Framework for Biodiversity Assessment Report

90 Gindurra Road, Somersby NSW 2250

State Significant Development Application (SSD 8660)

October 2018

NARLA

environmental

Report:	Framework for Biodiversity Assessment Report
Prepared for:	Jackson Environmental Pty Ltd on behalf of Mr and Mrs Ray and Sue Davis
Prepared by:	Narla Environmental Pty Ltd
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Report Certification

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I, Kurtis Lindsay, certify that:

- this document has been prepared in accordance with the brief provided by UNSW and OEH requirements of a Biodiversity Assessment Report.
- the information presented in this report is a true and accurate record of the study findings in the opinion of the authors.

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Contents

1. Glossary and abbreviations

Acronym	Description
BAR	Biodiversity Assessment Report
BioMetric	Refers to the State Government devised methodology for vegetation assessment
BCC	Bio-banking Credit Calculator
DPE	NSW Department of Planning and Environment
Subject Property	90 Gindurra Road, Somersby, NSW 2250
Subject Site	Development Area within 90 Gindurra Road, Somersby NSW 2250
EEC	Endangered Ecological Community
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FBA	Framework for Biodiversity Assessment
IBRA	Interim Bio-regionalisation of Australia
LGA	Local Government Area
LPI	Land and Property Information
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
m	Metres
km	Kilometres
ha	Hectares
TSC Act	NSW *Threatened Species Conservation Act 1995*

2. Introduction

2.1 Project Background

This Biodiversity Assessment Report (BAR) has been prepared to accompany the State Significant Development (SSD) Application (8660) relating to the Kariong Sand and Soil Supplies (KSSS) development at 90 Gindurra Road, Somersby NSW 2250 (Lot 521, DP1017539) (the 'Subject Property') (**Figure 1**).

The Development Area (hereby referred to as the 'Subject Site') for this assessment is defined as the northern part of Lot 521, DP1017539 (**Figure 2**).

The proposal requires a State Significant Development Application (8660) to be lodged to allow the KSSS site to be developed to receive, process and store up to 200,000 tonnes per annum of soil, sand and building materials for recycling and manufacturing.

This Biodiversity Assessment Report has been prepared to meet the requirements of the NSW Biodiversity Offsets Policy for Major Projects (NSW OEH 2014a).

Secretary's Environmental Assessment Requirements (SEARs) have been issued by the Department of Planning and Environment (DPE). The SEARs stipulate that the biodiversity impacts for the proposal be assessed in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014b). The FBA (OEH 2014b) assessment and BAR have been prepared by Kurtis Lindsay (accredited BioBanking assessor No.224), to satisfy the requirements of the SEARs.

The subject site is divided into the following sections:

- 'Cleared' land, comprising much of the centre of the subject site, as well as an area in the north of the subject site;
    - This includes buildings and all areas not affected by native vegetation or significant weed infestations.
- 'Weeds and Exotics' land, comprising the largest area within the Subject Site;
    - This includes all areas that are dominated by exotic vegetation and could not be assigned to a PCT.
- Two (2) Plant Community Types (PCTs), which include:
    - Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast
    - Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast

2.2 Proposed Development

The proposal will cover approximately 6.57 hectares of the site and will be implemented in 2 stages.

Stage 1 (Approved under DA54541/2017):

- Demolish existing corrugated iron sheds;
- Construct office building and warehouse;
- Construct car park next to buildings and new entrance; and,
- Install fence at front of site.

Stage 2 (Approval sought under State Significant Development application SSD8660)

- Excavation works to level site in preparation for construction
- Construct hardstand across operational areas
- Construct onsite road, new entrance and modifications to Gindurra (turning lane)
- Construct stormwater drainage system
- Install weighbridge

- Construct noise barriers of varying heights and lengths at key points identified in the Noise and Vibration Report
- Construct storage bunkers
- Install processing equipment
- Commissioning - up to 30,000 tpa throughput for 3 months
- Fully operational - ramp up to 200,000 tpa throughout.

In order to facilitate the proposed works, the removal of native vegetation is required. To facilitate development of the site through each stage, the complete clearing of the entire subject site (development area) has been assumed, except for a 10 m protected buffer surrounding a population of the threatened flora species, *Melaleuca biconvexa*. A total of 2.50 ha of native vegetation is proposed to be directly impacted by the development.

2.3 Site characteristics

2.3.1 Site Description and Land-use History

The Subject Property is located between Gindurra Road and Kangoo Road and is situated approximately 120m east (at the closes point) of the Pacific Motorway.

