant populations;
- presence of threats to koalas;
- effort required for restoration;
- current land tenure and land use zoning;

- pre-European vegetation of the area; and
- other considerations, including the goal of the project.

ii) Coordination of habitat restoration projects

One Port Stephens Council Officer should be made responsible for overall coordination of community revegetation works within the LGA. This Officer will consult with the CKPoM Steering Committee regarding the koala habitat restoration program.

iii) Land Managed by Council

Where priority areas for koala habitat restoration are identified on land managed by Port Stephens Council, provision should be made in the relevant Plan of Management for their restoration.

iv) Nursery Stock

Nursery stock to be used for restoration programs should be propagated from local provenance seed.

v) Weed Management

Council to increase its enforcement of the Noxious Weeds Act, and also its commitment to the management of environmental weeds.

Vi) Bushfire Management

Habitat restoration activities will take into account bushfire management principles (eg. the provision of fire breaks and access)

8. Traffic Management

8.1 Synopsis

According to figures provided by the Hunter Koala Preservation Society and the Native Animal Trust Fund, 325 koalas were hit by vehicles within the Port Stephens LGA between December, 1987 and March, 1998. Approximately 74% of these collisions resulted in the koala's death. This indicates the significant threat that motor vehicles pose to koalas in the Port Stephens LGA.

It would be impossible to completely eliminate the impacts of roads and traffic on koalas, due to the nature of koala movements and home-ranging behaviour and the substantial amount of habitat that is adjacent or in the vicinity of main roads. However, the management strategies addressed in the Port Stephens Council CKPoM aim to reduce the number of koalas hit on roads and to increase driver and community awareness so that when koalas are hit, people will know who to contact and be in a better position to assist.

The Traffic Management chapter (chapter 8) of the CKPoM Resource Document identifies three categories of roads (or sections of roads) within the Port Stephens LGA on the basis of the available koala collision records, including those obtained from the community-based koala survey. These include 'Black Spots', 'Conflict Areas', and 'Potential Problem Areas' (Figure 3 of this CKPoM).

A range of measures to reduce the impact to koalas of motor vehicles travelling along these roads are discussed in chapter 8 of the CKPoM Resource Document. The recommended actions to implement these measures are presented below. Chapter 8 of the CKPoM Resource document also includes a list of management options for koala traffic black spots. Guidelines for the design of koala underpasses and overpasses are provided in Appendix 7.

8.2 Actions

The following actions are recommended:

i) <u>Fatality Signs</u>

- Fatality signs erected along Lemon Tree Passage Road be updated by Council annually using information from the Native Animal Trust Fund and the Hunter Koala Preservation Society.

ii) <u>Black Spots</u>

- Council install 'Koala Warning' signs and 'Injured Native Wildlife' signs in appropriate locations at identified koala black spots;

- Following consultation with the community, Port Stephens Council formally approach the Roads and Traffic Authority to support the trial of 'Koala Speed Zones' similar to that being conducted in the Redlands Shire, Queensland. If the RTA supports the trial and the necessary funding can be secured, these 'Koala Speed Zones' should be trialled at selected black spots;

- Council install speed advisory signs recommending a reduction in speed by 20 km/h at identified black spots where current speed

zones are either 100 km/h or 80 km/h and where the 'Koala Speed Zones' outlined above are unlikely to be trialled. This should be accompanied by extensive promotion, which should incorporate marketing advice with respect to the design, advertisement and implementation of a suitable campaign;

- Council instigate a program for regular slashing of established roadside clear zones, aimed to minimise the height of ground cover at identified koala black spots;

- A research program be promoted by Council, in consultation with the CKPoM Steering Committee, to investigate the potential application of underpasses and overpasses, exclusion fencing and koala crossings within the LGA. Guidelines for designing and constructing effective koala underpasses and overpasses are included in Appendix 7.

- In the event that any of the above measures are determined to merit application at any of the identified koala black spots within the LGA, funding be sought by Council for their installation and monitoring; and

- If it is determined that koala crossings have potential application in specific situations, and that it can be demonstrated that the use of lighting will not deter or inhibit other fauna then Council approach the local energy supplier to investigate the possibility of installing associated street lighting.

- The Steering Committee to investigate additional safety measures for koala black spots such as wide white edge lines on the road to improve night time visibility of koalas to motorists.

- Promote further research on the need for fencing along roads in koala traffic black spot areas.

iii) Conflict Areas

- Council install 'Koala Warning Signs' and 'Injured Native Wildlife Signs' in appropriate locations at identified conflict areas. These warning signs should be funded by Council on local roads, while the Roads and Traffic Authority should be approached with respect to funding for signage on main roads; and

- Council instigate a program for regular slashing of established roadside clear zones, aimed to minimise the height of ground cover at identified koala conflict areas

- Trial the use of car whistles

iv) Potential Problem Areas

- The Roads and Traffic Authority be approached, if necessary, following the release of their Koala Monitoring Report to consider extending the exclusion fencing on the Raymond Terrace Bypass

to the north in order to reduce the chances of koalas moving around the fencing and entering the Raymond Terrace urban area from the east

- The identified potential problem areas within the Port Stephens LGA should be reviewed in conjunction with the annual CKPoM monitoring program.

v) Awareness Campaign

- An awareness campaign, which incorporates an explanation of the rationale for the above measures and information on how to reduce the likelihood of collisions between motor vehicles and koalas, should be incorporated in the education program proposed in chapter 13 of the CKPoM Resource Document. This campaign should target both Council staff and the general public.

9. Dog Management

9.1 Synopsis

There are currently over 6,500 registered dogs in the Port Stephens LGA, although the actual number of domestic dogs is likely to be considerably greater, if those unregistered could be taken into account. Irresponsible dog-ownership results in a substantial number of uncontrolled, roaming domestic dogs in parts of the LGA. These roaming dogs, particularly large dogs and dog packs, pose a significant threat to koalas that occupy habitat within and adjacent to urbanised areas.

According to data provided by the Native Animal Trust Fund and the Hunter Koala Preservation Society, 125 koalas were attacked by dogs in the Port Stephens Local Government Area (LGA) between January 1988 and March 1998. Seventy-seven of these koalas died as a result of their injuries, representing a 62% fatality rate.

It would be unrealistic to assert that dog attacks on Koalas could potentially be totally eradicated. The most effective method of reducing dog attacks is considered to be through the promotion of *responsible dog-ownership*. An appropriate education campaign is crucial in promoting responsible dog-ownership.

Chapter 9 of the CKPoM Resource Document discusses the range of management strategies available to Council, including regulation under the *Companion Animals Act 1998*. The recommended actions relating to dog management are listed below.

9.2 Actions

i) Litigation

- Where evidence likely to result in a conviction has been obtained, Council will prosecute under the Companion Animals Act 1998 the owner of any dog which (without provocation and outside of the property on which the dog was being kept) rushes at, attacks, bites, harasses or chases a koala.

ii) Council Rangers

- Council direct additional resources for dog control within the Port Stephens LGA; and

- In the event that Council secures funding to employ an additional Ranger, consideration be given to conducting additional night patrols during the koala breeding season (August to February), with patrols in areas where dogs are known to pose a threat to koalas a priority.

- Port Stephens Council Ordinance Officers to work split shifts to enable greater availability for dog control.

iii) Dog Control

- Where appropriate, Council declare a dog to be dangerous where the dog has attacked or killed a koala or repeatedly threatened to attack or repeatedly chased a koala, under the Companion Animals Act 1998.

- Undertake an investigation into the number of unregistered dogs in areas where dogs are having an impact on koalas.

- In each proposed new subdivision, investigate the application of section 88e of the Conveyancing Act in the context of dog control.

iv) Exercise Areas

- Council include, as part of its current review of dog exercise areas, the substitution of more suitable areas in place of those exercise areas which conflict with koala habitat. The location of these exercise areas should be widely promoted to the community. This policy should be periodically reviewed in the future, particularly where it relates to koalas and:

- Council should consult more with the Tilligerry community regarding dog exercise areas

- Council ensure that all public reserves are effectively signposted regarding dog exercise provisions.

v) Education

- Council publicise any successful prosecutions against dog owners with respect to offences that relate to koalas;

- A media campaign which will include pamphlet drops to inform the public in identified problem areas. These campaigns should occur annually during the koala breeding season;

- Community groups such as the Hunter Koala Preservation Society, the Native Animal Trust Fund and others continue to highlight the problem of dog attacks through the media, schools and information booths;

- The Native Animal Trust Fund and the Hunter Koala Preservation Society continue to maintain a register of reported dog attacks on koalas for provision tothe CKPoM Steering Committee every six months; and

- The Port Stephens Council Animal Management Committee develop suitable educational material after securing funding under the provisions of the Companion Animals Act 1998 and liaise with the CKPoM Steering Committee concerning the design of educational literature and programs aimed to promote responsible dog ownership.

vi) Local Companion Animals Management Plans

- The following special conditions are considered to be appropriate for areas identified as Preferred Koala Habitat in conjunction with the development of Local Companion Animals Management Plans for the Port Stephens LGA:

  - Designation of public places which contain Preferred Koala Habitat as “Wildlife Protection Areas”, where dogs are prohibited as provided under s. 14 (1) (h) of the Companion Animals Act 1998; and

  - As part of a public awareness campaign, owners of dogs be encouraged to, upon becoming aware of the presence of a koala on their property, restrain or confine the dog to protect the koala until it has left the premises.

- Educational material to include information on the most suitable breeds of dogs to keep in relation to koalas

10. Feral Animal Management

10.1 Synopsis

There are a number of feral animal species that are known to occur within the Port Stephens LGA, some of which have the potential to impact significantly on koalas. Feral dogs are known to prey on koalas in the Port Stephens LGA and are considered capable of taking even large, healthy adult koalas. Foxes and, to a lesser extent, feral cats are considered to have the potential to take small, old, or otherwise debilitated koalas.

Each of the principal land management agencies and interest groups within the Port Stephens LGA participate in the Port Stephens Vertebrate Pest Animal Management Committee. This committee is responsible for identifying problems relating to the management of feral animals (particularly vertebrate pests) in the Port Stephens LGA and coordinating the appropriate response by the relevant land management agency. Staff and students from the University of Newcastle undertake research to assist the committee with the identification of problem areas and to monitor the effectiveness of the management strategies that are implemented. The committee is currently finalising a draft Vertebrate Pest Animal Management Plan, which addresses a range of issues relating to vertebrate pest management, including the impact of such species on koalas.

Issues relating to feral animals and their impact on koalas are discussed in greater detail in chapter 10 of the CKPoM Resource Document.

10.2 Actions

i) All principal land management agencies and organisations within the Port Stephens Local Government Area continue to contribute to and support the initiatives of the Port Stephens Vertebrate Pest Animal Management Committee;

ii) The Port Stephens Vertebrate Pest Animal Management Plan identify and address koala-specific feral animal management issues; and

iii) The Port Stephens Vertebrate Pest Animal Management Committee continue to actively encourage the involvement of the University of Newcastle with feral animal research projects.

iv) Chicken farmers who are providing a supplementary source of food for feral animals in the form of chicken carcasses be encouraged to dispose of these carcasses through alternative processes

11. Bushfires

11.1 Synopsis

Bushfires represent a significant threat to koalas within the Port Stephens LGA, as evidenced by the January 1994 bushfires, which resulted in the death of 46 koalas and injured 53. High intensity fires, such as those in January 1994, are likely to kill or injure koalas; while frequent, low intensity fires (as are often employed for hazard reduction) may have long-term impacts on koala habitat and the plant and animal communities that occur in association with koala habitat. A summary of principles for managing fire and koala habitat are contained in Appendix 10. Further information on issues relating to bushfire hazard reduction and koalas can also be found within Chapter 11 of the CKPoM Resource Document. Therefore, it is important that potential impacts on koalas and koala habitat by bushfires are properly addressed. The appropriate means to do this is via fire management planning, such as bushfire risk management plans prepared under the *Rural Fires Act 1997*.

The Port Stephens Bushfire Management Committee was established under the *Rural Fires Act 1997* and consists of, among others, representatives of land management and emergency service agencies. This committee is responsible for the preparation of the Port Stephens Bushfire Risk Management Plan and Plan of Operations. The *Rural Fires Act 1997* provides for the consideration of impacts on fauna and flora in bushfire risk management plans and plans of operations.

Licensed fauna welfare organisations play an important role in mitigating the impact of bushfires on fauna such as koalas by rescuing and rehabilitating fauna affected by fire. Research into the impact of bushfires on koalas and their habitat, such as that conducted by the NSW National Parks and Wildlife Service following the January 1994 bushfires is also essential to help develop appropriate management strategies.

11.2 Actions

i) Port Stephens Council and the NSW National Parks and Wildlife Service (NPWS) encourage and promote appropriate ongoing research into the effects of bushfire on koalas and koala habitat and incorporate the results of the research by NPWS on the impact of bushfires on the koala population on the Tomago Sandbeds after it is published into fire management plans;

ii) Koalas and koala habitat, particularly areas of Preferred and Supplementary Koala Habitat and vegetated Habitat Buffers and Habitat Linking Areas as identified in the Port Stephens Council CKPoM, be thoroughly considered in any Plan of Operations and/or Bush Fire Risk Management Plan prepared by the Bush Fire Management Committee in accordance with the Rural Fires Act 1997;

iii) CKPoM Steering Committee liaise with the Bushfire Management Committee regarding proposals by public authorities to undertake hazard reduction burns, and encourage private landowners to consult with it, in order to assist in determining if

koalas or koala habitat are likely to be significantly affected by proposed hazard reduction activities

iv) Land management agencies and the NSW Rural Fire Service co-operate with the local wildlife carer groups and the NSW National Parks and Wildlife Service concerning fauna welfare issues following bushfires;

v) Land management agencies seek to ensure that any hazard reduction burns undertaken in areas known to support koalas are maintained at low intensity or managed and supervised by the land owner or manager responsible for the hazard reduction burn, in such a way as to minimise risk to resident koalas.

vi) Port Stephens Council, in conjunction with the CKPoM Steering Committee, investigate the possibility of establishing a research program concerning potential longer term impacts of hazard reduction burning on koala habitat. This research would contribute to the development of fire management strategies that best meet the objectives of minimising the risk to koalas while conserving koala habitat and associated plant and animal communities: and

vii) Port Stephens Council and the CKPoM Steering Committee investigate the potential for using satellite imagery as a means of mapping the extent and intensity of bushfires and for monitoring post-fire regrowth and report findings to the CKPoM Steering Committee described in section 18.1 of this CKPoM.

viii) Port Stephens Council to assist Rural Fire Service in conducting community education in respect to the processes required to undertake Hazard Reduction Burns.

ix) Assist where possible the Bushfire Management Committee in encouraging the sharing of resources for fire fighting.

12. Koala Welfare

12.1 Synopsis

Carers and carer groups in NSW require a licence from the NPWS (Wildlife Licensing Unit, NPWS, PO Box 1967, Hurstville NSW 2220). All issues concerning koala care in NSW have now been dealt with in a NPWS policy document entitled **"Guidelines and Conditions for Koala Care in NSW"** prepared by D. Lunney and A. Matthews (June 1997), incorporating extensive public consultation. This document is included in Chapter 12 of the CKPoM Resource Document complete and unabridged and should be referred to when dealing with all issues relating to koala welfare in Port Stephens LGA.

The Native Animal Trust Fund (NATF), the Australian Wildlife Hospital (AWH) and recently, the Hunter Koala Preservation Society (HKPS) hold licenses issued by the National Parks and Wildlife Service to care for sick, injured, orphaned or otherwise distressed koalas in the Port Stephens LGA. Koala carers in the Port Stephens area are supported by a number of local veterinary surgeons who have developed expertise in the assessment and treatment of sick, injured or orphaned koalas. These local veterinarians assist the koala carers in providing expert assessment and treatment of koalas.

Licensed koala welfare groups make a significant contribution to the conservation of koalas in the Port Stephens LGA, as well as collecting and maintaining important information that will assist with monitoring the ongoing status of the local koala population and the efficacy of this CKPoM.

12.2 Actions

- The CKPoM Steering Committee investigate the establishment of Koala Conservation Areas

13. Education

13.1 Synopsis

Education has a key role to play towards ensuring the long-term survival of the koala population in Port Stephens. Education programs are the principal means by which the community and decision makers can gain a full appreciation of relevant issues and the actions which they can undertake to aid koala conservation. Consequently, relevant environmental groups and government agencies need to participate effectively in public education through such measures as school education, raising the profile of koala conservation issues in the media and by making relevant information more accessible through information brochures and publications.

While many organisations are already involved in the dissemination of information concerning koala related issues to the residents of Port Stephens, there are other opportunities that could be pursued and more formal processes developed.

Overall objectives need to focus on educating people about the importance of retaining and managing koala habitat in the Port Stephens LGA, which is essential to the ongoing survival of the Port Stephens koala population. Other messages to be brought to the awareness of Port Stephens residents include what action to take, and who to contact, if they encounter an injured or distressed koala; the importance of responsible dog ownership; and the need to drive with caution in signed koala road crossing areas.

Chapter 13 of the CKPoM Resource Document provides a more detailed discussion of the education program.

13.2 Actions

i) <u>Information Brochures</u>

- That Port Stephens Council, in consultation with the CKPoM Steering Committee, the Australian Koala Foundation, the National Parks and Wildlife Service, the Hunter Koala Preservation Society, the Native Animal Trust Fund and the Tilligerry Habitat Association, modify and reprint one or both of the brochures prepared by the Tilligerry Habitat Association and the Hunter Koala Preservation Society (see Appendix 6 of the CKPoM Resource Document). This brochure should be made available through relevant agencies and organisations including Council and National Parks and Wildlife Service offices, Tourist Centres, Veterinary Clinics, and environment groups. This and other appropriate information should also be periodically distributed with the Port Stephens Council Rates notices.

- That Port Stephens Council, in conjunction with the CKPoM Steering Committee, prepare a brochure listing recommended tree species, appropriate for planting to restore koala habitat. The brochure should provide relevant horticultural information and be distributed to nurseries throughout the Port Stephens LGA, as well as being made available in association with the general information brochure.

- The Health and Environment Newsletter produced by Port Stephens Council be used to inform the public of the timing of the koala breeding season, the need for responsible dog ownership and responsible driving when travelling on roads near koala habitat, the results of trials of ameliorative measures and of updates on the status of the Port Stephens koala population.

ii) Environmental Education

- Port Stephens Council, in consultation with CKPoM Steering Committee prepare a trial education program for presentation to school and community groups, dealing with issues such as general koala biology, behaviour and habitat requirements of koalas, the importance of responsible pet ownership, and appropriate action if an injured, sick, distressed or dead koala or other native animal is found. Council's Road Safety Officer could also become involved in an Educational Strategy of this nature. Should this program prove successful, it should be conducted annually and linked to relevant existing programs, such as 'Learnscape' (tree planting) and 'Naturewatch' (monitoring);

- The Department of Education should be contacted to ensure that the proposed education program is compatible with the existing Environmental Education Curriculum;

- The National Parks and Wildlife Service should be consulted regarding any technical and scientific aspects of the program and to provide guest presentations if required;

- Councillors and Council staff, including planners and outdoor staff be educated in relation to koala conservation issues and actions;

- Developers and consultants be educated in areas such as new legislative and policy directions, through information brochures linked to the development application process and Council's Development Assessment Panel;

- Information be provided to the community on the economic benefits of conserving koalas and their habitat;

- Low key advertising be used to foster a local identity for Port Stephens as a place which conserves Koalas and their habitat; and

- Port Stephens Council should contact local bus companies regarding advertisements on buses encouraging drivers to slow down when driving along roads where koalas have been hit. Bus routes along 'Black Spots' or 'Conflict Areas' should be targeted in particular.

iii) Telephone Hold

- That Port Stephens Council and the National Parks and Wildlife Service investigate the provision of recorded information on hold

lines on their respective telephone systems, to include information about koalas and other environmental matters.

iv) Liaison with the Media

- Animal welfare groups and/or the CKPoM Steering Committee should develop formal systems to ensure relevant koala information is regularly provided to the local media. A co-ordinator should be appointed to liaise with a local newspaper with a view to providing a series of regular, koala feature articles on behalf of these groups.