The Subject Property covers an area of approximately 10.75 ha, which is currently zoned 'IN1 – General Industrial'. Land adjoining the subject site to the East is zoned 'RU1 – Primary Production', whilst a number of other surrounding properties to the south of the site are zoned for various types of infrastructure.

The Subject Site, which is 6.57 ha in size, has undergone extensive historical clearing, and is now highly infested by exotic weeds with natural regeneration of native vegetation along the western border of the subject site. Much of the weed infested and cleared land is currently occupied by large expanses of old stockpile materials, exotic grasslands, weed infestations and a number of abandoned caravans and site offices.

Native vegetation exists within a strip approximately 50m wide from the north of the subject site along the western border which extends down into the south of the Subject Site. This vegetation eventually leads into in-tact remnant native vegetation outside of the impact zone. Vegetation outside the impact zone was not assessed and therefore not considered part of this BAR.

The southern part of the Subject Property (outside of the Subject Site) isan area totalling 4.1 ha. This area is completely vegetated with remnant vegetation including historically mapped Coastal Upland Swamp Endangered Ecological Community and habitat for threatened flora. The proponent has deliberately avoided clearing this area as part of this proposal, with all native vegetation being retained. Part of the southern portion of the Subject Property is currently a management zone under the Somersby Industrial Zone Plan of Management (Connell Wagner 2005) and contains intact vegetation and habitat for a number of threatened species, including *Prostanthera junonis* and *Hibbertia procumbens.*

2.3.2 Soil Landscapes and Geology

The subject site is situated on the 'Sydney Town Soil Landscape', however is situated on the border of the 'Somersby Soil Landscape' (Chapman & Murphy 1989).

The Sydney Town soil landscape is characterised by undulating to rolling low hills and moderately inclined slopes on quartz sandstone (Hawkesbury Sandstone and Terrigal Formation: Narrabeen Group) along the edge of the Somersby Plateau and as ridges and crests in the Macdonald Ranges and Watagan Mountains. Local relief to 80 m. Slope gradients 5–25%. Ridges and crests are moderately broad, slopes moderately inclined and drainage lines narrow. Occasional rock benches are present.

This landscape is typically situated on Hawkesbury Sandstone—medium- to coarse-grained quartz sandstone with minor shale and laminite lenses; and Narrabeen Group—Gosford Subgroup—Terrigal Formation, lithic/quartz sandstone, siltstone and claystone. Field survey indicates the dominant lithology present is coarse quartz sandstones. The soils of Sydney Town are shallow to deep (150 cm) Yellow Earths, Earthy Sands and some Siliceous Sands on crests and slopes; shallow to moderately deep (150 cm) Siliceous Sands, Leached Sands and Grey Earths in poorly drained areas and drainage lines; moderately deep (100–150 cm) Yellow Podzolic Soils and Gleyed Podzolic Soils associated with shale lenses.

The Somersby soil landscape is characterised by gently undulating to rolling rises on deeply weathered Hawkesbury Sandstone plateau. Local relief to 40 m; slopes are long, and drainage lines are narrow. Extensively cleared low eucalypt open-woodland and scrubland. This landscape is typically situated on Hawkesbury Sandstone—medium- to coarse-grained quartz sandstone with minor shale and laminite lenses. Deep (10 m) weathering in many areas of the sandstone is widespread. Soils are moderately deep to deep (100–300 cm) Yellow Earths and Earthy Sandson crests and slopes with Grey Earths in poorly drained areas and Leached Sands and Siliceous Sands along drainage lines.

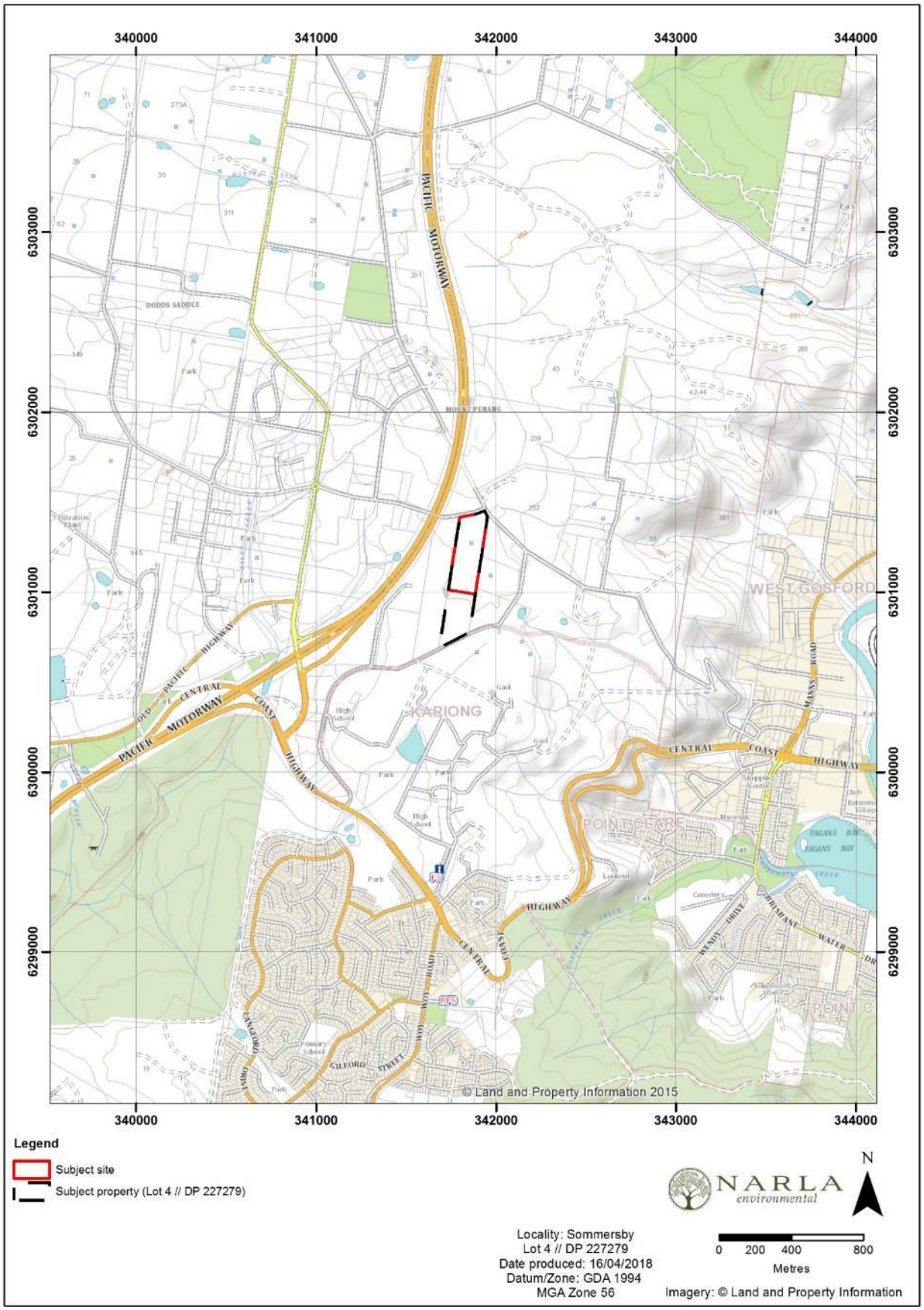

Figure 1: Site location

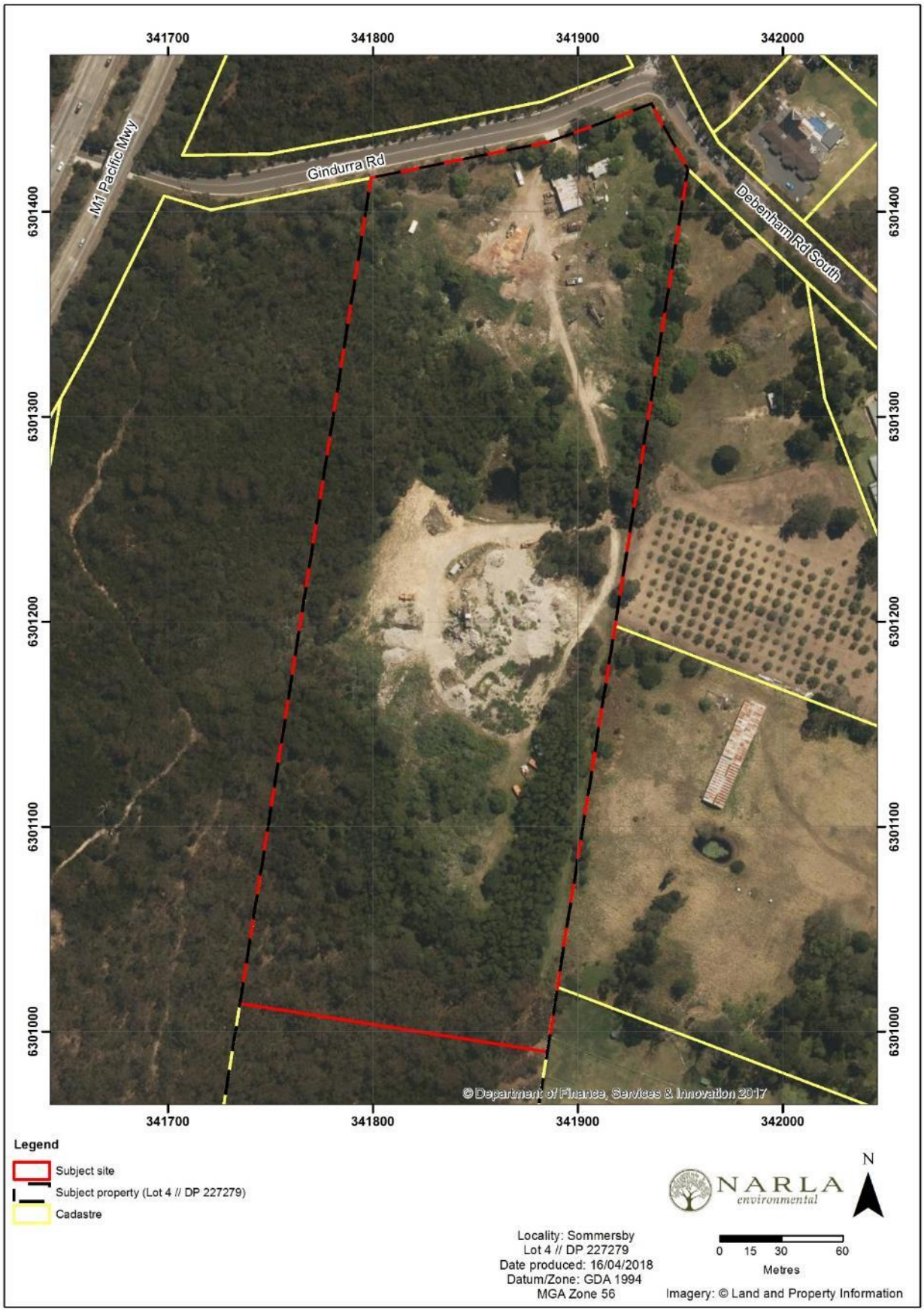

Figure 2: Subject site

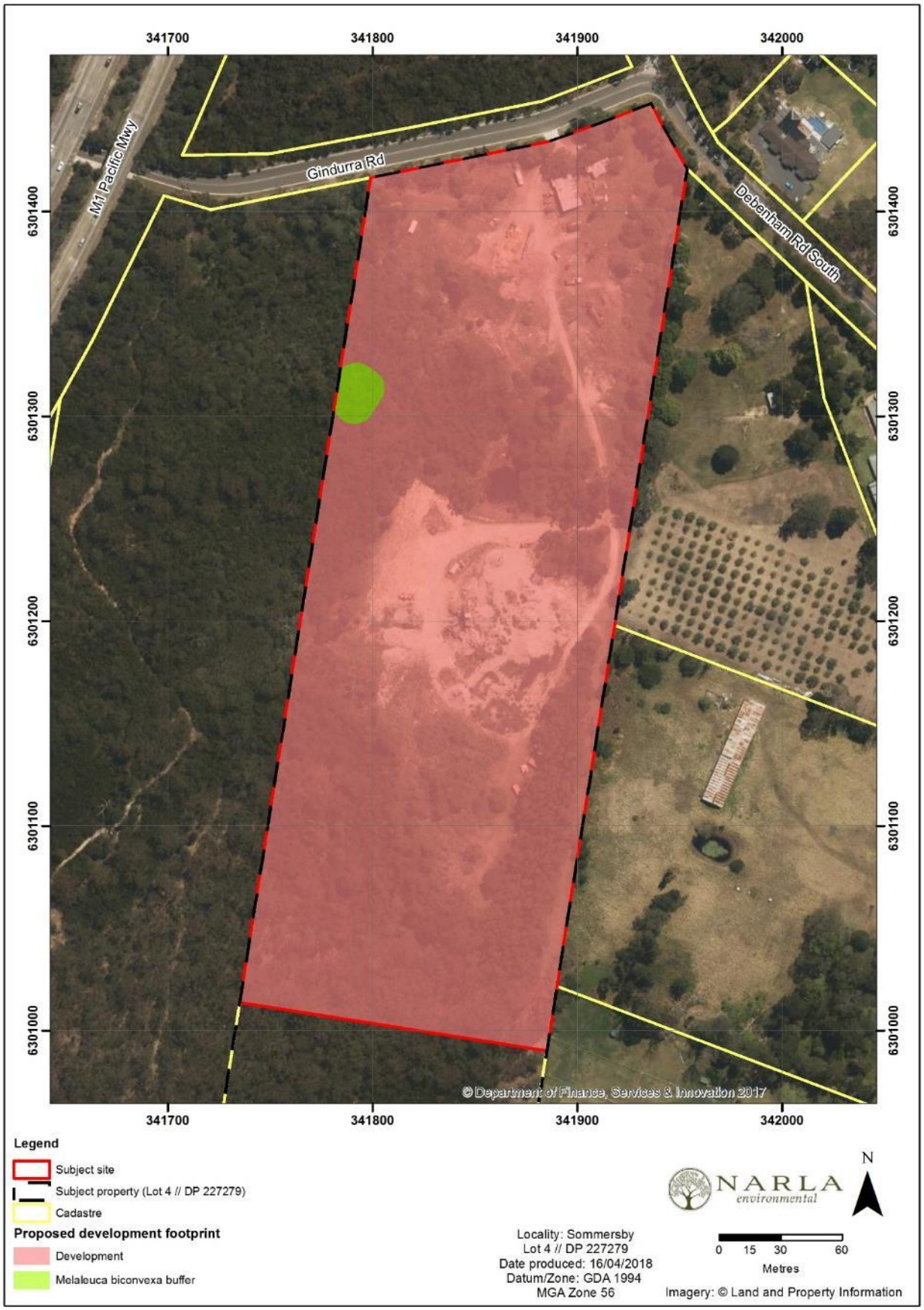

Figure 3: Proposed development footprint

3. Assessing Landscape Features

3.1 IBRA bioregions, IBRA subregions and Mitchell Landscapes

The subject site is within the NSW Sydney Basin IBRA region (version 7) and Pittwater IBRA subregion. The development site occurs entirely within one NSW Mitchell Landscape, 'Somersby Plateau' (Mitchell Landscapes V3.1) (**Figure 5**).

3.2 Percentage of Native Vegetation Cover

The change in native vegetation cover is assessed at two scales, which for this assessment are a 100 ha circle and a 1,000 ha circle. The area of vegetation in each circle before development was mapped using the 'Greater Hunter Vegetation Mapping' (OEH 2012; VIS3855), with the extent of vegetation updated using imagery obtained from NSW LPI SIX Viewer (**Figure 5**). Polygons tagged 'Non Native Vegetation' (MU000) were assumed to not contain native vegetation, and were therefore excluded from this assessment.

The proposed footprint of the development will impact on 2.5 ha of native vegetation, with the after-development calculations taking that impact into account.