- The National Parks and Wildlife Service investigate the possibility of providing regular articles in a local newspaper focusing on koalas and other local environmental issues.

v) Electronic media

- Information on koalas and their habitat be made available through electronic media including the Internet and e-mail.

vi) Extension programmes

- Council support the development of a regional advisory extension service such as a `Land for Wildlife' Scheme

vii Community Consultation

- Greater levels of consultation need to be undertaken with the community in relation to new planning policies and instruments such as LEP 1999 and the CKPoM

14. Tourism

14.1 Synopsis

Port Stephens is a very popular tourist destination, with visitors injecting approximately $152 million into the local economy in 1996/1997. Tourism in Port Stephens includes 'nature-based tourism', which is tourism that relies on the natural environment, but makes no provision for its long term management; and 'eco-tourism' which also relies on the natural environment, but, importantly, does provide for its long-term management and ensures that it is ecologically sustainable.

Port Stephens Tourism Limited controls the private sector of tourism in Port Stephens. This body represents an avenue for the implementation of recommendations in the Port Stephens Council CKPoM that pertain to tourism.

It has been estimated that the koala contributes $1.1 billion per annum to the Australian tourist industry and accounts for 9000 industry jobs (Hundloe and Hamilton 1997). This indicates the significance of the koala to the tourist industry.

There is a need to identify locations in the Port Stephens LGA that are suitable for koala-based eco-tourism and to monitor the impact of tourism activities on koalas and koala habitat. The CKPoM Steering Committee (described in section 18.1 of this CKPoM) should be given this responsibility.

Tourism based on koalas and koala habitat has the potential to aid the implementation of the Port Stephens Council CKPoM, by helping to raise public awareness via education programs that are run in conjunction with tourist activities and by contributing funds towards the implementation of the CKPoM.

Chapter 14 of the CKPoM Resource Document provides a more detailed discussion of issues relating to koalas and tourism in the Port Stephens LGA.

Actions

i) A base-line study of ecotourism potential and environmentally suitable areas be undertaken as a joint Port Stephens Council and National Parks and Wildlife Service project. Partial funding for this project could be sought under the Commonwealth Department of Tourism's National Eco-tourism and Grants Program.

ii) The CKPoM Steering Committee identify a suitable trial area and develop guidelines for the conduct of sustainable koala-based tourism that will help to ensure appropriate management of the environment and protect the welfare of koalas

iii) The Eco-tourism Committee of Port Stephens Tourism be further developed in terms of its representation and objectives, and become the main body for the development and monitoring of nature and eco-tourism based activities in Port Stephens

iv) Port Stephens Tourism Limited encourage all members engaged in nature based and eco-tourism activities to seek accreditation under the National Eco-tourism Accreditation Scheme and locally developed

standards. Local standards should be developed in consultation with the CKPoM Steering Committee, where they relate to koala-based tourism;

v) There should be a licensing system for local eco-tourism operators and no operator should be licensed before first being accredited under the National Eco-tourism Accreditation Scheme;

vi) That a formal mechanism be established to monitor the environmental impacts of any koala-based tourism activities;

vii) The Eco-tourism Committee develop a uniform interpretative and directional signage system for the various accredited koala based tourism activities, along with recommendations for funding this system;

viii) That eco-tourism be combined with other aspects of tourism to present a wide-ranging and appealing prospect to promote tourism in Port Stephens; and

ix) Tourism activity be used as a source of revenue to manage the natural environment of the Port Stephens LGA. A proportion of the economic benefits of koala-based tourism should be directed to the ongoing protection and management of koala habitat.

15. Funding

15.1 Synopsis

Successful implementation of the Port Stephens Council CKPoM will require appropriate levels of funding or in-kind support to resource the recommendations. Funding can be sought from a number of sources including State and Federal Government grants, Council revenue, the National Parks and Wildlife Service, and private or corporate sponsorship. Appropriate funding sources need to be identified for each of the recommendations of the Port Stephens Council CKPoM that require a financial input.

Funding could be obtained from a number of different State and Commonwealth government schemes, such as the Environmental Trust Grants, the Natural Heritage Trust and the Eco-tourism Grants Program. Port Stephens Council lodged an application in the 1999/2000 round of the Natural Heritage Trust, to fund koala habitat restoration projects throughout the LGA. Other options for funding include calls for donations from the public to fund koala management. This could be facilitated by airing such requests in conjunction with documentaries that focus on koalas in Port Stephens.

The CKPoM Steering Committee described in section 18.1 of the Port Stephens Council CKPoM and chapter 18 of the CKPoM Resource Document should be responsible for securing funding for management actions that require funds to be implemented.

Potential funding options are explored more fully in chapter 15 of the CKPoM Resource Document.

15.2 Actions

i) That the CKPoM Steering Committee, recommended in the Implementation Chapter of the CKPoM Resource Document, be responsible for costing, coordinating and seeking funding from appropriate sources to implement recommendations requiring financial input.

ii) That the CKPoM Steering Committee request media productions on koalas in the Port Stephens to include information on avenues for public donations for koala management.

16. Research

16.1 Synopsis

Koala habitat management, koala population management and land-use planning should be guided wherever possible by the outcomes of relevant scientific research. Research can provide a basis for monitoring and evaluating the effectiveness of management programs.

A range of koala research projects have been undertaken within the Port Stephens LGA in relation to topics such as tree species preferences, habitat utilisation, impact of bushfires, home-ranging behaviour and predation. However, not all koala research to date has been directed to areas of specific importance to authorities, such as Port Stephens Council, for the purposes of land use planning and habitat management. Additionally, there has been no centralised co-ordination and/or dissemination of koala research findings for the LGA.

The research chapter (chapter 16 of the CKPoM Resource Document) aims to encourage and facilitate koala research focusing on topics where current information is lacking and to ensure that research findings are applied to koala management practice and decision making.

In accordance with this aim, the CKPoM Steering Committee (as identified in sections 18.1 and 18.2 of this CKPoM and the Implementation chapter of the CKPoM Resource Document) will establish, maintain and promote a prioritised list of relevant koala research projects for the LGA. This list will be derived from the recommended research projects contained in the National Koala Strategy (ANZECC 1998).

16.2 Actions

i) The CKPoM Steering Committee formally approach the University of Newcastle for representation on the Committee when considering koala research projects and other relevant issues;

ii) The CKPoM Steering Committee identify and prioritise potential koala research projects in terms of application to koala habitat and population management within the Port Stephens LGA as well as implementation and monitoring of the CKPoM. The identification of potential research projects should be accompanied by investigation of possible funding sources;

iii) The CKPoM Steering Committee identify and promote potential final year or postgraduate University student research projects from the list derived as a result of ii) above;

iv) The CKPoM Steering Committee liaise with those undertaking koala research in order to facilitate the involvement of interested volunteers in any suitable research projects;

v) The CKPoM Steering Committee maintain a register of completed, ongoing and proposed future koala research projects within the Port Stephens LGA. This register is to be kept at the Port Stephens Council Chambers and maintained by Council;

vi) The CKPoM Steering Committee maintain a reference library at the Port Stephens Council Chambers of all reports concerning koala-related research undertaken within Port Stephens LGA;

vii) The Native Animal Trust Fund and the Hunter Koala Preservation Society continue to maintain databases for all reported koala sightings. The CKPoM Steering Committee will liaise with both organisations with a view to formalising a complementary approach to these independent databases. The data bases should be presented to the NSW National Parks and Wildlife Service on a six monthly basis in a form suitable for entry onto the 'Atlas of NSW Wildlife', as well as to Port Stephens Council; and

viii) The CKPoM Steering Committee should incorporate the results of relevant research into the CKPoM when they become available.

17. Monitoring Program

17.1 Synopsis

An ongoing monitoring program will be commenced in conjunction with adoption of the Port Stephens Council CKPoM. As part of this program a number of performance indicators will be identified to provide a means to determine the level to which the key outcomes have been achieved and to quantify the success or failure of the measures specified within the CKPoM. These performance indicators are presented in section 1.2 of this CKPoM. The monitoring program will also include a procedure to be followed should the CKPoM fail to meet the identified performance indicators. It is intended that the Port Stephens Council CKPoM will be reviewed annually with the potential for amendment of the measures employed where necessary.

The monitoring program will aim to provide periodic updates on the status of the koala population and koala habitat within the Port Stephens LGA. The status of the koala population will be assessed in terms of estimated koala numbers, evidence of breeding activity, clinical signs of disease, records of mortality and the overall distribution of koalas within the LGA. The program will also seek to record changes in the amount and quality of available koala habitat as well as changes in the levels of habitat utilisation. The impact of threatening processes upon the koala populations will be monitored to determine the level of success or failure of the measures within the Port Stephens Council CKPoM. The relative significance of each threatening processes will also be regularly assessed to ensure resources are focused in the highest priority areas.

A report on the findings of the monitoring program should be presented to the CKPoM Steering Committee (see section 18.1 of this CKPoM for details of this committee) on an annual basis and the results included in Council's annual State of the Environment Report.

Chapter 17 of the CKPoM Resource Document provides details of the proposed monitoring program.

17.2 Actions

i) Koala Habitat Monitoring

- Port Stephens Council and the CKPoM Steering Committee continue to refine the mapping of koala habitat within the Local Government Area with input from the community and consultation with landowners, and taking into account any information from Development Applications and rezoning applications.

- CKPoM Steering Committee will purchase the latest available satellite imagery for the Port Stephens LGA in early-2000 and at four year intervals after that to coincide with Council's Comprehensive State of the Environment Reporting;

- The CKPoM Steering Committee will assist Council to interpret these images to determine changes in the extent of each category of koala habitat associated with habitat clearance or habitat restoration in the Port Stephens LGA;

- The CKPoM Steering Committee will establish and maintain a register of habitat clearing activities and habitat restoration projects to be included in the annual reports to the CKPoM Steering Committee;

- The CKPoM Steering Committee will establish and maintain a register of potential discrepancies in the LGA-wide Vegetation Map and will, as time and resources permit, investigate these and revise the Vegetation Map where necessary; and

- The CKPoM Steering Committee will co-ordinate revision to the LGA-wide Vegetation Map and the Koala Habitat Planning Map where necessary.

ii) Koala Population Monitoring

- The CKPoM Steering Committee will co-ordinate a phone-in census that will be conducted each year on a specific weekend in spring. Assistance will be provided by volunteers from the Native Animal Trust Fund and the Hunter Koala Preservation Society;

- The CKPoM Steering Committee will co-ordinate annual transect-based searches of designated sites throughout the Port Stephens LGA. Assistance in conducting these searches will be sought from a variety of community groups and the Hunter District NPWS;

- The Hunter Koala Preservation Society will continue to maintain a record of koala sightings through its Koala Watch Program to be used as part of the LGA-wide monitoring program;

- The CKPoM Steering Committee will establish and monitor a series of sites throughout the LGA using the AKF Spot Assessment Technique; and

- The CKPoM Steering Committee will collate existing research results on koala faecal pellet longevity and determine if any additional research is required.

iii) Population Viability Analysis

- The CKPoM Steering Committee will investigate the potential for undertaking a Population Viability Analysis for the Port Stephens koala population and for using this process as a formal component of the monitoring program.

iv) Threatening Processes

- The Native Animal Trust Fund and the Hunter Koala Preservation Society continue to maintain their koala databases with this information utilised by the AKF Field Biologist in the annual reporting on the threatening processes impacting the Port Stephens koala population;

- Council's Rangers maintain a register on any cases involving domestic dog attacks on koalas;

v) Funding

- The CKPoM Steering Committee seek the necessary funding, assistance, resources and sponsorship to implement the monitoring program.

vi) Reporting

- The CKPoM Steering Committee present the findings of the ongoing monitoring program to the annually; and

- Council incorporate updates on the status of the koala within the Port Stephens LGA and the actions taken to implement the recommendations of the Port Stephens Council CKPoM into their annual State of the Environment reports.

vii) Review and Amendment

- The CKPoM Steering Committee shall review the Port Stephens Council CKPoM every 12 months. This will include review of the Performance Indicators, the monitoring program, and the extent to which the plan's recommendations have been implemented; and

- Any proposed amendments to the Port Stephens Council CKPoM will be determined by the CKPoM Steering Committee in consultation with the General Manager of Port Stephens Council and the Director-General of the NSW National Parks and Wildlife Service. Amendments to the CKPoM will be approved by both Port Stephens Council and the Director-General of the Department of Urban Affairs and Planning, before being formally adopted.

18. Implementation

18.1 Synopsis

A number of organisations have contributed to the preparation of the Port Stephens Council CKPoM and the CKPoM Resource Document. These include Port Stephens Council, the Australian Koala Foundation, and the NSW National Parks and Wildlife Service along with numerous individuals and organisations from the local community. It is considered essential to provide for the ongoing involvement of these organisations and individuals for the effective implementation and updating of the CKPoM Resource Document and the Port Stephens Council CKPoM.

In order to ensure the recommendations of the Port Stephens Council CKPoM are implemented, a CKPoM Steering Committee should be established. This Committee would be responsible for overseeing the implementation of the CKPoM. Core members would consist of a representative from each of Port Stephens Council (PSC), the NSW National Parks and Wildlife Service (NSW NPWS), the Australian Koala Foundation (AKF), the Native Animal Trust Fund (NATF), the Hunter Koala Preservation Society (HKPS), Australian Wildlife Hospital, and three individuals representing landholder interests. A Councillor from Port Stephens Council would chair the CKPoM Steering Committee.

Representatives from other organisations including the Roads and Traffic Authority (RTA); Hunter Water Corporation (HWC); State Forests of NSW (SF); Worimi Local Aboriginal Land Council (WLALC); the University of Newcastle; and Port Stephens Fire Control (PSFC) would be called upon for input as required by the Committee.

The CKPoM Steering Committee should convene immediately following formal endorsement and adoption of the Port Stephens Council CKPoM and should periodically review the CKPoM and provide for its revision where necessary. Further details of this committee and its role are provided in chapter 18 of the CKPoM Resource Document.

18.2 Actions

i) That a CKPoM Steering Committee be established. Core members will include a Councillor to chair the Committee, an Officer from each of Port Stephens Council, the NSW National Parks and Wildlife Service and the Australian Koala Foundation, together with a representative from each of the Native Animal Trust Fund, the Hunter Koala Preservation Society, Australian Wildlife Hospital, and a minimum of three local landholders;

ii) That representatives from other agencies and organisations be called upon by the CKPoM Steering Committee to participate as required;

iii) The core CKPoM Steering Committee shall meet quarterly in the first year and as often as considered necessary by the Committee thereafter;

iv) Port Stephens Council will provide the CKPoM Steering Committee with administrative support; and

v) The CKPoM Steering Committee shall produce an Annual Report which details progress on implementation of the CKPoM, outlines

current research projects and provides a review of any additional action that may be required. The first Annual Report is to be submitted to Port Stephens Council and the Director General of the Department of Urban Affairs and Planning for public exhibition twelve months after the first CKPoM Steering Committee meeting.

19. Action Plan

The following Action Plan lists each of the actions recommended in the Port Stephens Council CKPoM, the organisation/s responsible for its implementation and the nominal priority of each action. There is scope to provide a completion date for each action, although this is currently left blank. It is suggested that the completion dates are determined by the CKPoM Steering Committee following the final adoption of the Port Stephens Council CKPoM by Council and the Director General of Urban Affairs and Planning. The following abbreviations are used in the Action Plan table:

LEP	Local Environment Plan
DA	Development Application
VCA	Voluntary Conservation Agreement
REP	Regional Environmental Plan
SEPP 44	State Environmental Planning Policy 44
PS	Port Stephens
PSC	Port Stephens Council
NPWS	National Parks & Wildlife Service
DUAP	Department of Urban Affairs and Planning
AKF	Australian Koala Foundation
HWC	Hunter Water Corporation
SF of NSW	State Forests of New South Wales
DLWC	Department of Land & Water Conservation
NATF	Native Animal Trust Fund
HKPS	Hunter Koala Preservation Society
RTA	Roads and Traffic Authority
PSVPAMC	Port Stephens Vertebrate Pest Animal Management Committee
PSBFMC	Port Stephens Bushfire Management Committee
THA	Tilligerry Habitat Association
AWH	Australian Wildlife Hospital

Relevant chapter	Action	Responsible organisation	Priority	Completion Date
4	**Habitat Conservation Measures**			
	Rezone koala habitat on public land to Environmental Protection	PSC	H	
	Amend LEP Amendment Policy to include performance criteria for rezoning requests	PSC	H	
	Prepare amending clause of the LEP to activate provisions of CKPoM	PSC	H	
	Implement performance criteria for development applications	PSC	H	
	PKH, SKH, HLA & HB identified as a constraint in the Urban Settlement Strategy	PSC		
	Investigate the potential application of incentives-based measures	PSC	H	
	Investigate options for amendments to Council's Tree Management Policy	PSC	M	
	PSC incorporate provisions of the CKPoM into PoMs for land in its control	PSC	M	
	PSC demonstrate best practice management of koala habitat in all developments	PSC	H	
	NPWS assist with any future review of CKPoM or preparation of guidelines and standards	NPWS	H	
	NPWS discuss with landholders options for conservation, including VCAs	NPWS	H	
	NPWS investigate establishment of conservation reserves, particularly on Tomago Sandbeds	NPWS	H	
	NPWS provide advice to government agencies and landholders regarding koala conservation	NPWS	M	
	NPWS consider relevant aspects of this CKPoM for inclusion in state-wide Koala Recovery Plan	NPWS	H	
	HWC be requested to refer to CKPoM when undertaking self-determination (Part V) assessments on HWC land	HWC, Steering Committee	M	
	SF of NSW be requested to refer to this CKPoM when undertaking koala surveys	SF of NSW, NPWS	M	
	DLWC be requested to refer to this CKPoM when undertaking Crown Land assessments	DLWC	H	
	DLWC be requested to incorporate the provisions of this CKPoM in future Regional Vegetation Management Plans	DLWC	H	
	Dept. of Defence be requested to adopt standards of this CKPoM	Dept. of Defence	M	
5	**Development Assessment**			
	Council advertise in the local newspaper all development applications that are lodged in Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Buffers & Habitat Linking Areas	PSC		
	Council expand the information provided on section 149 certificates to reflect the presence of koala habitat.	PSC		

6	**SWOT Analyses**			
7	**Habitat Restoration**			
	Priority areas for koala habitat restoration identified on the basis of specified criteria	PSC, Steering Committee	H	
	One PSC officer be made responsible for overall co-ordination of community revegetation works and consult with CKPoM Steering Committee regarding koala habitat restoration program	PSC, Steering Committee	H	
	PoMs provide for the restoration of priority areas for koala habitat restoration	PSC	M	

	Nursery stock to be used for restoration programs be propagated from local provenance seed	PSC, AKF, community groups	M	
	Council to increase its enforcement of the Noxious Weeds Act and management of environmental weeds	PSC		
	Habitat Restoration Activities will take into account bushfire management principles	PSC		
8	**Traffic Management**			
	Fatality signs along Lemon Tree Passage Road updated annually	PSC, NATF, HKPS	L-M	
	PSC install Koala Warning signs and Injured Native Wildlife sign at black spots	PSC	H	
	Following community consultation approach RTA re trial of Koala Speed Zones at selected black spots	, PSC	H	
	PSC install speed advisory signs at blacks spots where Koala Speed Zones are not trialed	PSC	H	
	PSC regularly slash roadside clear zones at black spots	PSC	H	
	Promote research on application of underpasses and overpasses, exclusion fencing and koala crossings	Steering Committee	M	
	Seek funding to implement any of the above measures that merit application	PSC	M	
	Approach local energy supplier re installation of street lighting at koala crossings	PSC	M	
	Investigate additional safety measures at black spots such as wide white edge lines on the road	Steering Committee		
	Promote further research on the need for fencing along roads in koala traffic black spot areas	Steering Committee		
	PSC and RTA install Koala Warning signs and Injured Native Wildlife sign at conflict areas	PSC, RTA	H	
	PSC regularly slash roadside clear zones at conflict areas	PSC	M	
	Trial the use of car whistles	Steering Committee		
	Approach RTA to extend exclusion fencing on the Raymond Terrace Bypass to the north if necessary following release of their Koala Monitoring Report	PSC	H	

	Review problem areas as part of monitoring program	Steering Committee	M	
	Establish awareness campaign	PSC	H	
9	**Dog Management**			
	Where evidence available, PSC prosecute owner of any dog that attacks a koala	PSC	H	
	PSC direct additional resources for dog control	PSC	H	
	PSC rangers conduct additional night patrols during koala breeding season	PSC	H	
	PSC Ordinance Officers to work split shifts to enable greater availability for dog control	PSC		
	Where appropriate, PSC declare a dog to be dangerous where it has attacked a koala	PSC	H	
	Undertake an investigation into the number of unregistered dogs in areas where dogs are impacting on koalas	PSC		
	In each proposed new subdiivision, investigate the application of section 88e of the Conveyancing Act in the context of dog control	PSC		
	PSC provide more appropriate dog exercise areas as part of its current policy review	PSC,	H	
	PSC should consult more with the Tilligerry community regarding dog exercise areas	PSC		
	PSC ensure all public reserves are appropriately signposted	PSC	M	
	PSC publicise any successful prosecutions of dog owners	PSC	M	
	Media campaign including pamphlet drops in identified problem areas	PSC	M	
	Community groups participate in school and public education	NATF, HKPS, others	H	
	NATF and HKPS maintain register of reported dog attacks and provide to PSC	NATF, HKPS	H	
	Animal Management Committee develop suitable educational material	Committee, PSC		
	Special conditions relating to koala habitat be included in Local Companion Animal Plans	PSC		
	Educational material should include information on the most suitable breeds of dogs to keep in relation to koalas	Steering Committee		
10	**Feral Animal Management**			
	Land management agencies continue to contribute to and support PS VPA MC	All land management agencies	H	
	PS VPA Management Plan identify and address impacts of feral animals on koalas	PS VPA MC.	H	

	University of Newcastle continue to conduct research on feral animals	PS VPA MC, University		
	Chicken farmers who are providing a supplementary source of food for feral animals be encouraged	PSC		

	to dispose of these carcasses through alternative processes			
11	**Bushfires**			
	NPWS promote ongoing research into effects of bushfires on koalas and koala habitat	NPWS	H	
	Koala habitat is addressed in Port Stephens Bushfire Risk Management Plan	, PS BF MC	H	
	Steering Committee liaise with the Bushfire Management Committee regarding proposals by public authorities to undertake hazard reduction burns, and encourage private landholders to consult with it, in order to assist in determining if koalas or koala habitat are likely to be significantly affected by proposed hazard reduction activities.	Steering Committee	H	
	Land Management agencies and NSW Rural Fire Service cooperate with NPWS and local wildlife carer groups re fauna welfare during bushfire	Land Management Agencies, NPWS, local wildlife carer groups	H	
	Land Management Agencies seek to ensure that any hazard reduction burns in areas known to support koalas are maintained at low intensity or managed and supervised by the land owner or manager responsible for the hazard reduction burn in a manner to minimise risk to resident koalas	Land Management Agencies	H	
	PSC and CKPoM Steering Committee promote research on long term impacts of hazard reduction burns on koala habitat	PSC, Steering Committee	M	
	PSC and CKPoM Steering Committee investigate the potential use of satellite imagery to examine extent of bushfires	PSC, Steering Committee	M	
	PSC to assist Rural Fire Service in conducting community education in respect to the processes required to undertake Hazard Reduction Burns.	PSC		
	Assist where possible the Bushfire Management Committee in encouraging the sharing of resources for fire fighting.	PSC		
12	**Koala Welfare**			
	The CKPoM Steering Committee investigate the establishment of Koala Conservation Areas	CKPoM Steering Committee		
13	**Education**			
	Modify and reprint education brochure	PSC, AKF, NPWS, HKPS, NATF, THA, Steering Committee	H	
	Prepare brochure on recommended tree species for planting	PSC, Steering	H	

		Committee		
	Use Health and Environment Newsletter to deliver information on koala issues to the public	PSC,	H	
	Develop trial education program for schools and community groups	PSC, Steering Committee	H	
	Contact Department of Education re above program	PSC	M	
	NPWS consulted re scientific aspects of above program	PSC, NPWS	M	
	Councillors and Council staff be educated in relation to koala conservation issues	PSC, AKF, NPWS	H	
	Developers and consultants informed of new legislative and policy directions	PSC	H	
	Community informed of economic benefits of conserving koalas and their habitat	PSC	M	
	Low key advertising used to foster identity of PS as a place which conserves koalas and their habitat	PSC	L	
	Contact bus companies re advertisements on buses	PSC	M	
	PSC and NPWS investigate provision of recorded information on telephone hold lines	PSC, NPWS	L	
	Wildlife carer groups & / or the CKPoM Steering Committee coordinate provision of koala information to media	Carer groups, Steering Committee	M	

	NPWS investigate provision of regular articles on koalas in local newspaper	NPWS	M	
	Information on koala conservation be made available via electronic media	PSC, NPWS, AKF	H	
	PSC support the development of a regional extension service such as 'Land for Wildlife'	PSC		
	More consultation needs to be undertaken with community in respect to new planning policies and instruments	PSC	H	
14	**Tourism**			
	PSC and NPWS undertake a study of eco-tourism potential and locate suitable tourism ares	PSC, NPWS	H	
	CKPoM Steering Committee identify trial area and develop koala-based tourism guidelines	Steering Committee	H	
	Eco-tourism Committee of Port Stephens Tourism Ltd be further developed	PS Tourism Ltd	M	
	Port Stephens Tourism Ltd encourage members to seek relevant accreditation	PS Tourism Ltd	M	
	Develop licensing system for local eco-tourism operators	PS Tourism Ltd	M	
	Establish a formal mechanism to monitor impacts of tourism	Steering Committee, PSC		
	Develop uniform interpretative and directional signs	PS Tourism Ltd	M	
	Eco-tourism combined with other forms of tourism	PSC, PS Tourism Ltd	L	
	Tourism be used a source of revenue to fund koala conservation projects	PSC, PS Tourism Ltd	H	

15	**Funding**			
	CKPoM Steering Committee responsible for costing and securing funding for implementation	Steering Committee	H	
	CKPoM Steering Committee request media to include information for public donations	Steering Committee	M	
16	**Research**			
	CKPoM Steering Committee approach Uni of Newcastle to meet with the Committee when relevant	Steering Committee	M	
	CKPoM Steering Committee prioritise potential koala research projects	Steering Committee	H	
	CKPoM Steering Committee promote research projects to Universities	Steering Committee	H	
	CKPoM Steering Committee facilitate the involvement of volunteers in research projects	Steering Committee	M	
	CKPoM Steering Committee maintain a register of completed, ongoing and proposed research projects	Steering Committee, PSC, AKF	M	
	CKPoM Steering Committee maintain a reference library, including research reports	Steering Committee	M	
	NATF and HKPS maintain koala databases, CKPoM Steering Committee liaise to integrate these data bases	NATF, HKPS, AKF	H	
	CKPoM Steering Committee incorporate results of relevant research into the CKPoM	Steering Committee	H	
17	**Monitoring Program**			
	PSC and the CKPoM Steering Committee continue to refine the mapping of koala habitat	PSC, Steering Committee	H	
	CKPoM Steering Committee will purchase latest satellite imagery	Steering Committee	H	
	CKPoM Steering Committee interpret these images to ascertain changes in koala habitat	Steering Committee	H	

	CKPoM Steering Committee to maintain register of habitat clearing activities	Steering Committee	H	
	CKPoM Steering Committee to maintain register of discrepancies in the Vegetation Map and investigate and revise where possible	Steering Committee	H	
	CKPoM Steering Committee coordinate revision of Vegetation Map and Koala Habitat Planning Map	Steering Committee	H	
	CKPoM Steering Committee coordinate annual phone-in census	Steering Committee	H	
	CKPoM Steering Committee coordinate annual transect-based surveys, NPWS to assist	Steering Committee, NPWS	H	
	HKPS maintain record of koala sightings through its Koala Watch program	HKPS	H	
	CKPoM Steering Committee monitor koala habitat utilisation using Spot Assessment Technique	Steering Committee	H	
	CKPoM Steering Committee to collate existing research on koala faecal pellet longevity and determine if additional research is required	Steering Committee	L	

	CKPoM Steering Committee investigate potential use of Population Viability Analysis in monitoring program	Steering Committee	M	
	NATF and HKPS maintain their koala databases and provide data for monitoring program	NATF, HKPS	H	
	PSC rangers maintain register on cases involving domestic dog attack on koalas	PSC	M	
	CKPoM Steering Committee seek necessary funding to implement monitoring program	Steering Committee	H	
	CKPoM Steering Committee present annual reports on ongoing monitoring program	Steering Committee	H	
	PSC include updates on status of koala in annual State of Environment reports	PSC	H	
	CKPoM Steering Committee review the PS CKPoM every 12 months	Steering Committee	H	
	CKPoM Steering Committee, PSC and NPWS determine the need for amendments to the CKPoM and forward these to PSC and DUAP for formal approval	Steering Committee, PSC, NPWS	H	
18	**Implementation**			
	Establish core CKPoM Steering Committee	PSC, AKF, NPWS, DUAP, NATF, HKPS, landholder groups, AWH	H	
	Invite other organisations where necessary	Steering Committee	M	
	CKPoM Steering Committee meet quarterly in the first year and then as often as necessary	Steering Committee	H	
	CKPoM Steering Committee produce an annual report on the progress of the CKPoM	Steering Committee	H	

20. Glossary of Terms

Preferred Koala Habitat: identified by Lunney *et al*. (1998) as the most important category of koala habitat in the Port Stephens LGA and hence should be afforded the highest level of protection. Includes all Koala Habitat Atlas (KHA) Primary Habitat and KHA Secondary Habitat plus Community based survey categories A and B (regardless of whether or not they overlap)

Supplementary Koala Habitat: where only Koala Habitat Atlas Marginal Habitat and middle ranking Community based survey categories C & D overlap. Along with PKH is also important to the long term conservation of koalas in Port Stephens (Lunney *et al*. 1998) and thus also requires protection, albeit with less restrictions on development than Preferred Koala Habitat.

Marginal Koala Habitat: where Koala Habitat Atlas Marginal Habitat and the lowest Community based survey category E overlap (This is essentially all forested areas which are neither Preferred or Supplementary Koala Habitat)

Habitat Linking Area: identified in order to establish a sound basis for long term planning to protect and manage remaining areas of significant koala habitat , and where appropriate, to identify degraded areas for potential restoration. The identification and effective management of Habitat Linking Areas is considered to be essential for the effective conservation of koala populations. Habitat Linking Areas would potentially provide opportunities for the effective movement of dispersing sub adult koalas between breeding populations and vacant habitat areas. These areas may also provide opportunities for koalas to establish home ranges either as extensions from active breeding populations or by koalas otherwise unable to establish home ranges within higher quality habitat.

Habitat Buffer: Can contribute to the long-term survival of Preferred Koala Habitat by ensuring incompatible development or land use does not occur on land immediately adjacent to Preferred Koala Habitat. Habitat Buffers may also afford protection to Preferred Koala Habitat by minimising the detrimental impact of "edge effects" such as nutrient impacts, wind damage and weed invasion. Habitat Buffers also provide for the likely extension of significant koala activity beyond Preferred Koala Habitat. Even Habitat Buffers that extend over Mainly Cleared Land and which contain only scattered trees can perform this latter function. Hence, all Habitat Buffers should also be afforded the highest level of protection and considered for possible restoration where appropriate. The ecological criteria for determining the size of habitat buffers is contained in Appendix 9.

Low impact development: Development that maximises the retention and minimises degradation of native vegetation, and in particular koala habitat. Such developments will be consistent with the objectives of the `Performance Criteria for Development Applications' contained in the Port Stephens Council CKPoM. Low impact developments will also minimise recognised threats to koalas which include dogs, bushfires, traffic, feral animals, and habitat fragmentation (including barriers to koala movement).

Building / Development Envelope & Associated works: that area of land that contains the proposed building or development and its associated works (eg. pools, septic tank transpiration area, driveways, roads, & parking & fire fuel reduction zones).

Agriculture: means the cultivation of crops, and the keeping and breeding of livestock, bees, worms or poultry and other birds, and the like, for commercial purposes, but does not include an intensive agricultural pursuit, intensive agriculture, or clearing activities.

Intensive Agriculture: means any form of agriculture or horticulture which:

a) involves the confinement in an area with watering and feeding facilities where the animals are completely hand or mechanically fed for the purpose of production: or
b) requires particular treatment or practices for the management of liquid or solid wastes to prevent the pollution of any part of the environment: or
c) requires separation from surrounding land uses to minimise the risk of land use conflict for any other reason

Rezoning request: Any amendment to the Port Stephens Council Local Environmental Plan. (eg. requesting a change in land use zone for a particular parcel of land).

Development Application: means an application for consent under Part 4 of the *Environmental Planning & Assessment Act 1979* to carry out development but does not include an application for a complying development certificate .

Fuel reduction zone: area of reduced fire fuel between a building or development and bushland from which bushfires traditionally approach. The fuel reduction zone can include existing fuel free zones such as roadways, rivers or bare ground. The characteristics of a home or development site will determine the appropriate fuel reduction zone for a particular property.

Feral Animal: An animal established in the wild after escape or release from human custody.

21. Abbreviations

CKPoM	Comprehensive Koala Plan of Management
SEPP 44	State Environmental Planning Policy 44 – Koala Habitat Protection
PSC	Port Stephens Council
DUAP	Department of Urban Affairs and Planning
NPWS	National Parks & Wildlife Service
PKH	Preferred Koala Habitat
SKH	Supplementary Koala Habitat
MKH	Marginal Koala Habitat
HB	Habitat Buffer
HLA	Habitat Linking Area
LEP	Local Environmental Plan
KMU	Koala Management Unit
HWC	Hunter Water Corporation
LGA	Local Government Area
S.W.O.T.	Strengths. Weaknesses. Opportunities. Threats.
HKPS	Hunter Koala Preservation Society
NATF	Native Animal Trust Fund
DA	Development Application
RTA	Roads and Traffic Authority
AKF	Australian Koala Foundation
SF	State Forests of NSW
WLALC	Worimi Local Aboriginal Land Council
PSFC	Port Stephens Fire Control
KHA	Koala Habitat Atlas
AWH	Australian Wildlife Hospital

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Appendix 1

Justification for rezoning of selected public land to Environmental Protection to protect Koala Habitat

The following is the general justification for rezoning Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Linking Areas and Habitat Buffers on public land to Environmental Protection to protect koala habitat.

Rezoning koala habitat on public land to Environmental Protection provides a high degree of certainty. It provides a clear indication to future public land managers that such areas contain important koala habitat and need to be managed accordingly. The current land use zone is likely to be one of the first things considered by public land managers, so they can see if the permissible uses of that land are consistent with their future plans. While prospective managers of public land which contains koala habitat (but which is zoned other than Environmental Protection) should be made aware of the development controls that apply to the koala habitat as specified by the CKPoM, it will be a much clearer message if the land is zoned Environmental Protection. In this way it will provide clear guidance to agencies that manage public land of the importance of such land as koala habitat.

Rezoning koala habitat on public land to Environmental Protection is a pro-active means of protecting koala habitat; whereas the other proposed regulatory measures (performance criteria for rezoning requests, the amending clause of the LEP and the performance criteria for development applications) are reactive measures, in that they are not activated until there is a rezoning request or development application. By rezoning land to Environmental Protection now, there will be less need to deal with rezoning requests in the future.

Furthermore, rezoning koala habitat on public land to Environmental Protection represents an open and clear approach to protecting koala habitat, in that it provides for a separate phase of public exhibition and consultation (in addition to that related to the public exhibition of the CKPoM). The objectives of Environmental Protection zones (especially the proposed 7(a) zone) are also more consistent with the intention to set the land aside for koala habitat protection than the objectives of other land use zones.

In summary, rezoning koala habitat on public land to Environmental Protection represents a pro-active and transparent means of protecting koala habitat.

Appendix 2

Performance Criteria for Rezoning Requests

These Performance Criteria for rezoning requests apply only to circumstances where a request is made of Council to rezone land. They do not apply to individual Development Applications. The performance criteria for development applications are contained in Appendices 4 & 5. Any activity that is currently allowed under an existing land use zone is not affected by the following performance criteria for Rezoning Requests.

Consideration is to be given to the following matters when assessing rezoning requests including any amendment to the Port Stephens LEP Prior to approving any such rezoning proposal, Council is to take into consideration the likely impacts of the development made possible by the rezoning including environmental impacts on both the natural and built environment, and social and economic impacts on the locality. In particular Council should be satisfied that the rezoning would:

a) not result in development within areas of Preferred Koala Habitat or defined Habitat Buffers;

b) allow for only low impact development within areas of Supplementary Koala Habitat and Habitat Linking Areas;

c) minimise the removal of any individuals of preferred koala food trees, where ever they occur on the site; and

d) not result in development which would sever koala movement across the site. This should include consideration of the need for maximising tree retention on the site generally and for minimising the likelihood of impediments to safe/unrestricted koala movement.

To facilitate the application of the above performance criteria when assessing rezoning proposals, Council's LEP Amendment Policy should be amended to include these performance criteria. The information required to support a rezoning proposal must include an investigation of the site by an appropriately qualified person in accordance with the Guidelines for Koala Habitat Assessment presented in Appendix 6 of this CKPoM.

Appendix 3

Proposed amending clause of the Port Stephens LEP

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

PORT STEPHENS LOCAL ENVIRONMENTAL PLAN
(DRAFT AMENDMENT No. #)

I, the Minister for Urban Affairs and Planning, in pursuance of section 70 of the Environmental Planning and Assessment Act 1979, make the local environmental plan set out hereunder.

Minister for Urban Affairs and Planning

Sydney, 1999.

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Citation

1. This plan may be cited as Port Stephens Local Environmental Plan (Amendment No.#).

Land to which this plan applies

2. This plan applies to all land within the local government area of Port Stephens.

Objectives

3. This plan aims to amend Port Stephens Local Environmental Plan in order to activate the provisions of the Port Stephens Council Comprehensive Koala Plan of Management and thereby ensure the long term sustainability of the local koala population.

Relationship to other environmental planning instruments

4. This plan amends Port Stephens Local Environmental Plan in the manner shown in clause 5.

Amendment of Port Stephens Local Environmental Plan

5. Port Stephens Local Environmental Plan 1987 is amended by inserting the following clause:

Port Stephens Council Comprehensive Koala Plan of Management

(1) This clause applies to all land within the Port Stephens Local Government Area.

(2) All development applications within the Port Stephens Local Government Area must comply with the provisions of the Port Stephens Council Comprehensive Koala Plan of Management. Compliance with the provisions of the Port Stephens Council Comprehensive Koala Plan of Management will constitute compliance with the provisions of State Environmental Planning Policy No. 44 – Koala Habitat Protection.

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Appendix 4

Performance Criteria for development applications (excluding development applications proposing agricultural activities)

Regulation of development via the assessment of development applications represents an important means by which koala habitat can be protected and effectively managed. All development applications in the Port Stephens LGA will be required to comply with the provisions of this appendix of the Port Stephens Council CKPoM to comply with State Environmental Planning Policy No. 44 – Koala Habitat Protection. This requirement is activated by the proposed amending clause of the Port Stephens LEP (Appendix 3).