The results of the assessment are provided in (**Table 1**). Due to the small amount of clearing no change will occur in either assessment circle, and a score of **0** is allocated for the percent native vegetation score.

Table 1: Change in percent native vegetation for each assessment circle

Assessment circle	Before development (ha)	Before development (%)	After development (ha)	After development (%)
Inner (100 ha)	49.5	46 - 50	47.0	46 - 50
Outer (1000 ha)	564.4	56 - 60	561.9	56 - 60

3.3 Connectivity Value

3.3.1 Rivers, Streams and Estuaries

There are no rivers, streams or estuaries identified within the subject site based on the topographic mapping available (1 : 25,000 scale). The closest drainage feature lies approximately 90m to the east of the subject site and is an unnamed first order stream draining east to Narara Creek. The nearest estuary lies approximately 2km to the east of the subject site, being part of the Brisbane Water Estuary.

The absence of these features was confirmed during the field visit and the proposal is not expected to impact on rivers, streams or estuaries.

3.3.1 Local and Important Wetlands

There are no local or important wetlands located within the subject site or within the 1,000 ha assessment circle.

3.3.2 State and Regional

The site does not incorporate a state or regional biodiversity link approved by the Chief Executive, OEH.

3.3.3 Connectivity Assessment

As the proposed development does not impact on a connectivity value class such as a riparian buffer of a 4th – 6th Strahler stream order, estuary or important wetland, or State or Regional biodiversity link, a complete connectivity assessment was required.

The site adjoins contiguous native vegetation to the west, between the subject site and the M1 Pacific Motorway. The vegetation, although narrow near the subject site, extends north for over 5km before being cut by the M1 Pacific Motorway. To the south of the subject site the connection is far more restricted, ending approximately 500m south of the subject site.

An assessment of the impact of the proposed development on both connectivity width and condition was conducted. Although the development will impact on native vegetation within the subject site, the narrowest part of the link remains off-site, to the north-west of the subject site. The width of the connected link will therefore not be impacted by the proposed development. Due to the small amount of impact proposed within the subject site, and the overall good condition of the link, no reduction in average condition (for either over storey or mid storey) is expected from the development.