The general aims and objectives of these performance criteria are as follows:

i) To ensure that the koala population in the Port Stephens LGA is sustainable over the long-term.

ii) To protect koala habitat areas from any development which would compromise habitat quality or integrity.

iii) To ensure that any development within or adjacent to koala habitat areas occurs in an environmentally sensitive manner.

iv) To ensure that acceptable levels of investigation are undertaken, considered and accepted prior to any development in or adjacent to koala habitat areas.

v) To encourage koala habitat rehabilitation and restoration.

vi) Maintain interconnection between areas of Preferred and Supplementary Koala Habitat and minimise threats to safe koala movements between such areas.

vii) To ensure that development does not further fragment habitat areas either through the removal of habitat or habitat links or through the imposition of significant threats to koalas.

viii) To provide guidelines and standards to minimise impacts on koalas during and after development, including any monitoring requirements.

ix) To provide readily understandable advice to proponents preparing development applications and for Council officers involved in the assessment of those applications.

All Development Applications (excluding development applications proposing agricultural activities)in the Port Stephens LGA must demonstrate that they are consistent with the above objectives. All subdivisions must demonstrate that their design is consistent with the above objectives.

The performance criteria contained in this appendix require an understanding of koala habitat types within the Port Stephens LGA. The distribution of the following habitat categories are shown on the CKPoM map entitled “Koala Habitat Planning Map”. Hard copies of this map are available from the offices of Port Stephens Council, free of charge.

The performance criteria listed below apply to the following categories of koala habitat:

Preferred Koala Habitat was identified by Lunney *et al*. (1998) as the most important category of koala habitat in the Port Stephens LGA and hence should be afforded the highest level of protection.

Supplementary Koala Habitat is also important to the long term conservation of koalas in Port Stephens (Lunney *et al*. 1998) and thus also requires protection, albeit with less restrictions on development than Preferred Koala Habitat.

Habitat Buffers (as determined by the ecological criteria contained in Appendix 9) can contribute to the long-term survival of Preferred Koala Habitat by ensuring incompatible development or land use does not occur on land immediately adjacent to Preferred Koala Habitat. Habitat Buffers may also afford protection to Preferred Koala Habitat by minimising the detrimental impact of "edge effects" such as nutrient impacts, wind damage and weed invasion. Habitat Buffers also provide for the likely extension of significant koala activity beyond Preferred Koala Habitat. Even Habitat Buffers that extend over Mainly Cleared Land and which contain only scattered trees can perform this latter function. Hence, all Habitat Buffers should also be afforded the highest level of protection and considered for possible restoration where appropriate.

Habitat Linking Areas may provide opportunities for the successful movement of koalas between breeding populations or into areas of vacant habitat. They may also provide for the establishment of koala home range areas, depending upon their size and the quality of habitat they contain. Habitat Linking Areas which overlap with Mainly Cleared Land may still perform such functions. Development may be permitted in Habitat Linking Areas provided it does not compromise the safe use of such areas by koalas. Habitat Linking Areas are to be subject to the same criteria as Supplementary Koala Habitat.

Performance criteria

The following criteria (a-h) apply to all developments (excluding development applications proposing agricultural activities) proposed on sites that contain or are adjacent to Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas. For the purposes of these criteria, native vegetation is defined as any of the following types of indigenous vegetation: trees (including saplings and shrubs), understorey plants, groundcover or plants occurring in a wetland (as per sections 4 and 6 of the *Native Vegetation Conservation Act 1997*).

Council may waive the provisions of a), b) and c) of these criteria **only** for the purposes of establishing a building envelope and associated works, and **only if** the proponent can demonstrate:

1. That the building envelope and associated works including fire fuel reduction zones **cannot** be located in such a way that would avoid the removal of native vegetation within Preferred or Supplementary Koala Habitat, Habitat Buffers, or Habitat Linking Areas, or removal of preferred koala food trees;

2. That the location of the building envelope and associated works **minimises** the need to remove vegetation as per 1 above;

3. That, in the case of subdivisions, they are designed in such a way as to retain and enhance koala habitat on the site and are consistent with the objectives of this appendix; and

4. That koala survey methods (as per the Guidelines for Koala Habitat Assessment in Appendix 6) have been used to determine the most appropriate location for the building envelope and associated works (so as to minimise the impact on koala habitat and any koala populations that might occur on the site).

The Performance Criteria are as follows:

Proposed development (other than agricultural activities) **must:**

a) Minimise the removal or degradation of native vegetation within Preferred Koala Habitat or Habitat Buffers;

b) Maximise retention and minimise degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas;

c) Minimise the removal of any individuals of preferred koala food trees, where ever they occur on a development site. In the Port Stephens LGA these tree species are Swamp Mahogany (*Eucalyptus robusta*), Parramatta Red Gum (*Eucalyptus parramattensis*), and Forest Red Gum (*Eucalyptus tereticornis*), and hybrids of any of these species. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8

d) Make provision, where appropriate, for restoration or rehabilitation of areas identified as Koala Habitat including Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land. In instances where Council approves the removal of koala habitat (in accordance with dot points 1-4 of the above waive clause), and where circumstances permit, this is to include measures which result in a “net gain” of koala habitat on the site and/or adjacent land;

e) Make provision for long term management and protection of koala habitat including both existing and restored habitat;

f) Not compromise the potential for safe movement of koalas across the site. This should include maximising tree retention generally and minimising the likelihood that the proposal would result in the creation of barriers to koala movement, such as would be imposed by certain types of fencing. The preferred option for minimising restrictions to safe koala movement is that there be no fencing (of a sort that would preclude koalas) associated with dog free developments within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas. Suitable fencing for such areas could include:

   i) fences where the bottom of the fence is a minimum of 200 mm above ground level that would allow koalas to move underneath;

ii) fences that facilitate easy climbing by koalas; for example, sturdy chain mesh fences, or solid style fences with timber posts on both sides at regular intervals of approximately 20m; or

iii) open post and rail or post and wire (definitely not barbed wire on the bottom strand).

However, where the keeping of domestic dogs has been permitted within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, fencing of a type that would be required to contain dogs (and which may also preclude koalas) should be restricted to the designated building envelope. Fences which are intended to preclude koalas should be located away from any trees which now or in the future could allow koalas to cross the fence.

g) Be restricted to identified envelopes which contain all buildings and infrastructure and fire fuel reduction zone. Generally there will be no clearing on the site outside these envelopes. In the case of applications for subdivision, such envelopes should be registered as a restriction on the title, pursuant to the Conveyancing Act 1919; and

h) Include measures to effectively minimise the threat posed to koalas by dogs, motor vehicles and swimming pools by adopting the following minimum standards.

i) The development must include measures that effectively abate the threat posed to koalas by dogs through prohibitions or restrictions on dog ownership. Restrictions on title may be appropriate.

ii) The development must include measures that effectively minimise the threat posed to koalas from traffic by restricting motor vehicle speeds, where appropriate, to 40 kph or less.

iii) The development must reduce the risk of koala mortality by drowning in backyard swimming pools. Appropriate measures could include: trailing a length of stout rope (minimum diameter of 50mm), which is secured to a stable poolside fixture, in the swimming pool at all times; designing the pool in such a way that koalas can readily escape; or enclosing the pool with a fence that precludes koalas. This last option should include locating the fence away from any trees which koalas could use to cross the fence.

Information to Accompany Applications.

The following information must be submitted with applications for all development (excluding development applications proposing agricultural activities) on **sites that contain** Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas.

1. An assessment of koala habitat, by a suitably qualified person, in accordance with the attached Guidelines for Koala Habitat Assessment, which appear in Appendix 6.

2. Clear details concerning which vegetation is to be cleared or disturbed and that which is to be retained.

3. Details of any proposed building envelopes and fire fuel reduction zones and the means by which they are to be enforced.

4. Proposed measures to restore or rehabilitate koala habitat, including measures which will result in the net gain of koala habitat.

5. Proposed measures to allow the safe movement of koalas across the site including road designs and speed mediation measures, fence construction details where fencing is proposed, and swimming pool specifications.

6. Proposed measures to mitigate the impacts on koalas by dogs.

7. Details of any proposed program to monitor koalas and koala habitat, during and following development activity on a site. Monitoring programs would not be required for single lot developments. Rather, they would be expected for subdivisions.

The following information must be submitted with applications for development on **sites that are adjacent to** Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas.

8. Proposed measures to mitigate the impacts by dogs on koalas which occupy adjacent habitat. This must include measures (such as education of dog owners, appropriate signs, or restrictions on dog ownership) that reduce the likelihood of domestic dogs straying into koala habitat.

9. Proposed measures to mitigate the impact on koalas of motor vehicles travelling to the site. This must include appropriate traffic control measures on roads which run through or adjacent to nearby koala habitat and which are subject to increased traffic volumes due to the development on the site.

Appendix 5

Performance Criteria for Development Applications proposing agricultural activities.

Regulation of agricultural activities (as defined in the Glossary of Terms) via the assessment of development applications where these are required in accordance with the Port Stephens Council LEP, represents an important means by which koala habitat can be protected and effectively managed. Under certain circumstances (eg. particular land use zones including 1(a), 1(c1), 1(c2), 1(c2), 1(c4), 1(c5), 1(d), 1(g)) the Port Stephens LEP does not require a Development Application to be lodged for agricultural activities. However if clearing is required to undertake the agricultural activity in these zones, development consent is required from Council, and where the extent of clearing proposed exceeds 2 hectares in area, consent is also required from the Department of Land & Water Conservation.

In instances where a DA is required to undertake an agricultural activity (eg. where clearing is proposed), it will be required to comply with the provisions of this appendix of the Port Stephens Council CKPoM to comply with State Environmental Planning Policy No. 44 – Koala Habitat Protection. This requirement is activated by the proposed amending clause of the Port Stephens LEP (Appendix 3).

The general aims and objectives of these performance criteria are as follows:

1. To ensure that the koala population in the Port Stephens LGA is sustainable over the long-term.

2. To protect koala habitat areas from any agricultural activities requiring a DA which would compromise habitat quality or integrity.

3. To ensure that any agricultural activity requiring a DA proposed within or adjacent to koala habitat areas occurs in an environmentally sensitive manner.

4. To ensure that acceptable levels of investigation are undertaken, considered and accepted prior to any agricultural activity requiring a DA in or adjacent to koala habitat areas.

5. To encourage koala habitat rehabilitation and restoration.

6. Maintain interconnection between areas of Preferred and Supplementary Koala Habitat and minimise threats to safe koala movements between such areas.

7. To ensure that agricultural activities requiring a DA do not further fragment habitat areas either through the removal of habitat or habitat links or through the imposition of significant threats to koalas.

8. To provide guidelines and standards to minimise impacts on koalas during and after agricultural activities which require a DA.

9. To provide readily understandable advice to proponents preparing development applications for agricultural activities that require a DA and for Council officers involved in the assessment of those applications.

All Development Applications proposing agricultural activities in the Port Stephens LGA must demonstrate that they are consistent with the above objectives, and conform to the requirements of section 79c of the *Environmental Planning and Assessment Act 1979*..

The performance criteria contained in this appendix require an understanding of koala habitat types within the Port Stephens LGA. The distribution of the following habitat categories are shown on the CKPoM map entitled "Koala Habitat Planning Map". Hard copies of this map are available from the offices of Port Stephens Council, free of charge.

The performance criteria for Development Applications proposing agricultural activities apply to the following categories of koala habitat:

Preferred Koala Habitat was identified by Lunney *et al*. (1998) as the most important category of koala habitat in the Port Stephens LGA and hence should be afforded the highest level of protection.

Supplementary Koala Habitat is also important to the long term conservation of koalas in Port Stephens (Lunney *et al*. 1998) and thus also requires protection, albeit with less restrictions on development than Preferred Koala Habitat.

Habitat Buffers (as determined by the ecological criteria contained in Appendix 9) can contribute to the long-term survival of Preferred Koala Habitat by ensuring incompatible development or land use does not occur on land immediately adjacent to Preferred Koala Habitat. Habitat Buffers may also afford protection to Preferred Koala Habitat by minimising the detrimental impact of "edge effects" such as nutrient impacts, wind damage and weed invasion. Habitat Buffers also provide for the likely extension of significant koala activity beyond Preferred Koala Habitat. Even Habitat Buffers that extend over Mainly Cleared Land and which contain only scattered trees can perform this latter function. Hence, all Habitat Buffers should also be afforded the highest level of protection and considered for possible restoration where appropriate.

Habitat Linking Areas may provide opportunities for the successful movement of koalas between breeding populations or into areas of vacant habitat. They may also provide for the establishment of koala home range areas, depending upon their size and the quality of habitat they contain. Habitat Linking Areas which overlap with Mainly Cleared Land may still perform such functions. Development may be permitted in Habitat Linking Areas provided it does not compromise the safe use of such areas by koalas. Habitat Linking Areas are to be subject to the same criteria as Supplementary Koala Habitat.

Performance Criteria for Development Applications Proposing Agricultural Activities

The following criteria (a – f) apply to all Development Applications proposing agricultural activities proposed on sites that contain or are adjacent to Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas. For the purposes of these criteria, native vegetation is defined as any of the following types of indigenous vegetation: trees (including saplings and shrubs), understorey plants, groundcover or plants occurring in a wetland (as per sections 4 and 6 of the *Native Vegetation Conservation Act 1997*).

Council may waive the provisions of a), b) and c) below of the performance criteria for Development Applications proposing agricultural activities **only if** the proponent can demonstrate:

1. That the agricultural activity **cannot** be located or undertaken in such a way that would avoid the removal of native vegetation within Preferred or Supplementary Koala Habitat, Habitat Buffers, or Habitat Linking Areas, or removal of preferred koala food trees;

2. That the location of the agricultural activity **minimises** the need to remove vegetation as per 1 above;

3. That koala survey methods (as per the Guidelines for Koala Habitat Assessment in Appendix 6) have been used to determine the most appropriate location for the agricultural activity (so as to minimise the impact on koala habitat and any koala populations that might occur as a result of the activity).

The performance criteria for Development Applications Proposing Agricultural Activities are as follows:

Proposed agricultural activities must:

a) Minimise the removal or degradation of native vegetation within Preferred Koala Habitat or Habitat Buffers;

b) Maximise retention and minimise degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas;

c) Minimise the removal of any individuals of preferred koala food trees, where ever they occur the site. In the Port Stephens LGA these tree species are Swamp Mahogany (Eucalyptus robusta), Parramatta Red Gum (Eucalyptus parramattensis), and Forest Red Gum (Eucalyptus tereticornis), and hybrids of any of these species. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8;

d) Make provision, where appropriate, for restoration or rehabilitation of areas identified as Koala Habitat including Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land. In instances where Council approves the removal of koala habitat (in accordance with dot points 1-3 of the waive clause for Development Applications Proposing Agricultural Activities), and where circumstances permit, this is to include measures which result in a “net gain” of koala habitat on the site and/or adjacent land;

e) Make provision for long term management and protection of koala habitat including both existing and restored habitat;

f) Not compromise the potential for safe movement of koalas across the site. This should include maximising tree retention generally and minimising the likelihood that the proposal would result in the creation of barriers to koala movement, such as would be imposed by certain types of fencing. Suitable fencing for agricultural activities could include:

- open post and rail or post and wire. If a barbed wire fence is required to contain livestock there should not be barbed wire

on the bottom strand, it must be be plain wire and be a minimum of 200mm above the ground.

Information to Accompany Development Applications Proposing Agricultural Activities

The following information must be submitted with all Development Applications proposing agricultural activities on **sites that contain** Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas.

1. An assessment of koala habitat, by a suitably qualified person, in accordance with the attached Guidelines for Koala Habitat Assessment, which appear in Appendix 6.

2. Clear details concerning which vegetation is to be cleared or disturbed and that which is to be retained.

3. Proposed measures to restore or rehabilitate koala habitat, including measures which will result in the net gain of koala habitat.

4. Proposed measures to allow the safe movement of koalas across the site including fence construction details where fencing is proposed.

5. Proposed measures to mitigate the impacts on koalas by dogs. This must include measures that reduce the likelihood of farm dogs straying into koala habitat.

The following information must be submitted with Development Applications proposing agricultural activities on **sites that are adjacent to** Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas.

1. Proposed measures to mitigate the impacts by dogs on koalas which occupy adjacent habitat. This must include measures that reduce the likelihood of farm dogs straying into koala habitat.

Appendix 6

Guidelines for Koala Habitat Assessments

The Guidelines for Koala Habitat Assessments in the Port Stephens LGA serve the following functions:

- provide the information necessary to support a rezoning proposal under Part 3 of the EP&A Act; and

- provide the information necessary to support a development application being considered under Part 4 of the EP&A Act.

As regards the latter, application of these guidelines will also substantially contribute to consideration of the impact of a proposed development on koalas or their habitat as required under s.5A of the EP&A Act.

The Guidelines for Koala Habitat Assessments **must** be carried out by a person or persons with qualifications and experience in tree species identification and, in the case of assessments of koala habitat utilisation at Step 4, qualifications and experience in biological science and fauna survey and management. This should also include experience in conducting koala surveys. It is necessary that a brief curriculum vitae of each person involved with assessments conducted using these guidelines be appended to the survey report.

Koala Habitat Assessment in the Port Stephens LGA should include the following steps as the minimum acceptable approach (see Figure 9 for a summary flow chart):

1. Preliminary Assessment;

2. Vegetation Mapping;

3. Koala Habitat Identification; and

4. Assessment of the proposal.

Figure 4. Flow chart that summarises the procedure to be undertaken when conducting Koala Habitat Assessments in the Port Stephens LGA. See text for a more detailed explanation. The following abbreviations are included in the flow chart: KHPM=Koala Habitat Planning Map; PKH=Preferred Koala Habitat; SKH=Supplementary Koala Habitat; LGA=Local Government Area; DA=Development Application.

1. **Preliminary assessment**. The preliminary assessment must include the following:

    i) Reference to the Koala Habitat Planning Map for the Port Stephens LGA* (or excerpts thereof) to make a preliminary assessment of the koala habitat on the site of the proposed development (hereafter referred to as the site) and to consider the koala habitat of the site in the broader local (and regional) context; and

    ii) An inspection of the site to determine whether the site contains individuals of preferred koala food trees outside areas mapped as Preferred Koala Habitat.

    (*Note: Data licensing agreements will be established to allow consultants to purchase relevant sections of the Koala Habitat Planning Map and the underlying Vegetation Map for such purposes. The former is jointly owned by the NSW National Parks and Wildlife Service and the Australian Koala Foundation, while the Vegetation Mapping is owned by the Australian Koala Foundation. Given that consultants will be requested to provide their site specific vegetation mapping to update and refine the LGA-wide Vegetation Map and Koala Habitat Planning Map, a credit system will be established whereby a consultant would receive credit for contributing to the refinement of the LGA-wide maps.)

From this it should be determined if the site contains Preferred or Supplementary Koala Habitat, any Habitat Buffers, or Habitat Linking Areas (other than those that overlap with Mainly Cleared Land) according to the LGA-wide Koala Habitat Planning Map and/or if it contains preferred koala food trees. If the site contains any of the above, it will be necessary to proceed to Step 2 Vegetation Mapping.

If the site contains Habitat Linking Areas over Mainly Cleared Land according to the LGA-wide Koala Habitat Planning Map and has an area of more than 1ha, or has, together with any adjoining land in the same ownership, an area of more than 1ha, then it will be necessary to proceed to Step 4 Assessment of the Proposal.

If the site does not contain Habitat Linking Areas over Mainly Cleared Land according to the Koala Habitat Planning Map, or it does contain such Habitat Linking Areas but is less than 1 hectare in size, then no further koala habitat assessment is required and consent for the proposed development (or rezoning) should not be withheld on koala habitat grounds.

A minimum area of 1ha is used to specify whether these guidelines apply to land designated Habitat Linking Area over Mainly Cleared Land to preclude the need for Koala Habitat Assessments on small lots that have been developed previously. Substantial areas in the Port Stephens LGA are currently zoned Residential, have already been built on and overlap with Habitat Linking Areas over Mainly Cleared Land. While koalas are capable of travelling considerable distances between trees and could potentially use Habitat Linking Areas over Mainly Cleared Land to move between patches of Preferred Koala Habitat, it would not be practical to require landowners to undertake a Koala Habitat Assessment to accompany DAs that apply to small lots that have already been developed. Furthermore, while Habitat Linking Areas over Mainly Cleared Land

represent an important opportunity for koala habitat restoration projects, these are likely to be most effective when carried out over larger areas.

2. **Vegetation mapping**. The vegetation of the site should be mapped at the largest scale appropriate, and presented in accompanying reports at A3 size. It is recommended that aerial photography (depending upon scale) complemented by detailed ground-truthing be used as a basis for such mapping. Ground-truthing must include verification of vegetation association boundaries, and systematic sampling of the floristic and structural characteristics (e.g. using methods specified by Walker and Hopkins (1990)) within each vegetation association using standard procedures such as quadrat-based or transect-based survey. The vegetation map must accurately:

    i. Show the distribution of vegetation associations (defined on the basis of the floristic composition of the tallest stratum along with structural data, as per Walker and Hopkins 1990); e.g. Open Swamp Mahogany - Broad-Leaved Paperbark Forest), for the site plus a 100m area around the site; and

    ii. Show the location of all individuals of preferred koala food tree species; *Eucalyptus robusta*, *E. parramattensis* and *E. tereticornis**, and hybrids of any of these species where ever they occur on the site, outside vegetation associations classified as Preferred Koala Habitat.

    (*Note: the field survey (Koala Habitat Atlas) identified E. tereticornis as a preferred koala food tree species within the Port Stephens LGA, where it occurs on higher nutrient soils (such as volcanic or alluvial based soils). However, for the purposes of development assessment within the LGA it was resolved that it would be unrealistic to expect the importance of E. tereticornis to be accurately differentiated for a given area on the basis of substrate. Even where accurate soil mapping is available for a site, disregard of this species due to a lesser significance to koalas on lower nutrient substrates would fail to acknowledge the potential occurrence of localised higher nutrient areas within broader soil landscapes).

The boundaries of vegetation associations and the location of preferred koala food trees (where they occur outside of identified preferred koala habitat) are to be accurately surveyed (such as a stadia survey in the case of individual preferred koala food tree species where they occur outside of Preferred Koala Habitat), or mapped through the use of differential GPS, in accordance with points i. and ii. above.

Once a site-specific Vegetation Map has been prepared in accordance with the above standards it should be compared to the LGA-wide Vegetation Map. If the site-specific Vegetation Map is consistent with the LGA-wide Vegetation Map (particularly as regards the mapping of vegetation associations that comprise Preferred or Supplementary Koala Habitat) then the LGA-wide Koala Habitat Planning Map and the site-specific map of preferred koala food trees will apply for the assessment of the proposal (see Step 3b Koala Habitat Identification). If there are inconsistencies between the site-specific and LGA-wide Vegetation Maps it will be necessary to undertake the procedure for Koala Habitat Identification outlined at Step 3a (i.e. production of a site-specific Koala Habitat Planning Map).

Because the LGA-wide Vegetation Map was prepared from 1: 25 000 scale aerial photographs, there will likely be limitations regarding its accuracy for the purposes of development assessment for a given site. Thus, it is likely that there will be a need to refine vegetation association boundaries when mapped at a larger scale. In instances where the LGA-wide Vegetation Map has accurately identified the vegetation associations, but where there are inaccuracies regarding the location of vegetation association boundaries, it will be appropriate to proceed to Step 3b, provided any such inaccuracies are corrected. This must include surveying or mapping (using differential GPS) of these boundaries as specified above.

Council staff would also ask that consultants notify them of any suspected instances off site where the LGA-wide Vegetation Map appears to be inaccurate (particularly where this could influence the location of Habitat Buffers and/or Habitat Linking Areas across a site), and to assess koala habitat on the site accordingly.

3. Koala Habitat Identification

3a) This step should be applied in instances where the LGA-wide Vegetation Map does not accurately describe the nature of the vegetation on the site. This will require the following:

i. Application of the definitions of Preferred and Supplementary Koala Habitat detailed by Lunney et al. (1998)* to the vegetation map to show the distribution of these habitat categories across the site and adjacent areas, where revisions were necessary;

ii. Application of Habitat Buffers to all Preferred Koala Habitat. Habitat Buffers should be differentiated on the basis of the respective habitat category with which they overlap (e.g. Habitat Buffer over Supplementary Koala Habitat or Habitat Buffer over Mainly Cleared Land); and

iii. Approximation of Habitat Linking Areas between all patches of Preferred Koala Habitat that occur within 800m of each other, where revision of the Koala Habitat Planning Map has been necessary. Habitat Linking Areas should also be differentiated on the basis of the habitat category with which they overlap (as per Habitat Buffers). Habitat Linking Areas could be identified using GIS software where this is available. Alternately, site inspections and survey work (to identify areas that are either in use by koalas or that are considered to have the potential to be effectively used by koalas) could be applied to identify suitable Habitat Linking Areas.

After a site-specific Koala Habitat Planning Map has been produced, proceed to Step 3b.

*Note with regard to applying the habitat categories to specific sites:

There are a number of considerations relating to application of the habitat categories detailed by Lunney et al. (1998) to any sites which may have been incorrectly typed by the LGA-wide vegetation survey. In particular, conditions will apply when reassigning any remapped vegetation association to a

different habitat category on the basis of the rankings derived from the community-based survey results alone. The reasons for this are outlined below.

Vegetation associations were identified and ranked in terms of koala habitat from the community-based koala survey by correlating the location of koala records with the LGA-wide vegetation map to determine the overall density of koala records (koala records per hectare) for each vegetation association. This means that the koala habitat rankings for vegetation associations as derived from the community-based survey results are dependent upon the total area for each association as depicted on the original vegetation map. Therefore, in the case of instances where the LGA-wide vegetation map may require substantial revision, habitat categories should be reassigned on the basis of the field survey (KHA) categories in the first instance and Council should be contacted for further advice concerning the application of categories derived exclusively from the community-based survey results (e.g. that the application of habitat categories derived exclusively from the community-based survey results only be permitted when consistent with the original Koala Habitat Planning Map).

The field survey results, as regards the identification of preferred koala food trees, are independent of the LGA-wide vegetation map and can subsequently be reapplied to any corrected vegetation mapping.

3b) This step should be applied after completing Step 3a or in instances where the LGA-wide Vegetation Map accurately describes the vegetation of the site (and where any inaccuracies regarding the location of vegetation association boundaries have been corrected). A site-specific map showing the location of individuals of preferred koala food trees, where ever they occur outside Preferred Koala Habitat, is also required at this step. If the relevant Koala Habitat Planning Map indicates that there is either Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas on the site, and/or the site-specific map indicates that the site contains preferred koala food trees, proceed to Step 4 Assessment of Proposal. If none of the above occur on the site consent should not be withheld on koala habitat grounds.

4. Assessment of Proposal

The final step involves using the information produced from Steps 1 to 3 to assess the appropriateness of the proposal. This must involve reference to the Performance Criteria for rezoning proposals and development applications contained in the Port Stephens Council CKPoM. This must also include a map showing the key elements of the proposal overlain on the Koala Habitat Planning Map, as revised if necessary. The assessment must also address the impacts of potential future development of the site in the broader context of a catchment area with an outer limit of 1km beyond the site boundary, with particular reference to any areas of Preferred or Supplementary Koala Habitat or Habitat Linking Areas as shown on the Koala Habitat Planning Map.

Rezoning requests must meet the performance criteria specified in Appendix 2 of the CKPoM. Development applications must meet the performance criteria specified in Appendices 4 & 5 of the CKPoM. If an applicant requests that Council waive provisions a), b) and c) of either Appendix 4 or Appendix 5 (and this is given approval), then the following additional survey work is required to identify the most suitable location for building envelopes and associated works.

An assessment of koala habitat utilisation on the site must be undertaken by a suitably qualified person with experience in koala surveys. A standard, reportable survey technique that allows habitat utilisation by koalas to be quantified, such as the AKF's faecal pellet-based Spot Assessment Technique (Phillips and Callaghan 1995; see Appendix 8 of the CKPoM Resource Document), must be employed to identify the extent of significant koala activity levels across the site. When using the Spot Assessment Technique, the minimum density of spot assessment plots should be 1 plot per 1000m^2 of land that contains native trees within the areas where building envelopes and associated works could potentially be located.

Wherever possible, development (building envelopes and associated works) within areas which return significant koala activity levels (30% or greater (Phillips and Callaghan 1995)) should be avoided. Where this is not possible, development should be located in areas which return the lowest koala activity levels.

Appendix 7

Principles for the effective design and construction of koala underpasses and overpasses

The impact of collisions between koalas and motor vehicles on koala populations is well documented (see Chapter 8 Traffic Management of the CKPoM Resource Document), and represents a significant threat to koalas in the Port Stephens LGA and elsewhere. Two possible measures that could ameliorate this impact, by allowing koalas to potentially safely traverse a road, are underpasses and overpasses. Underpasses are structures built under a road to facilitate the movement of fauna between habitat on either side. Overpasses aim to fulfil the same function by providing the means for fauna to move safely above the road. Both underpasses and overpasses are likely to be most effective when used in conjunction with exclusion fencing, which aims to prevent fauna from crossing the roadway itself. This appendix provides basic principles recommended for the design and construction of koala underpasses and overpasses. It should be pointed out that while the use of koala and other fauna underpasses is currently being trialed in several locations in NSW, there are few examples of koala overpasses being employed.

Road alignment

The best way to minimise likely collisions between koalas and motor vehicles is to ensure new road alignments do not further fragment koala habitat, especially Preferred Koala Habitat, nor existing koala populations. Obviously, this measure can only be applied to proposed new roads or to road realignments. Future road proposals should take into account relevant information regarding the location of koala habitat by referring to the Koala Habitat Planning Map (Figure 1) and by applying the Guidelines for Koala Habitat Assessments (Appendix 6), information regarding existing koala populations, existing koala records and by conducting relevant field surveys.

Principle: *The design of future roads and road realignments should take into account information regarding the location of koala habitat and koala populations and should not further fragment koala habitat, particularly Preferred Koala Habitat, nor existing koala populations.*

Potential provision of Underpasses or Overpasses

If a proposed road cannot be located in such a way that it will not fragment koala habitat or existing koala populations (or in the case of proposed upgrading or realignment of an existing roadway), it will be necessary to investigate the potential application of measures such as underpasses or overpasses. Due to the costs associated with such measures, their potential application will need to be assessed on the basis of the features of the surrounding habitat and the local koala population and other fauna species, as well as the nature of the roadway in terms of traffic speeds and volume (both at the present time and in the future). It is important to realise that the location of underpasses and overpasses, as well as size and other design features, is likely to significantly influence their effectiveness.

A variety of methods could be employed to firstly assess the need and, secondly, to determine the most appropriate locations for underpass or overpass structures. These include:

- A radio-tracking program of resident koalas in the vicinity of the road works. Such a study should ascertain whether the home ranges of any

koalas overlap with the proposed road and, if so, where regular crossings are likely to occur;

- Faecal pellet-based field surveys, which could be used to survey for the presence of a resident koala population and to investigate patterns of habitat utilisation by koalas in the vicinity of the proposed road works;
- Information on the distribution of koala habitat in the vicinity of the proposed road works. For instance, the presence of Preferred Koala Habitat or preferred koala food trees may indicate areas where koalas are most likely to cross the path of a proposed road; and
- Review records of koala and other fauna road fatalities or injuries that may have been maintained for the general area by local koala welfare organisations or the National Parks and Wildlife Service.

Another matter that would need to be taken into account when determining the appropriate location for underpasses or overpasses is the principal objectives for providing the structures. The first two dot points above would provide information on the best location to facilitate the continued use of existing home range areas occupied by members of the local koala population, but may not effectively contribute to facilitating dispersal of sub-adult koalas, with subsequent long term exchange of genetic material between breeding groups that may occupy habitat over some distance on either side of the proposed road. The last two dot points may help locate structures so as to best provide for potential use by dispersing sub-adult koalas.

Basic design criteria for underpasses and overpasses

Where the need and suitability for koala road crossing measures has been established, a number of design features will need to be considered in order to increase the likelihood of effective use by koalas and other fauna, and to take into account the case-by-case features of the particular area and roadway. When considering the best design for underpasses and overpasses it is necessary to also address the design, impact and maintenance of associated exclusion fencing.

Design of underpasses

The following principles should be employed when designing underpasses:

- Design underpasses to be as large as possible. In their study of three fauna underpasses on the F3 freeway, AMBS (1997) found that the larger the underpass, the greater range of species tended to use it. In a radio-tracking and monitoring study in the Tweed Shire, Callaghan and Phillips (1998) recorded that a 3m x 3m box culvert was most used by koalas as well as a range of other local fauna species, while a 2.1m x 1.5m underpass received less use, and a nearby 0.9m x 0.6m culvert was never used by koalas and was only used on a few occasions by small mammals as well as a cat and a dog;
- Design underpasses to be of a size which allows the skyline, or at least adjoining habitat, to be seen from either end (AMBS 1997);
- Design an underpass so that dry passage is provided for animals, for example, by raising one cell of a multi-cell culvert (AMBS 1997);
- If underpasses are longer than a standard two-lane carriage-way, incorporate structures which may allow koalas to escape from predators, such as wooden posts with a top rail;
- A wooden post should ideally be positioned near the underpass entrances to allow koalas to escape above ground if chased by dogs. Such structures should have a cross member near the top to allow a koala to sit comfortably; and
- Additional planting of preferred koala food trees near to the entrances may improve the chances that they will be effectively located by koalas.

Design of overpasses

Overpass structures could be provided to link either side of embankments where the roadway passes through a cutting, with banks on both sides of the roadway. Such structures would need to be of sturdy construction and should be as wide as possible in order to increase the likelihood of effective use by koalas and other fauna species. Such structures might be combined with pedestrian access across roadways in some cases.

The last three dot points for koala underpasses also apply to design criteria for fauna overpasses.

Design of exclusion fencing

Exclusion fencing is a crucial component of a fauna underpass or overpass, as it is required to prevent koalas from crossing the roadway itself and to direct koalas towards any underpass or overpass structures provided. For either an underpass or an overpass to function effectively, the exclusion fencing must be well-designed and maintained. Basic design criteria for exclusion fencing include:

- Exclusion fencing must be well-constructed. In particular, it should be designed in such a way as to direct koalas towards the underpass structures and it should not be constructed immediately adjacent to any trees which could allow a koala to climb and jump over the fencing. Tree guards, comprised of sheet metal wrapped loosely around the tree trunk, can be used for established trees, rather than removing them if the fence cannot be aligned away from them;
- Suitable designs are available from work conducted in conjunction with a number of other studies for sections of the Pacific Highway in northern NSW; and
- Exclusion fencing must be regularly inspected and effectively maintained as part of an established road maintenance program.

Making use of other structures

Other structures such as bridges or underpass structures provided to cater for very low traffic volumes and low speeds, may also function to varying degrees as fauna underpasses. For this to occur:

- Such structures should be set back from the waterbody or vehicle access to allow additional space for koalas and other fauna to cross;
- If designed to cater for traffic flow, traffic speeds must be very low and the approaches should ideally be well lighted; and
- These areas should also be planted out with koala food trees where possible.

Potential long-term impacts on koalas and other fauna

A number of additional factors need to be carefully addressed when giving consideration to the potential provision of fauna underpasses, overpasses and associated exclusion fencing. These factors include the potential long-term effects on koalas and other fauna species should the structures fail to function effectively at a population level. In such circumstances the exclusion fencing may well have a detrimental long-term effect on fauna populations by providing a further barrier to dispersal. It may be appropriate to leave a plain wire mesh section at the base of the exclusion fencing in order to allow smaller fauna, that are perhaps less likely to

successfully use fauna underpasses, to pass through the fencing and potentially cross the roadway.

It seems reasonable to suggest that aside from the more obvious impacts of fauna injuries and fatalities, roads carrying high traffic speeds and volumes (in particular) could essentially act as barriers to fauna dispersion in their own right. A common sense approach and careful consideration will be necessary when determining when and where to provide fauna underpasses, overpasses and exclusion fencing.

Research and monitoring

With some exceptions, for instance, the radio-tracking of koalas by Ishta Consultants to assess the impacts of the Raymond Terrace bypass and a radio-tracking and monitoring study by the Australian Koala Foundation to monitor a road realignment in the Tweed Shire in northern NSW, there has been relatively little research undertaken to establish the efficacy of koala underpasses and even less research to assess the effectiveness of koala overpasses. The Roads and Traffic Authority of NSW recently commissioned a long term study to assess the efficacy of a range of measures aimed at ameliorating the impact of the Pacific Highway realignment at several locations on the North Coast of NSW, but the results of this study will not be available for some time.

Because of this lack of information, it is crucial that underpasses and overpasses be adequately monitored to gauge their effectiveness and to permit future design modification where warranted. Monitoring programs may include: radio-tracking studies, use of videos and sand-traps within underpasses, follow-up faecal pellet-based surveys, koala counts, community-based surveys, regular searches of the roadway and road verges for road kills and liaison with the local koala welfare groups. An appropriate monitoring program would need to be designed on the basis of the nature of the road and traffic, available funds and resources and the overall objectives for the study. Monitoring programs should preferably be long term in order to establish the likely effectiveness of such measures over time at a population level.

As further information is made available from current and future research and monitoring programs, the above design principles should be amended accordingly.

References

AMBS (1997) Fauna usage of three underpasses beneath the F3 Freeway between Sydney and Newcastle. Report prepared by Australian Museum Business Services for the Roads and Traffic Authority.

Callaghan, J. and Phillips, S. (1998) Monitoring of impacts on koalas associated with the upgrading and part realignment of Old Bogangar Road. 2nd Report prepared by the Australian Koala Foundation for Tweed Shire Council.

Appendix 8

Tree species that may be important to koalas in the Port Stephens Local Government Area as identified by anecdotal evidence (source: Callaghan et al, 1994)

Grey Gum (*Eucalyptus punctata*)

Scribbly Gum (*Eucalyptus haemastoma* or *E. signata*)

Brown Stringybark (*Eucalyptus capitellata*)

White Mahogany (*Eucalyptus acmenioides*)

Red Mahogany (*Eucalypyus resinifera*)

Tallowood (*Eucalyptus microcorys*)

Sydney Blue Gum (*Eucalyptus saligna*)

Sydney Peppermint (*Eucalyptus piperita*)

Blackbutt (*Eucalyptus pilularis*)

Spotted Gum (*Eucalyptus maculata*)

Grey Ironbark (*Eucalyptus paniculata*)

Narrow-leaved Red Ironbark (*Eucalyptus crebra*)

Broad – leaved White Mahogany (*Eucalyptus umbra*)

Flooded Gum (*Eucalyptus grandis*)

Small – leaved Peppermint (*Eucalyptus nicholii*)

Red Bloodwood (*Eucalyptus gumnifera*)

Smooth Barked Apple (*Angophora costata*)

Broad – leafed Paperbark (*Melaleuca quinquinerva*)

Swamp She-oak (*Casuarina glauca*)

Appendix 9

Ecological Criteria for the establishment of Habitat Buffers for Preferred Koala Habitat

At its meeting on 1st June 2000, the CKPoM Consultative Committee recommended that the width of Habitat Buffers should be determined on a case-by-case basis, rather than 100m Habitat Buffers being applied to all Preferred Koala Habitat throughout the Port Stephens LGA. The CKPoM Consultative Committee also determined that ecological criteria should be developed to guide the specification of Habitat Buffer width. This appendix explains the purpose of Habitat Buffers, discusses issues relevant to their application and specifies the ecological criteria that must be used to determine the width of Habitat Buffers on a case-by-case basis.