As no change in connectivity width or condition is anticipated a score of **0** is allocated for the connectivity score.

Table 2: Change in connectivity width and condition

Connectivity condition	Before development (ha)	After development (ha)
Connectivity width	>30-100m	>30-100m
Over storey condition	PFC at BM	PFC at BM
Mid storey / ground cover condition	PFC of mid storey/ground cover at BM	PFC of mid storey/ground cover at BM

3.4 Patch Size

Patch size was calculated using the site vegetation map combined with all vegetation within 100 m identified through the vegetation mapping amended from OEH (2012) referred to in Section 3.2.

Due to the large, contiguous patch of vegetation extending north (referred to above) the maximum patch size of 1,001ha was entered into the credit calculator. A total patch size score of **12** is recorded.

3.5 Landscape Score

Using the above data, the final landscape score was calculated to be **12**.

3.6 North East Regional Forest Agreement

The North East Regional Forest Agreement (RFA) is one of three RFAs in New South Wales, and comprises two sub regions: Upper North East and Lower North East. The Australian and New South Wales governments signed the North East RFA on 31 March 2000, establishing the framework for the sustainable management of the forests in the North East RFA region (Commonwealth Department of Agriculture and Water Resources 2018).

This Regional Forest Agreement (RFA) establishes the framework for the management of the forests of the Upper North East and Lower North East regions. Parties are committed to ensuring the Agreement is durable and that the obligations and commitments that it contains are delivered to ensure effective conservation, forest management and forest industry outcomes.

The purpose of the RFA is to:

- identify areas in the region or regions that the Parties believe are required for the purposes of a Comprehensive, Adequate and Representative Reserve System, and provides for the conservation of those areas;
- provide for the ecologically sustainable management and use of forested areas in the regions;
- provide long-term stability of forests and forest industries; and
- have regard to studies and projects carried out in relation to all of the following matters that are relevant to the regions:
    - environmental values, including Old Growth, Wilderness, endangered species, National Estate Values and World Heritage Values;
    - Indigenous heritage values;
    - economic values of forested areas and forest industries;
    - social values (including community needs); and
    - principles of Ecologically Sustainable Forest Management.

The Subject Site is mapped as 'Other Tenure – Freehold Land, Crown Land and Other Tenures' within 'Map 1 (B) Lower North East Region' which displays land tenure and zoning including Comprehensive, Adequate and Representative (CAR) Reserve System.

As the Subject Site is not mapped within a CAR Reserve System, the RFA does not apply to the Subject Site.

3.7 Regional Forest Agreements Act 2002

The main objectives of the Regional Forest Agreements Act 2002 (RFA Act) are as follows:

- to give effect to certain obligations of the Commonwealth under Regional Forest Agreements;
- to give effect to certain aspects of the National Forest Policy Statement;
- to provide for the existence of the Forest and Wood Products Council.

The Subject Site is not covered under the Regional Forest Agreements Act 2002.

3.8 Groundwater Dependent Ecosystems

Groundwater plays an important role in sustaining aquatic and terrestrial ecosystems, such as springs, wetlands, rivers and vegetation. Understanding these groundwater-dependent ecosystems (GDEs) is essential for groundwater management and planning (Bureau of Meteorology 2018).

The Groundwater Dependent Ecosystems Atlas (GDE Atlas) was developed as a national dataset of Australian GDEs to inform groundwater planning and management. It is the first and only national inventory of GDEs in Australia (Bureau of Meteorology 2018).

The Atlas contains information about three types of ecosystems:

- Aquatic ecosystems that rely on the surface expression of groundwater–this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs. Marine and estuarine ecosystems can also be groundwater dependent, but these are not mapped in the Atlas.
- Terrestrial ecosystems that rely on the subsurface presence of groundwater–this includes all vegetation ecosystems.
- Subterranean ecosystems–this includes cave and aquifer ecosystems.

Narla Environmental accessed the GDE Atlas on 23rd October 2018 which revealed that there are no GDEs within the Subject Site (**Figure 4**). The Narla Ecologists did not find any vegetation communities or other ecosystems that would meet the definition of GDE during the site assessment.