The Aim of Habitat Buffers

The Habitat Buffers proposed for all Preferred Koala Habitat seek to fulfil two main objectives:

1. To protect Preferred Koala Habitat from the detrimental impact of "edge effects"; and
2. To provide for the likely extension of significant koala activity beyond Preferred Koala Habitat.

Issues relevant to each of these objectives are discussed below.

Edge Effects

What are edge effects?

Widespread clearing of native vegetation, as has occurred in the Port Stephens Local Government Area (LGA) for agricultural and urban development (Knott *et al*. 1998), causes fragmentation of the landscape, which leaves a series of patches of remnant vegetation surrounded by an environment of different vegetation and/or land use (Saunders *et al*. 1991). This surrounding environment imposes a range of different physical, microclimatic and biological conditions on these patches of remnant vegetation (Saunders *et al*. 1991; Murcia 1995). Because these altered conditions are often most apparent at the abrupt transition between the remnant vegetation and the surrounding environment (the edge), they have become known as "edge effects" (Murcia 1995).

Murcia (1995) identifies both abiotic (non-living) and biological edge effects. Abiotic edge effects are those that relate to changed environmental conditions within the remnant and include changes to: air moisture, air temperature, solar radiation levels, soil moisture, soil temperature and chemical composition (such as nutrient inputs). Other abiotic edge effects include changes to wind speed and pattern (Saunders *et al*. 1991). Biological edge effects involve changes in species abundance and distribution, either directly due to changed environmental conditions at the edge, or indirectly, through changes in species interactions, such as predation, herbivory, parasitism, competition, and biotic seed pollination and seed dispersal (Murcia 1995). It is also recognised that many edge effects, both abiotic and biological, are likely to interact (Murcia 1995). While in the past forest edges were considered to be beneficial, particularly to game animals (Wilcove *et al*. 1986; Sisk and Margules 1993), it is now well understood that edge effects are detrimental to a wide range of

flora and fauna (Janzen 1986; Lovejoy *et al*. 1986; Wilcove *et al*. 1986; Laurance 1991; Saunders *et al*. 1991; Sisk and Margules 1993, Murcia 1995; Laurance 2000).

Predation of koalas and other fauna species by vertebrate predators, particularly roaming domestic and feral dogs, are also potentially influenced by edge effects. May (1997) reported that whilst the vast majority of research on edge-related predation has been undertaken in the northern hemisphere and has tended to focus on the incidence of predation on nests, some studies had indicated that levels of predation were higher within edge environments than within the interior of remnants. Although not yet quantified by research, it seems reasonable to assume that koalas are likely to be more vulnerable to predation by dogs near to the edge of habitat remnants, particularly where the area beyond the edge has been heavily degraded or contains trees at low density.

Edge effects have been reported as impacting specifically on koala habitat. Increased run-off from adjacent urban areas has been implicated in the dieback of koala food trees in the Pittwater area of Sydney (Smith and Smith 1990). Also, increased nutrient inputs from adjacent urban areas, together with altered fire regimes, are facilitating the invasion of rainforest species into koala habitat, which is likely to inhibit recruitment of eucalypt species (Smith and Smith 1990).

Clearly, native vegetation (such as koala habitat) needs to be protected from such edge effects. This can be achieved by retaining or replanting vegetation to function as a buffer, which acts to move the edge of the remnant, and hence detrimental edge effects, further out (Hobbs 1993). The scope for mitigation of the impact of edge effects through retention and restoration of adjacent vegetation is also recognised by Lovejoy *et al*. (1986), Laurance and Yensen (1991), Sisk and Margules (1993), Matlack (1993; 1994), Margules *et al*. (1995), Gascon *et al*. (1999), Laurance (1999) and Mesquita *et al*. (1999).

How wide will buffers need to be?

Determination of the buffer width required to protect Preferred Koala Habitat from adverse edge effects requires a consideration of the distance to which edge effects penetrate into a remnant (Hobbs 1993). However, it is widely recognised (Laurance and Yensen 1991; Hobbs 1993; Murcia 1995; Fox *et al*. 1997; Laurance 2000) that edge effects vary considerably in the distances of penetration, depending on such things as, the type of edge effect measured, the vegetation community being studied, the characteristics of the surrounding environment (e.g. pastures, crops, urban areas, or regrowth forest) and the age of the remnant edge (time since edge was created).

Examples of the distance to which edge effects have been reported to penetrate into remnants include:

- high levels of canopy damage up to 150m and detectable levels of disturbance up to 500m inside remnant tropical rainforest in NE Queensland (Laurance 1991);
- altered microclimatic variables up to 50m and changes in floristic composition up to 40m from the edge of temperate forest in the USA (Matlack 1993; 1994);
- changes in floristic composition up to 16m inside remnant temperate rainforest in NSW (Fox *et al*. 1997);
- higher proportions of exotic plant species and higher mean basal area of the native weed *Pittosporum undulatum* within 30m of suburban edges in dry sclerophyll forest and woodland on the Hornsby Plateau, NSW (Rose and Fairweather 1997; Rose 1997);

- increased phosphorous levels up to 20m into dry sclerophyll woodland in Western Australia (Scougall *et al*. 1993); and
- increased nest predation up to 600m inside a temperate forest in the USA (Wilcove *et al*. 1986).

The impacts of edge effects on remnant vegetation can also be exacerbated by incursions by livestock (Scougall *et al*. 1993; Fox *et al*. 1997).

In her seminal review of studies on edge effects, Murcia (1995) reported that most edge effects had disappeared over the first 50m into a remnant. A more recent review (Laurance 2000), concluded that most empirical studies of edge effects reported distances of penetration less than 150m. However, edge effects are also thought to occur over much larger scales, such as 1-5km (Janzen 1986; Skole and Tucker 1993). Several recent studies reviewed by Laurance (2000) were presented as support for edge effects penetrating up to 10km into remnants under some circumstances.

This great variation in the reported distance of penetration of edge effects, itself confounded by deficiencies in many studies (such as poor experimental design, lack of consistency in methodology and oversimplification of the perception of edges and edge effects), has meant that studies are generally only site-specific and has precluded the development of a universal theory on edge effects (Murcia 1995). Therefore, determination of an appropriate buffer width to effectively ameliorate edge effects on Preferred Koala Habitat in the Port Stephens LGA would require studies aimed at assessing the impact of different types of edge effects on vegetation communities in the area. Such studies would need to be well-designed, preferably long term, and would need to sample the range of edge effects, vegetation communities, ages since edge creation, orientation (aspect) of the edge, and type of land use in the surrounding environment in the LGA (Murcia 1995). While one study aimed at investigating the effects of habitat fragmentation on flora and invertebrate fauna following sand mining on the Tomago Sandbeds, which includes an examination of both abiotic and biological edge effects, is currently in progress (K. Ross, University of New South Wales, pers. comm.), there are no published studies of edge effects on vegetation communities in the Port Stephens LGA.

The type of research required to properly assess the buffer width required to protect Preferred Koala Habitat from edge effects is well beyond the scope (particularly time and resources) of most flora and fauna assessments prepared to accompany a development application. Hence, it is inappropriate to require flora and fauna consultants to separately assess the likely impact of edge effects of a given development and to specify a suitable minimum buffer width required to protect Preferred Koala Habitat. In lieu of this, it will be necessary to specify a minimum buffer width which must be applied to all patches of Preferred Koala Habitat.

Such an approach is supported by the concept of Ecologically Sustainable Development (ESD), which is enshrined in both Commonwealth and State legislation, and, in particular, that component of ESD known as the Precautionary Principle. As defined in the *Protection of the Environment Administration Act (NSW) 1991* (s. 6(2)), the Precautionary Principle states:

> that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the context of specifying a minimum width of Habitat Buffer to protect Preferred Koala Habitat from detrimental edge effects, the Precautionary Principle would apply as follows. It is well established by the scientific literature that edge effects have a deleterious impact on a variety of species and ecological communities; hence, it is necessary to apply Habitat Buffers to protect Preferred Koala Habitat from such impacts. However, precise information on the distance of penetration of edge effects, particularly for the types of vegetation communities that occur in the Port Stephens LGA, is currently lacking. In the absence of well-designed, long-term studies to determine an appropriate buffer width for Preferred Koala Habitat in the Port Stephens LGA, together with the fact that such studies are well beyond the scope of works and resources of consultants conducting flora and fauna assessments, it is appropriate to specify a minimum buffer width to be applied in all instances.

There are several examples of the use of buffer areas in NSW legislation and environmental planning instruments. For instance, the Greater Metropolitan Regional Environmental Plan (REP) No. 2 – Georges River Catchment 1999 applies planning controls, including prohibitions on certain types of development, for buffer zones within 40m of the Georges River and its tributaries. This REP also specifies that where certain types of development adjoin such buffer zones, the retention or restoration of remnant vegetation within the adjacent buffer is required. State Environmental Planning Policy No. 26 – Littoral Rainforests incorporates the concept of a buffer applying to land within 100m of the outer edge of a mapped littoral rainforest. The Liverpool City Council Development Control Plan No. 8 – Natural Assets (1999) requires buffers of native vegetation of between 20m and 50m width adjacent to natural waterbodies and wetlands. Other environmental planning instruments which incorporate buffer areas include the Kiama Local Environmental Plan (LEP) 1996 and the Singleton LEP 1996.

Given that the most comprehensive review of edge effects to date (Murcia 1995) noted that most edge effects were reported to have disappeared within 50m of the remnant edge, it has been determined to apply this as the **minimum width of all Habitat Buffers on Preferred Koala Habitat in the Port Stephens LGA**. However, this buffer width should be reviewed in the future as further information on edge effects on remnant vegetation in the Port Stephens LGA becomes available.

A minimum buffer width of 50m is considered to have a reasonable likelihood of ameliorating many of the adverse edge effects likely to impact on koala habitat in the Port Stephens LGA. However, as noted by Murcia (1995), there is an urgent need for further studies on edge effects, as it may well be that much of the information to date underestimates the distance to which edge effects penetrate into remnant vegetation; a concern more recently supported by Laurance (2000).

Extension of Significant Koala Activity

The second objective of Buffers on Preferred Koala Habitat is to provide for the likely extension of significant koala activity. Here significant koala activity relates to terminology defined by Phillips and Callaghan (1995). Koala activity levels can be quantified by application of a standard faecal-pellet based survey methodology, such as the Spot Assessment Technique (Phillips and Callaghan 1995), and represents the overall proportion (percentage) of the trees surveyed in a spot assessment plot under which one or more faecal pellets were recorded within a one metre search catchment around the base of each tree. Phillips and Callaghan (1995) define an activity level of 30% as representing the critical level of significance and consider activity levels greater than or equal to 30% to be indicative of habitat utilised by members of a stable aggregation of koalas.

During the field survey component of the Draft Port Stephens Council CKPoM (Phillips *et al*. 2000), the Australian Koala Foundation conducted a number of transects leading out from patches of Preferred Koala Habitat to determine the extent to which significant koala activity extended beyond the boundary of Preferred Koala Habitat. The results of these surveys (AKF unpublished data) were used to determine appropriate buffer widths for the Draft Port Stephens Council CKPoM (1999).

Unlike the level of research required to determine the distance of penetration of specific edge effects, a suitable approach to determine the extent of significant koala activity at a specific site is far more achievable. Hence, it is considered appropriate for this to be undertaken by flora and fauna consultants on a case-by-case basis to help determine an appropriate buffer width for a specific proposed development, beyond the designated minimum width necessary to protect the habitat.

Ecological Criteria for the case-by-case assessment of the potential need to extend the Habitat Buffer width beyond the 50m minimum

The following process must be undertaken to determine the appropriate width for Habitat Buffers on Preferred Koala Habitat for any development application or rezoning request that applies to land either containing or immediately adjacent to Preferred Koala Habitat. For the purposes of these Ecological Criteria, there is a formal requirement to apply Habitat Buffers (including the 50m minimum buffer) **only** to those patches of Preferred Koala Habitat which:

a) have an area of 0.5 hectares or greater; and

b) contain vegetation which would be considered to be of a woodland, open forest or closed forest structural formation class (i.e. having greater than or equal to 10% projective foliage cover *sensu* Specht *et al*. 1974, or a crown separation ratio of less than or equal to 1 *sensu* Walker and Hopkins 1990).

1. A **minimum buffer of 50m** is to be applied to all patches of Preferred Koala Habitat to help protect against detrimental edge effects. The minimum buffers will apply in all cases, including instances where they overlap with predominantly cleared land ;

2. Faecal-pellet based surveys are to be undertaken **beyond** the minimum buffer of 50m to establish the full width of the Habitat Buffer. These surveys will take the form of transect-based surveys out from the edge of the 50m buffer. Each transect will be comprised of adjoining 20m x 20m quadrats, perpendicular to the buffer edge. Each quadrat should be assessed according to the methodology of Phillips and Callaghan (1995) to determine the koala activity level. These assessments must be undertaken by persons with appropriate qualifications and experience in koala survey.

   The purpose of these assessments is to establish the extent of significant koala activity beyond the minimum 50m buffer. Assessments should be continued along each transect until activity levels less than 30% are recorded, or the 50m buffer boundary for adjacent Preferred Koala Habitat or an adjoining property of different land ownership is reached. For the purpose of identifying the point at which activity levels fall below 30%, a transect should not be discontinued at a quadrat that includes less than 10 trees, irrespective of the activity level.

   Where a patch of Preferred Koala Habitat is surrounded by predominantly cleared land containing no trees or only scattered trees, no transects will be required and only the minimum 50m buffer will apply.

   There are two options available to determine the appropriate additional habitat buffer for a given patch of Preferred Koala Habitat. Option a) relies on the determination of an average additional buffer width which is to be applied consistently around an entire patch of Preferred Koala Habitat. Option b) allows for the differential application of additional activity buffers around a given patch of Preferred Koala Habitat, based on the differential use of adjoining vegetation associations. The details of each of these methods are provided below.

Option a

There is to be an absolute minimum of 2 transects per patch of Preferred Koala Habitat, and at least one transect for each vegetation association adjoining the outer edge of the compulsory minimum 50m Habitat Buffer (i.e. the starting point of the transects). Therefore, a patch of Preferred Koala Habitat with one vegetation association adjoining the outer edge of the compulsory minimum 50m Habitat Buffer within the study area would require at least two transects; a patch with two adjoining vegetation associations would require at least two transects, one in each association; a patch with three adjoining associations would require at least three transects; a patch with four adjoining associations would require at least four; and so on. Transects should be spaced in such a way to ensure that adjacent transects are at no point closer than 50m apart. Where possible, transects should also be orientated in the direction of the nearest known patches of Preferred Koala Habitat. Consultants are also encouraged to undertake a greater number of transects than the minimum specified where it is considered appropriate.

The additional buffer width (to be added to the minimum 50m) shall be determined as the mean distance of extension of significant koala activity from each patch of Preferred Koala Habitat. For instance, if, for a given patch, significant koala activity is recorded from only the first 20m x 20m quadrat in one transect and from the first two 20m x 20m quadrats in the second transect, the extension of significant koala activity will be considered to be 20m for one transect and 40m for the other. Therefore, the additional buffer width with respect to that patch of Preferred Koala Habitat would be 30m. In this instance, the total buffer width for the patch of Preferred Koala Habitat would be 80m, comprised of the 50m minimum buffer to protect from edge effects, plus the additional 30m to capture the extension of significant koala activity.

Option b

This option, in addition to being consistent with the methods described above, will require an absolute minimum of 4 transects per patch of Preferred Koala Habitat and at least 2 transects per adjoining vegetation association. The extent of the additional buffer will be determined based on the average distance of extension of significant koala activity in each adjoining vegetation association (as calculated by means similar to that described for a whole patch in Option a) and should be applied consistently within each adjoining vegetation association.

All results from these assessments are to be presented in a report to accompany the development application or rezoning request.

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Appendix 10

Fire Management Principles for the Conservation of Koalas and Koala Habitat

This appendix outlines a series of fire management principles that should be employed by agencies and landholders when undertaking bushfire management in or adjacent to Preferred Koala Habitat, Supplementary Koala Habitat, Habitat Buffers and Habitat Linking Areas. These principles are based on the discussion in Chapter 11 Bushfires of the CKPoM Resource Document. It should be noted that bushfire management must take into account not only the imperative to conserve threatened species, such as koalas, and their habitat, but also the need to protect human life and property.

High intensity fires

High intensity (or 'hot') fires, particularly those which affect the tree canopy, are likely to kill or injure koalas and cause short-term damage to their habitat. The effects of such fires are exacerbated when koala habitat is fragmented, which inhibits potential re-colonisation of burnt and regenerating habitat by koalas from adjacent areas.

Principle: *Fire management strategies should aim to minimise the likelihood of high intensity fires, such as canopy fires, occurring within koala habitat.*

High frequency fires

High frequency wild fires and recurrent hazard reduction burns may cause long-term changes to koala habitat by inhibiting the recruitment of preferred koala food trees and other essential habitat trees. High frequency fires are widely understood to adversely affect many plant and animal communities and are likely to similarly affect those associated with koala habitat. The detrimental impact of high frequency fires, including recurrent hazard reduction burns, is acknowledged and should be avoided. However, the need for effective fuel management practices including hazard reduction burns where necessary to minimise the likelihood of high intensity fires, is also recognised and supported. The optimal balance should be sought between these two potentially contradictory factors.

Principle: *While hazard reduction burns are a necessary component of many bushfire management strategies, wherever possible they should be carried out at intervals which avoid high frequency burns within koala habitat. The relevant scientific literature should be consulted to help determine appropriate intervals between hazard reduction burns.*

Research

There is a pressing need for further research to examine the responses of koala habitat and associated plant and animal communities to different fire regimes, including regimes of high frequency fires, such as recurrent hazard reduction burns. Such research should aim to determine the range of fire regimes suitable to satisfy the multiple objectives of conserving koalas, koala habitat and associated plant and animal communities, while protecting human life and property. Research should also be carried out on possible alternatives to hazard reduction burns. The findings of future research should be incorporated into revisions of this CKPoM and the Port Stephens Bushfire Risk Management Plan.

Principle: *The findings of future research on the responses of koala habitat and associated plant and animal communities to different fire regimes should be used to refine these fire management principles and other relevant plans.*

Determining the distribution of Koala habitat across a shire as a basis for conservation: a case study from Port Stephens, New South Wales

DANIEL LUNNEY,[1] STEPHEN PHILLIPS,[2] JOHN CALLAGHAN[2] and DIONNE COBURN[1]

The Australian National Koala Conservation Strategy recognizes the importance of conserving Koalas in their existing habitat, particularly through the integration of Koala conservation into local government planning (ANZECC 1998). The aim of this study was to define, rank and map the distribution of Koala habitat in Port Stephens Shire, New South Wales. The procedure was to merge the results of two independent survey techniques, each of which was interpreted using a vegetation map specifically prepared for this study. A field survey used a plot-based sampling protocol to determine tree species preferences based on the presence/absence of Koala faecal pellets. Data were obtained on 8 764 trees comprising 19 eucalypt and 12 non-eucalypt species. A high-profile community survey obtained 2 756 Koala records. Koala habitat maps from both survey methods were examined as overlapping GIS layers. Combined Koala habitat categories were then devised, ranked and mapped across the Shire. This study provides a practical and repeatable means of identifying and conserving Koala habitat in existing remnant vegetation over which local government has planning jurisdiction.

Key words: *Phascolarctos cinereus*, Koala, Habitat identification, Community survey, Field survey, Port Stephens, Environmental planning, Local government, Tree preferences.

INTRODUCTION

THE Australian National Koala Conservation Strategy recognizes the importance of conserving Koalas in their existing habitat. The Strategy also states that this can be achieved through the identification and protection of Koala habitat and the integration of Koala conservation into local government planning processes (ANZECC 1998). A 1986–87 state-wide survey concluded that the New South Wales Koala population has suffered a major range contraction since European settlement (Reed *et al.* 1990). This prompted the convening of a "Koala Summit" which identified increasing pressures on Koala populations and their habitat as issues requiring study and management at a local level (Lunney *et al.* 1990). Port Stephens Shire, on the central coast of New South Wales, was considered to warrant particular attention because it was recognized as having one of the most significant southerly Koala populations in New South Wales (Lunney and Reed 1990).

A "Draft Koala Plan of Management for Port Stephens" (Callaghan *et al.* 1994) reflected the first substantial attempt to address the longer term management requirements of the Port Stephens Koala population. The plan was underpinned by the results of a shire-wide community Koala survey which, *inter alia*, provided data on the localities where Koalas were most frequently observed. A new insight in the draft plan was the linking of mapped Koala habitat with the land-use zones used by strategic planners (Leathley *et al.* 1995; Leathley and O'Connor 1996). Further, the draft plan demonstrated the necessity for a rigorous scientific foundation for Koala planning and management at a shire-wide level.

The approach that had been taken in Port Stephens became New South Wales Government policy with the promulgation of *State Environmental Planning Policy No. 44, Koala Habitat Protection* (SEPP 44) in January 1995. An alternative approach to community survey was the field-based Koala Habitat Atlas, which has been developed by the Australian Koala Foundation (AKF) to identify Koala habitat using an unbiased sampling protocol. Tree preferences and other habitat use parameters are quantified on the basis of the presence or absence of Koala faecal pellets. This enables hierarchical habitat categories to be determined which reflect the relative abundance of preferred tree species (Sharp and Phillips 1997). Further refinement of SEPP 44 led to the development of guidelines for the preparation of shire-wide Koala Plans of Management. It states that both community records and field-based data are required to identify habitat (Lunney *et al.* 1997). Thus, the aim of this study was to integrate two independent methods of survey, namely community survey and field investigation and, in so doing, define, rank and map the distribution of Koala habitat in port Stephens Shire.

[1]NSW National Parks and Wildlife Service, P.O. Box 1967, Hurstville, New South Wales, Australia 2220.
[2]Australian Koala Foundation, G.P.O. Box 9899, Brisbane, Queensland, Australia 4001.

PACIFIC CONSERVATION BIOLOGY Vol. 4: 186–96. Surrey Beatty & Sons, Sydney. 1998.

METHODS

The study area

Port Stephens Shire is located approximately 145 kms in a direct line from Sydney on the central coast of New South Wales (32°35'S to 32°50'S and 151°30'E to 152°30'E). Common land uses in the Shire include water catchment, forestry and farming, with local industry dominated by primary production, tourism, sand mining and defence force activities.

Vegetation mapping

A primary requirement of the study was a vegetation map which covered the entire study area. A map was specifically prepared for this study by a consultant contracted to the AKF. It was produced by interpretation of 1994 1:25 000 aerial photographs with the vegetation described according to Specht (1981). Where necessary, plant specimens were collected and matched against voucher specimens held at the National Herbarium of New South Wales. Intensive field surveys and ground truthing for the preparation of the map were conducted between December 1994 and March 1995. The vegetation map identified 52 distinct vegetation associations throughout the study area.

Community survey

In May 1992, Koala survey forms were posted to each of the 16 500 residences in Port Stephens Shire. The forms included a letter to residents, a questionnaire and maps for the purposes of recording Koala sightings. The map of the Shire was A3 (420 × 594 mm) size and featured roads and other landmarks to assist respondents to accurately mark Koala sightings. To further assist in the accurate location of sightings, there were also two larger scale A4 (210 × 297 mm) size maps detailing those areas within the Shire known to have high concentrations of Koalas. Survey forms were distributed in conjunction with an extensive media campaign and replies were returned by "freepost".

The scale of the maps allowed Koala sightings to be recorded as AMG (Australian Map Grid) co-ordinates to the nearest 100 m which were then entered into the National Parks and Wildlife Service's "Atlas of New South Wales Wildlife" database before being transferred into Geographic Information System (GIS) software (E-RMS — Environmental Resource Mapping System). Initial analysis calculated the density of Koala records within each vegetation association, then used these to rank and map vegetation associations where Koalas had been sighted. For analyses, a Koala "record" was defined as the presence of one or more Koala sightings in a 1 ha grid cell.

Field survey

The tree species most preferred by Koalas were determined using analyses of log-likelihood ratios. These were derived from a sampling protocol based on the presence/absence of Koala faecal pellets beneath trees within selected plots (Sharp and Phillips 1997; Phillips *et al.*, in press). Plots were selected by stratifying the study area into sampling units that shared common geological, soil landscape and floristic attributes (hereafter referred to as "GSFs"). Floristic attributes were determined from the vegetation associations, combined with local knowledge and a previous vegetation map in Callaghan *et al.* (1994). This resulted in 96 primary plot sites being sampled in addition to 14 supplementary sites, the latter located where Koala pellets were found in vegetation associations with low densities of Koalas. There were 49 primary field sites and nine supplementary sites on Quaternary deposits, and 47 primary plots and five supplementary plots on the Nerong and Patterson Volcanics group. Data from each active site (i.e., a plot with a Koala pellet) on each GSF were pooled. These were then summed for each tree species to provide an indicative or notional level of use, called a "strike rate" (Phillips *et al.*, in press).

The principal outcome of the field-based survey was to identify the tree species most preferred by Koalas. In order to develop the associated habitat "model", all data layers (geology, soil landscape, terrain, vegetation, drainage and roads) relating to the study area were either digitized or installed on to a Genamap based GIS. Density of preferred tree species within each of the vegetation associations was determined from the field data. This layer was then intersected with underlying soil landscape, drainage and geological data on the GIS. Koala habitat was identified using standard algorithms to construct cell based boolean overlays. Habitat modelling parameters were based on the presence and density of the preferred tree species in accord with the following definitions:

- *Primary Koala Habitat:* vegetation associations where dominant or co-dominant tree species were both preferred by Koalas and showed a level of use that was density independent.
- *Secondary Koala Habitat:* vegetation associations where preferred tree species constituted between 10% and 35% of the overstorey vegetation.
- *Marginal Koala Habitat:* vegetation associations where preferred tree species were largely absent or otherwise occurred at very low densities (<10%).
- *Habitat Value "Unknown":* small areas of vegetation associations that could not be

quantified due to a lack of signs of Koala activity.

The above categories formed the basis of a map-based habitat model (called the Koala Habitat Atlas) for comparison with the community survey results. Koala habitat maps from both methods were examined as overlapping GIS layers.

RESULTS

Community survey

There were 2 995 survey forms returned, representing an 18% return rate. From these responses, a total of 2 756 Koala records was obtained. Their distribution showed a pronounced east-west band running through the mid-section of the Shire. Few Koala records were obtained for the northern part of the Shire, including the State Forests, or for the western section of the Shire (west of the Pacific Highway).

The initial analysis of the survey results was to examine the density of Koala records within each vegetation association. Vegetation associations with no Koala records were excluded from further consideration. A further eight associations (*marked in Table 1) were identified as requiring further investigation. Of these, "mainly cleared land (some trees)" carried over half (53%) of all Koala records. The remaining seven associations marked in Table 1 made up a further 12% of records and warranted similar detailed examination.

A review of these data revealed that Koala records within "mainly cleared land (some trees)" showed a distinct clustering. These clusters were associated with urban centres and to a lesser extent were found along major roads. Had these records occurred with a uniform scatter over cleared land it may have been reasonable to conclude that this habitat supported a Koala population. However, their general distribution suggested that high sightability near urban areas and along roads resulted in an over-inflated number of Koala sightings for those areas. The use of mainly cleared land by Koalas may be associated with the extension of home ranging activity either around the periphery of significant habitat or between habitat patches. For these reasons, Koala records falling into this vegetation category were excluded from further analysis.

Koala records in "moist heathland/sedgeland" were similarly high (9.5% of records). However, they were mostly concentrated towards the southern edges adjacent to *Eucalyptus robusta* (Swamp Mahogany)/*Melaleuca quinquinervia* (Broad-leaved Paperbark) forest, which was a vegetation association found to contain frequent Koala sightings and thus ranked highly as an association preferred by Koalas. Also, this association is adjacent to a busy road. Since these factors were considered to have resulted in a high sightability of Koalas in the area, these records were also excluded. Six other associations, marked in Table 1, also showed this pattern and were similarly excluded. Excluded associations were subsequently grouped with "Other Vegetation".

The ranking of the vegetation associations based on the relative density of Koala records fell into five categories separated by natural discontinuities in the data (Table 1). These were used to produce a Koala habitat map as a base layer for comparison with field survey results.

Field survey

Within the plots a total of 8 764 trees comprising 5 419 eucalypts and 3 345 non-eucalypts were assessed for the presence or absence of faecal pellets. Detailed results on some aspects of this work have been described by Sharp and Phillips (1997) and Phillips *et al.* (in press).

On Quaternary deposits, a total of 4 298 trees was assessed, comprising 19 eucalypt and 12 non-eucalypt species. Of the 49 primary plots, 38 contained evidence of use by Koalas, with pellets recorded from 12 eucalypt and 10 non-eucalypt species. Data sets which met the criteria for analyses (see Phillips *et al.*, in press) were obtained for 7 of the 12 eucalypt species and 5 of the 10 non-eucalypts. Strike rates ranged from 0.55 for *E. robusta* to 0.10 for *E. tereticornis* (Forest Red Gum). There was significant heterogeneity among the strike rates ($G = 85.755 > \chi^2_{.001[6]}$). *E. robusta* and *E. parramattensis* (Drooping Red Gum) were identified as the tree species most preferred by Koalas on this GSF.

On the Nerong and Paterson Volcanics there was a total of 4 466 trees assessed, comprising 25 eucalypt and 12 non-eucalypt species. Of the 47 primary plots, 25 contained evidence of use by Koalas, with pellets recorded from beneath 21 species of eucalypts and 5 non-eucalypts. The total number of trees with pellets comprised 8.0% of the trees assessed. However, the Nerong and Paterson Volcanics group did not provide substantive data sets with regard to Koala activity. Despite a sampling effort equivalent to that on the Quaternary deposits, associations could not be determined for most tree species due to the paucity of pellets. Only two eucalypt species were assessed to a level which could support a measure of confidence in the result: *E. tereticornis* ($P_{eter} = 0.84$; $n_{eter} = 37$) and *E. acmenoides* (White Mahogany — $P_{eacm} = 0.18$; $n_{eacm} = 179$).

Table 1. Vegetation associations in Port Stephens Shire showing the area of each association, the percentage of the total area, the numbers of Koala records (KRs) for each association and KRs per hectare. The vegetation associations in each of the community-based survey Koala habitat categories (A to E) are also shown.

	Vegetation Association	Area (ha)	KRs	KRs/ha
Category A	Tallowwood (Golf Course Planting)	4.8	5	1.052
	Syd Red Gum, Red Bloodwood, Brown Stringybark, White Stringybark F with Scribbly Gum	23.9	6	0.251
	F Red Gum and Broad-leaved White Mahogany F	22.6	5	0.222
	Open Sw Mahogany and Sw Oak F with Sw Mahogany and F Red Gum dm	26.6	5	0.188
	Open F Red Gum F	6.9	1	0.144
	Open Scribbly Gum F	115.7	12	0.104
Category B	Brown Stringybark and Broad-leaved White Mahogany F	95.8	6	0.063
	F Red Gum, White Stringybark and Broad-leaved White Mahogany Woodland	16.1	1	0.062
	Open Blackbutt F	283.1	17	0.060
	Tall Open Blackbutt and Syd Red Gum F with Scribbly Gum	1 023.8	59	0.058
	Brown Stringybark, Broad-leaved White Mahogany and Scribbly Gum with ROTAP species	18.4	1	0.054
	Open Sw Mahogany and Sw Oak F with Sw Mahogany dm	2 718.3	148	0.054
Category C	Open Sw Mahogany and Sw Oak F with Paperbark	1 155.1	59	0.051
	Tall Open Blackbutt and Syd Red Gum F	9 026.7	400	0.044
Category D	Coastal Sw F with Parramatta Red Gum *(E. parramattensis)* dm	41.2	1	0.024
	Open Sw Mahogany and Sw Oak F	125.9	3	0.024
	Tall Open Blue Gum F	144.8	3	0.021
	Open Sw Mahogany and Sw Oak F with Paperbark dm	755.6	13	0.017
Category E	Open F Red Gum and Grey Box F	409.3	5	0.012
	Syd Red Gum, Red Bloodwood, Brown Stringybark, White Stringybark F	9 932.0	105	0.011
	Open F Red Gum and Spotted Gum F	2 577.8	23	0.009
	Open F along Major Rivers and Floodplains	1 183.4	8	0.007
	Spotted Gum and Ironbark F	10 034.6	71	0.007
Cleared	*Mainly Cleared Land (some trees)	31 875.3	1 463	0.046
	Shifting Sand Dunes	2 335.6	0	0
	*Rockshelf	113.2	1	0.009
Excluded	*Moist Heathland/Sedgeland	2 916.9	263	0.090
	*Exotic Trees	293.5	11	0.037
	*Sw with Dense Reedland	104.4	3	0.029
	*Closed Heathland	135.1	3	0.022
	*Sparse Heathland with Bitou Bush	181.1	3	0.017
	*Mangrove Saltmarsh Complex	4 254.4	52	0.012
No KRs	Tall Open Blackbutt and Syd Red Gum F with Sw Mahogany	9.5	0	0
	Tall Open Blackbutt and Syd Red Gum F with Scribbly Gum and Syd Pp	13.1	0	0
	Tall Open Blackbutt and Syd Red Gum F with Scribbly Gum and Sw Mahogany	15.8	0	0
	Syd Red Gum, Red Bloodwood, Brown Stringybark, White Stringybark F with Syd Pp	74.1	0	0
	Brown Stringybark and Broad-leaved White Mahogany F with Scribbly Gum	24.4	0	0
	Open F with F Red Gum, Grey Box and Spotted Gum	50.4	0	0
	Open Remnant Blackbutt F	18.6	0	0
	Littoral Rain F	7.8	0	0
	Mangrove Saltmarsh Complex with F Red Gum	5.3	0	0
	Open F along Major Creeks	60.4	0	0
	Open F along Major Rivers and Floodplains with F Red Gum dm	79.8	0	0
	Gully Rainforest	88.6	0	0
	Open Flooded Gum and Sw Mahogany F with F Red Gum	7.5	0	0
	Open Flooded Gum and Sw Mahogany F	18.1	0	0
	Open Sw. Mahogany and Sw Oak F	4.1	0	0
	Open Sw. Mahogany and F Red Gum F	5.4	0	0
	Sparse Heathlands on Shifting Sand Dunes	184.3	0	0
	Brown Stringybark and Broad-leaved White Mahogany with ROTAP species	23.9	0	0
	F Red Gum, White Stringybark, Broad-leaved White Mahogany and Scribbly Gum Woodland	0.8	0	0
	Spotted Gum and Ironbark F with Scribbly Gum	1.1	0	0

Note: dm = dominant, F = Forest, Pp = Peppermint, Sm-brk = Smooth-barked, Sw = Swamp, Syd = Sydney.

Descriptions of each map-based habitat category based on field work are as follows:

Primary Koala habitat:

- Vegetation associations dominated by *E. robusta* and/or *E. parramattensis,* including the vulnerable sub species *E. parramattensis decadens* growing on Aeolian and Swamp Landscapes associated with Quaternary Deposits;
- Vegetation associations dominated by *E. robusta* growing on Transferral Landscapes associated with alluvial deposits of Quaternary origin; and
- Vegetation associations dominated by *E. tereticornis* growing on Erosional Landscapes of predominantly yellow podzolics and lithosols associated with Nerong Volcanics.

Secondary Koala habitat:

- Vegetation associations on Aeolian Swamp or Transferral Soil Landscapes of Quaternary origin supporting *E. robusta* and/or *E. parramattensis* as sub-dominant components of the overstorey;
- Vegetation associations on Transferral Soil Landscapes of Quaternary origin supporting *E. robusta* and/or *E. tereticornis* as sub-dominant components of the overstorey;
- Vegetation associations on erosional landscapes supporting *E. tereticornis* as a sub-dominant component of the overstorey; and
- Open *E. tereticornis/E. moluccana* (Grey Box) and open *E. tereticornis/E. maculata* (Spotted Gum) forest within 25 m of a watercourse or drainage line.

Marginal Koala habitat:

- Vegetation associations containing low densities of species known to be preferred by Koalas.

Despite the paucity of evidence relating to Koala activity in the western parts of the Shire, the presence of both *E. microcorys* (Tallowwood) and *E. propinqua* (Small-fruited Grey Gum) were also taken into account when categorizing habitat because of their known importance to Koalas in other areas (Reed *et al.* 1990; AKF, unpubl. data).

Combination of community and field Koala habitat maps

To effectively integrate the maps produced by the two survey methods, the number of community survey habitat categories was reduced from five to three to match the three field survey categories. Community survey habitat categories A and B were merged, due to the small area of category A (only 200 ha). Similarly, community survey categories C and D were merged because category D covered only 1 067 ha. There was a high level of overlap between each of the corresponding levels of the two methods. When community survey category A/B was compared with field Primary Koala Habitat, the overlap was 91%. When category C/D was overlapped with field Secondary Habitat the overlap was 47%. When category E was overlapped with field Marginal Habitat the overlap was 67% (Table 2).

To avoid confusion between the terms applied by both methods, new terms of ranked Koala habitat were required. The highest category, termed "Preferred Habitat", was derived from the recognition that the highest habitat categories from each method had clearly identified components of the most important Koala habitat. They were therefore considered to be additive. The next two habitat categories, in order, were "Supplementary" and "Marginal". These were identified only when the two methods concurred (i.e., where marginal habitat from the field survey and category C/D from the community survey overlapped on the map, and similarly when marginal and category E overlapped). It was also recognized that no vegetation association would be down-graded as a result of this process. Therefore, vegetation

Table 2. The area (in hectares) of each habitat category from both the field survey and the community survey are shown in the totals (bold). Also shown is the extent of overlap (%) between the results of the two survey methods. These figures were obtained from the GIS overlap of the Koala habitat maps derived from each method.

	Field Survey Habitat Categories				
Community Survey Habitat Categories	% Primary	% Secondary	% Marginal	% Unknown	Totals (ha)
Category A/B	91	2	4	0	**4 356**
Category C/D	6	47	28	89	**11 249**
Category E	0	48	67	0	**24 137**
No Overlap	3	3	1	11	**390**
Totals (ha)	**3 016**	**2 448**	**34 505**	**163**	**40 132**

Table 3. Area of each Koala habitat category for Port Stephens Shire from the combined Koala habitat map derived from integrating the Koala habitat maps from the two independent survey methods. The three defined habitat categories are, in ranked order, preferred, supplementary and marginal Koala habitat. A small area of unknown habitat quality is shown, as is the area of other vegetation and a large category classified as "mainly cleared land (some trees)".

Habitats	Area (ha)	% of Habitat	% of Shire
Preferred Koala Habitat	7 366.8	18.4	9.0
Supplementary Koala Habitat	9 778.0	24.4	11.9
Marginal Koala Habitat	22 781.9	56.8	27.7
Unknown Habitat Quality	162.9	0.4	0.2
Other Vegetation	7 752.7	0	9.5
Mainly Cleared Land (some trees)	34 274.9	0	41.7
Totals	82 117.2	100.0	100.0

associations identified at a specific level of Koala habitat from either method would retain at least that level of importance. The definitions for the combined Koala habitat map are:

- *Preferred Koala Habitat* — a combination of all field survey Primary, Secondary, and community survey category A/B (regardless of whether or not they overlap).
- *Supplementary Koala Habitat* — where field survey Marginal and community survey category C/D overlap.
- *Marginal Koala Habitat* — where field survey Marginal and community survey category E overlap.