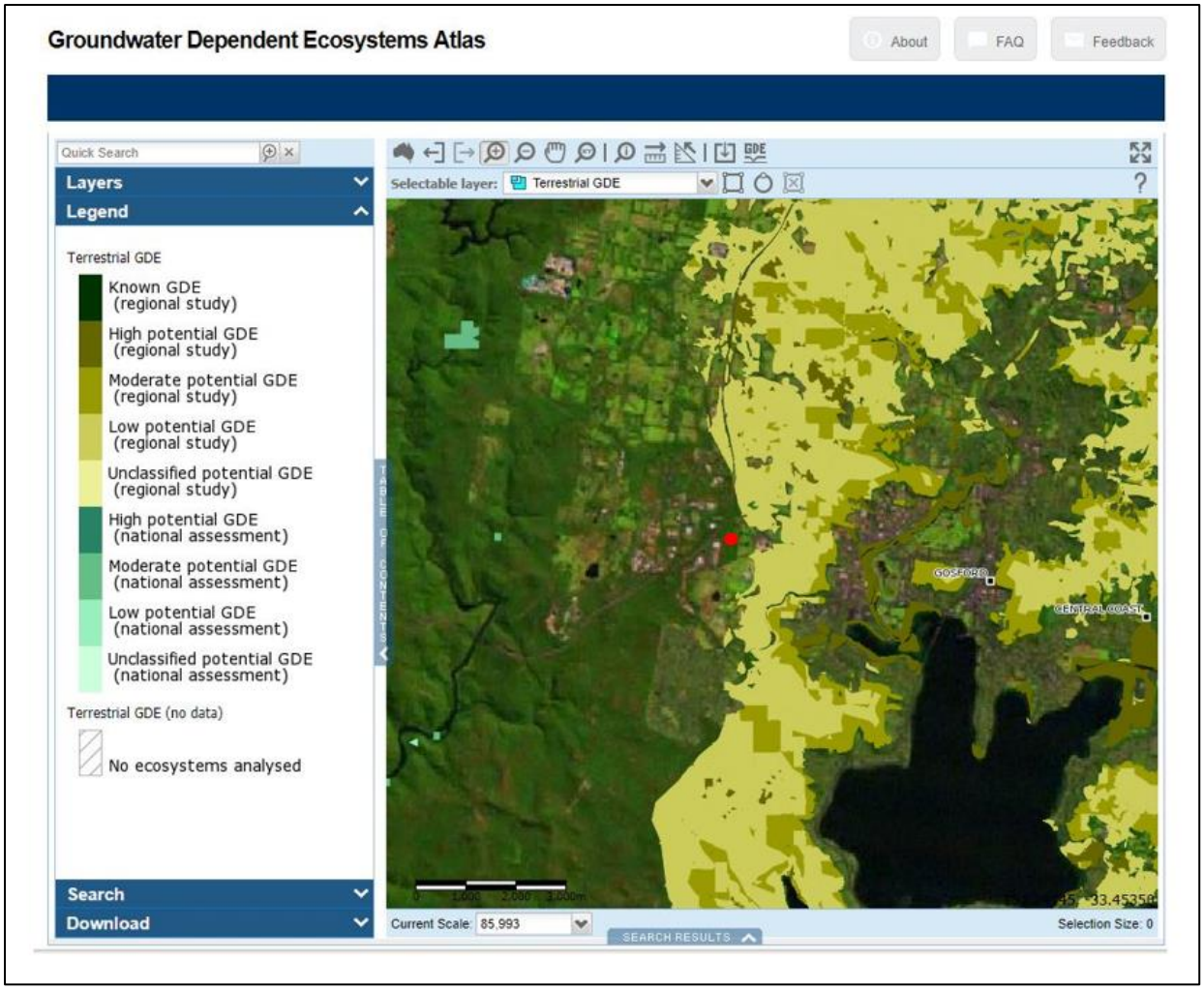

Figure 4. Groundwater Dependent Ecosystems as provided by the GDE Atlas on 23rd October 2018. Subject Site indicated by Red point.