Habitat categories were then mapped across the study area to create a combined Koala Habitat Map for Port Stephens Shire (Fig. 1). The area of each of the three habitat categories is provided in Table 3. The two most important habitat categories, preferred and supplementary totalled 17 145 ha, representing 21% of the Shire. Marginal habitat totalled 22 782 ha, representing 28% of the Shire.

DISCUSSION

Approach to the problem of identifying and defining Koala habitat

Published studies which have attempted to gain a better understanding of Koala habitat over large geographic areas are both few and relatively recent (Cork *et al.* 1990; Norton and Neave 1996; Bryan 1997). The approach employed in this study in Port Stephens was similar to that of Bryan (1997) who used a dichotomous filtering process of either "optimal" or "unsuitable" attributes in order to identify Koala habitat through a GIS approach in the Mt Lofty Ranges of South Australia. Whereas Bryan's work depended on assumptions relating to tree species preferences and soil type, the result described in this study was based on a more detailed field-based approach, thus eliminating assumptions and minimizing the potential for error. Such an assessment is supported by the high degree of overlap between the habitat defined by community-based records and the habitat predicted on the basis of quantitative assessment of tree species preferences. Thus, the outcome of this project demonstrates an approach that is both scientifically rigorous and correctly focused to suit the scale at which major conservation decisions are being made.

The need for a more refined approach to the issue of identifying Koala habitat is consistent with the views of Norton and Neave (1996) and Cork *et al.* (1990), who have argued for a more precise understanding of habitat than that which has been available, specifically with regard to food resources. The approach that we have developed is thus a valuable tool in fulfilling the primary aims of strategies designed to conserve Koalas, their habitat and that component of biodiversity captured by areas of remnant bushland which can now be reliably defined as Koala habitat. The fact that 18% of the households responded to the community-based survey reveals the high profile of Koalas within Port Stephens Shire, their importance as a local conservation issue, and the willingness of residents to participate in the assessment process (Lunney *et al.*, in press). The high number of records provided a wealth of information on which to base a range of conservation options. Koala encounters remain vivid in people's memories and can additionally provide a clear picture of change in the local Koala population as has already been demonstrated by the work of Reed *et al.* (1990), Lunney *et al.* (1996) and Patterson (1996).

Evaluation of combining community and field surveys

The ecological application of community-based wildlife surveys to locate fauna habitat is a new

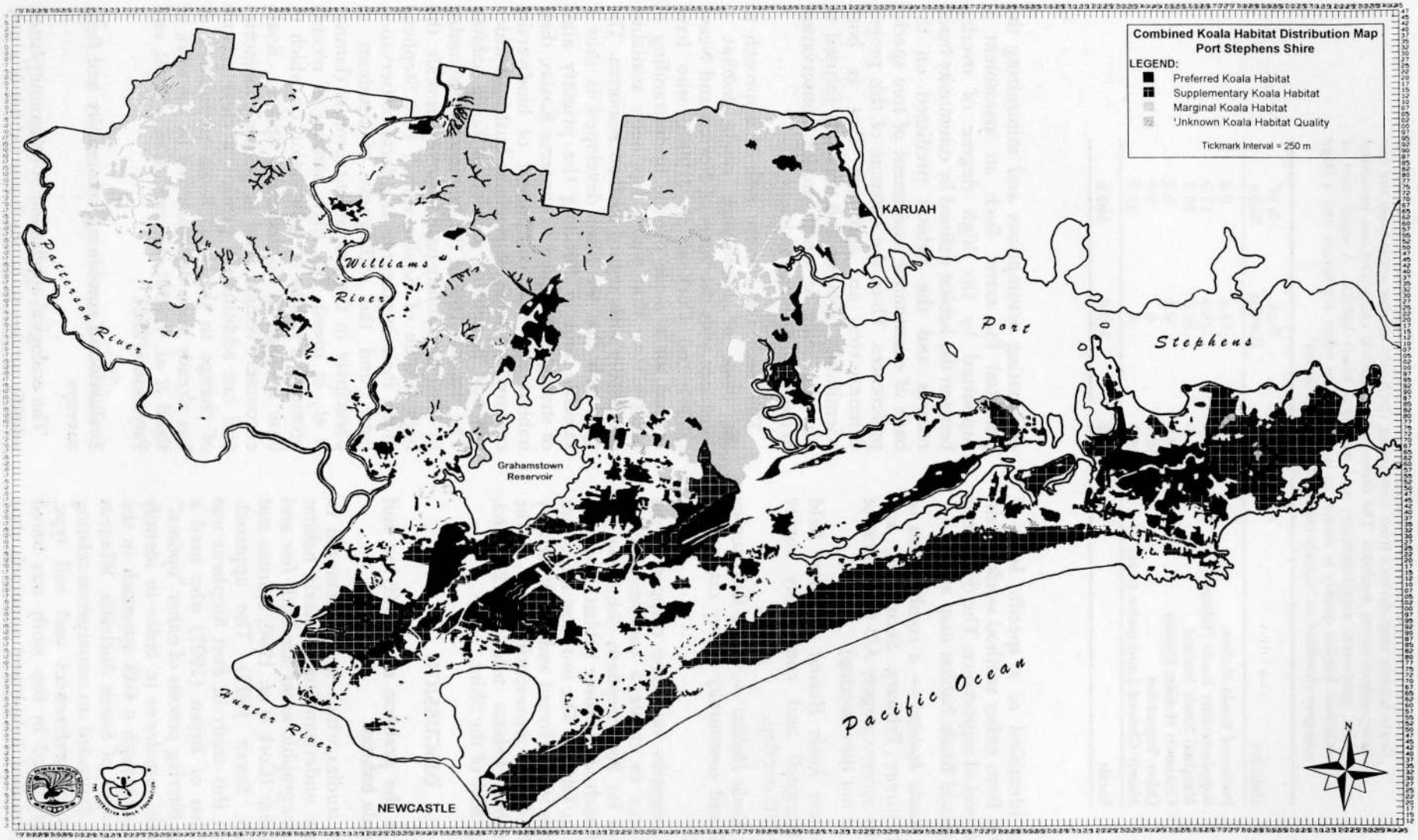

Fig. 1. Koala habitat map for Port Stephens Shire. This map was derived from the integration of habitat maps obtained from independent community and field surveys. The habitats were based upon a vegetation map specifically prepared for this study. The work was done using GIS in a format, and on a scale, compatible with the GIS available to planners in Port Stephens Shire Council. (Note: the category "Unknown" on the map refers to all of the field survey "unknown" category that did not overlap with any community survey categories.) The areas of each of these habitat categories are shown in Table 3.

endeavour (Lunney *et al.* 1996). While there is a great deal to be gained from its use, the limits must be taken into account. Strengths of the community survey approach include: tapping into community knowledge and thus determining changes in distribution, particularly with regard to areas where Koalas once occurred but are now absent; obtaining records for private land without entering the land; acquiring wildlife records irrespective of the weather, season or year (e.g., drought); gaining knowledge of "black spots" on roads, dog attacks on Koalas and locations of breeding Koalas; simultaneously gathering information on other wildlife species; and locating people with historically important information. The limitations include the potential bias towards areas of high human population and activity; the inability to accurately determine the tree species preferences of Koalas; and the potential inaccuracy of records arising from poor memory, or incorrectly marking a location on a map.

Similarly, the field-based component has its strengths and limitations. Strengths include: the application of a stratified approach to the sampling of habitat that is independent of human population density; the use of a technique that does not rely on Koala sightings for the determination of tree species preferences; and the ability to identify tree preferences and habitat utilization with a high level of confidence. Limitations include: potential difficulties of access to private property; the modelling capacity is limited by the nature, accuracy and resolution of spatial data, particularly that relating to the structure and complexity of vegetation associations; and fieldwork is labour intensive. Despite its limitations, the field component of this study was of fundamental importance given its ability to resolve issues related to the identification of preferred food tree species.

The use of faecal pellets raises issues with regard to their suitability as a reliable indicator of tree use by Koalas. However, faecal pellets have been used by a number of workers (Achurch 1989; Moon 1990; Phillips and Callaghan 1995; Munks *et al.* 1996; Pahl 1996; Sharp and Phillips 1997; Phillips *et al.*, in press) to investigate various aspects of habitat use by Koalas. Problems associated with their use include visibility and longevity (Achurch 1989) and the number of pellets present (Munks *et al.* 1996; Pahl 1996). Jones and Phillips (AKF, unpubl. data) have identified other variables such as tree diameter, aspect, tree height and foliage cover, that can affect the reliability and suitability of gross counts. As recently demonstrated by Phillips *et al.* (in press), their influence can be negated by adopting the presence/absence approach used in this study. A further issue relates to that of pellet longevity. Jurskis and Potter (1997) reported scat decay rates of between 6 and 24 months in their study of Koalas in the Eden area of southeastern New South Wales, with variation associated with location and forest type. In the Port Stephens area, investigations by some of us (Lunney *et al.*, NPWS unpubl. data) have similarly established differential decay rates and longevity times of six weeks to six months. The issue of decay rates and longevity is exacerbated when procedures that rely on gross counts are employed, but it become much less important when numbers are not required, such as when presence/absence is used. Additionally, the question of longevity is even less important with the knowledge that Koalas repeatedly use the same trees (especially food trees) and have a long-term fidelity to a home range. Both attributes facilitate regular faecal pellet deposition. The issue further fades in importance when the sampling intensity is high, as was the case in this study.

The two survey methods were complementary in that the limitations associated with each were addressed by the strengths of the other. Additionally, it is noted that identifying preferred tree species and the associated distribution of primary and/or secondary habitat, as determined by the field survey, is largely in accord with that predicted by community based records obtained over a long period of time. This concordance suggests that issues such as seasonal variation in food tree selection as reported by Hindell *et al.* (1985) and Hindell and Lee (1990) are unlikely to influence the determination of Koala habitat by the methods employed in this study.

The challenges of this combined approach are that a) it requires a detailed and accurate vegetation map which can be time consuming and costly to produce; b) the community-based survey must be properly advertised and based on a well-designed survey form with clear and accurate maps, and must be competently collated; and c) it is dependent on a rigorous approach to field survey and a high level of competence in analysing the data. Further, it requires GIS capability together with diligence, good ecological judgement and skill to combine the two datasets onto one map. A shortfall in any of these areas is likely to produce an underestimate of Koala habitat, which would provide incorrect guidance to planners on where the emphasis should fall for habitat protection. When these challenges have been addressed, the strength of combining the two techniques will be rewarded by a much greater confidence in the outcome, especially in pinpointing the most significant habitat.

The importance of a map-based approach to Koala habitat conservation has been recognized by the many authors, such as those who have contributed to three well-recognized and recent publications on Koala research and conservation (Lee *et al.* 1990; Gordon 1996; and Lunney *et al.* 1990). However, no procedure for achieving this had been identified. This study achieves that goal, particularly as it has the capacity for validation, because the two survey techniques are independent. The interest shown by planners in this approach to defining wildlife habitat supports our contention that this novel approach has much to offer land-use planning for wildlife conservation and habitat protection. Therefore, it is now possible to support planners in their arguments for providing the highest environmental protection to the most significant habitats.

Vegetation and tree associations identified in this study

Phillips *et al.* (in press) found a strong association between the presence of preferentially utilized species (*E. robusta* and *E. parramattensis*) and high Koala activity levels. Further analyses enabled the conclusion to be drawn that the higher than expected use of other tree species in such areas was primarily due to the presence of these two species. It was also apparent that significant Koala activity extended into adjoining areas of supplementary and/or marginal habitat and that such areas also must be considered as an important habitat component (Phillips *et al.*, in press). Thus the effective conservation of both Preferred and Supplementary Habitat are integral to the long-term future of Koalas in Port Stephens Shire. However, while distinctions between habitat categories are necessary for strategic planning, they do not lessen the importance of the preferentially utilized tree species wherever they occur in the Shire.

It was apparent that some of the identified habitat no longer supports extant Koala populations. This is most notable in the western and northern parts of the Shire where evidence suggests a widely dispersed, low density population, possibly comprising transient individuals, rather than established, sedentary, breeding populations. This contention is supported by the low activity levels recorded in these areas, coupled with the extensive foot-based searches which occurred in conjunction with the field survey component. This points to widespread localized extinctions, the field survey strongly suggesting that Koala populations have been unable to re-establish in these areas. In remaining areas of habitat in the eastern parts of the Shire, breeding Koala populations are largely focused on discrete areas of preferred and supplementary habitat on the Tilligerry Peninsula and the Tomago Sandbeds. Even here, it is possible to demonstrate that several areas of otherwise suitable habitat are no longer supporting Koalas (Phillips *et al.*, in press). A concurrent historical investigation has graphically illustrated the extent to which Koala habitat has been cleared and fragmented since European settlement commenced in the area in 1801 (Knott *et al.*, in press). Historical records and accounts from long-term residents showed that Koalas were once common in many parts of the Shire, including the western areas where they no longer occur. From this perspective it was shown that habitat loss, combined with the hunting of Koalas by early settlers and other more recent land-use practices, has had a lasting effect on the Koala population of Port Stephens.

Conservation conclusions

This study in Port Stephens was designed to bridge the gap between the requirements of ecological research and the constraints imposed on land-use planners to furnish a reliable means of identifying Koala habitat and ranking and mapping it at a scale that suits the planning process. It thus provides, for the first time, a practical and repeatable means to identify and conserve Koala habitat by combining an ecological outlook with the approach traditionally used by planners. This is the first step in providing an ecologically sound basis for long-term planning and conservation of existing remnant habitat over which local government has jurisdiction. The remaining Koala habitat in Port Stephens Shire is highly fragmented and associated studies have shown that habitat loss is being compounded by other threatening processes, particularly those of dog predation, road deaths and bushfire (Lunney *et al.*, in press; Callaghan *et al.* 1994). This points to an urgent need to stem further habitat loss and degradation and to ensure that the remaining areas of Preferred Habitat are afforded the highest level of environmental protection available. It is also necessary to recognize that Supplementary Habitat is widespread and requires protection, with possibly less development constraints as for Preferred Habitat. The Koala population in Port Stephens Shire is in need of a comprehensive management plan which protects existing habitat, aims to link and restore former habitat and tackles threats such as fire, dogs and cars.

ACKNOWLEDGEMENTS

The community-based Koala survey was initiated as a joint project between the New South Wales National Parks and Wildlife Service and Port Stephens Council and was supported

by the Hunter Koala Preservation Society. We are indebted to all those residents who took the time to reply. Funding and resources for the community-based survey were assisted by two Heritage Assistance Grants, the Foundation for the National Parks and Wildlife, Port Stephens Council and Tomago Aluminium (supply of survey forms). Field plot assessments undertaken by the Australian Koala Foundation were largely conducted with the help provided by representatives of the San Diego Zoological Society in association with a consortium of international zookeepers/curators. Thanks to Dave Mitchell (AKF) who tirelessly drove the GIS and to Robert Payne who conducted the vegetation survey and produced a revised vegetation map of the study area. Jane Thompson (AKF) assisted with data entry, data processing, report and map presentation. Additional assistance with data processing was provided by Sam Tabart. Assistance with digitizing was provided by Peta Gleeson. Thanks also go to current and former staff members of Port Stephens Council, particularly S. Ball, K. Gale, S. Leathley, S. O'Connor, G. Warnes. This work also benefited enormously from the assistance of, C. Moon, T. Knott, the NPWS GIS and IT Divisions and other staff of the Hunter District Office of NPWS, F. Faulkner, A. Matthews and J. Ravallion in NPWS Head Office. We would also like to thank I. Dunn for critical comment on the manuscript. This paper is the result of a co-operative effort between the New South Wales National Parks and Wildlife Service, the Australian Koala Foundation and Port Stephens Council. Its completion would not have been possible without the full co-operation shown by all of these agencies.

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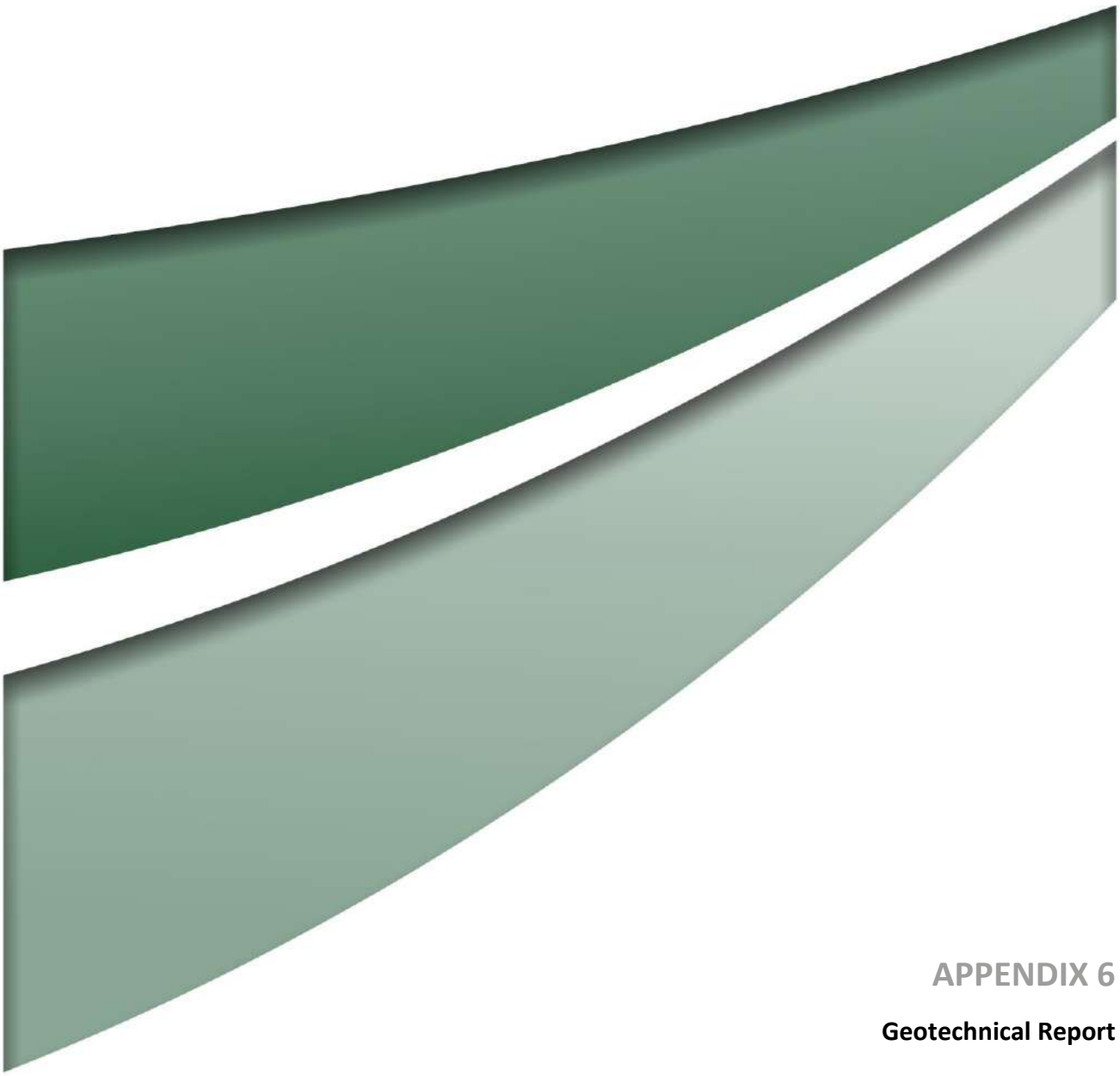

APPENDIX 6

Geotechnical Report

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T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au