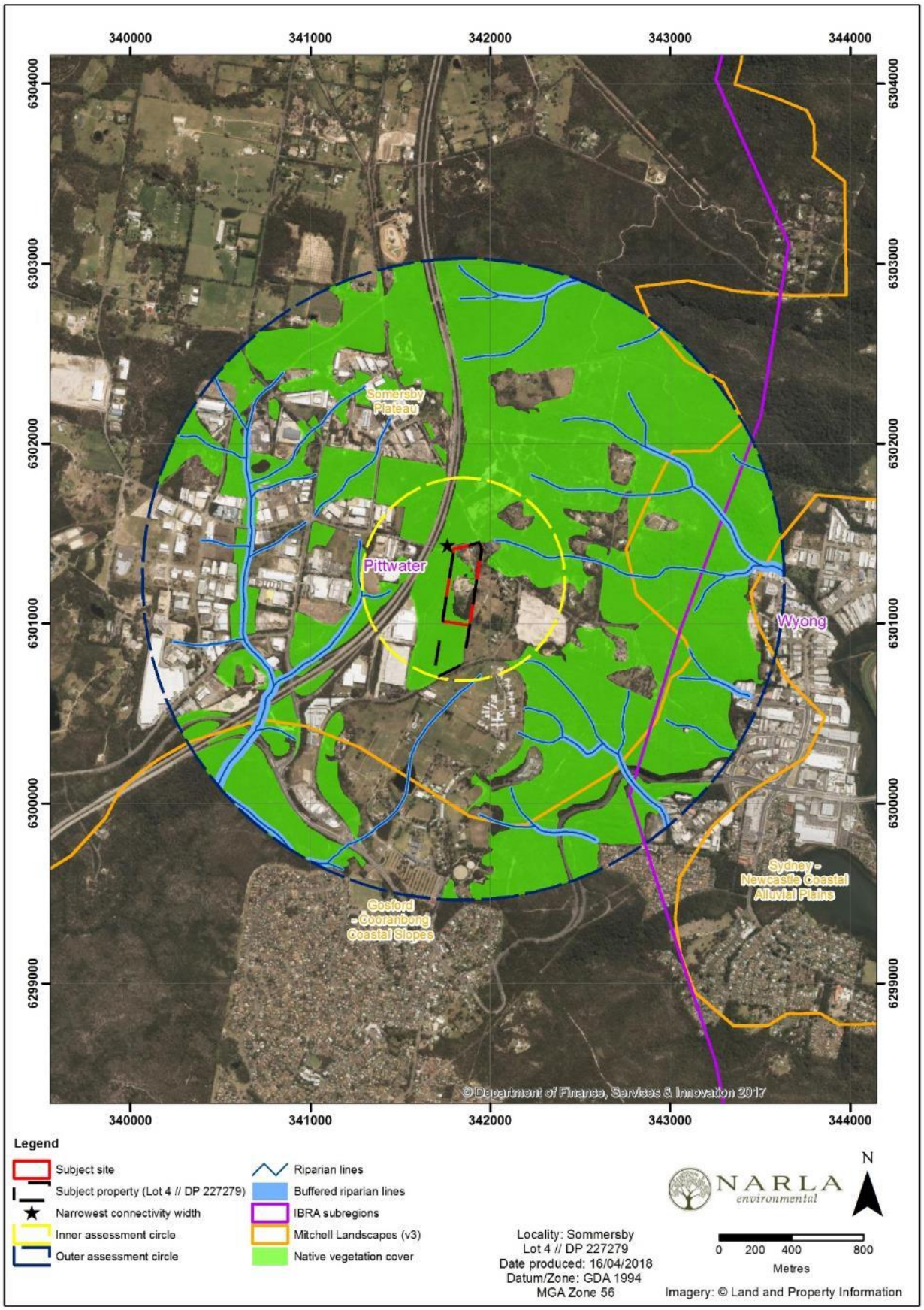

Figure 5: Location map

4. Assessing Native Vegetation

4.1 Description of The Native Vegetation on the Subject Site

4.1.1 Desktop Assessment

Vegetation within the subject site had been historically mapped within the Gosford Mapping System (Bell 2004) within three vegetation communities, including:

- E29 - Hawkesbury Banksia Scrub – Woodland
- E26 - Exposed Hawkesbury Woodland
- Xr - Disturbed - Canopy Only

Greater Hunter Native Vegetation Mapping (Sivertsen et al. 2011) revealed that the subject site contained only one vegetation community (**Figure 6)**

- Scribbly Gum / Red Bloodwood / Old Man Banksia heathy woodland of southern Central Coast

4.1.2 Site Assessment

Site assessment was undertaken by Narla Environmental Ecologists over the course of three days; 16th January 2018, 13th February 2018 and 10th April 2018. The Ecologists determined that a large portion of the subject site contained existing stockpiles of a range of materials including large slabs of concrete, polystyrene, corrugated iron and conglomerate rocks, surrounded by large weed infestations and exotic pasture grasses. Native vegetation was restricted mainly to the western boundary of the subject site, in which vegetation was derived from two vegetation communities.

4.2 Identifying Native PCTs and Ecological Communities

Vegetation type (Bell 2004)	Plant Community Type	Total area (ha)
Exposed Hawkesbury Woodland – Banksia Scrub Woodland Variant	1783 - Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	2.19
Exposed Hawkesbury Woodland – Type Variant	1783 - Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	
Exposed Hawkesbury Woodland – Type Variant	1776 - Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	0.31
-	Cleared land	1.65
-	Dam	0.04
-	Weeds and exotics	2.38
	Total area (ha)	**6.57**

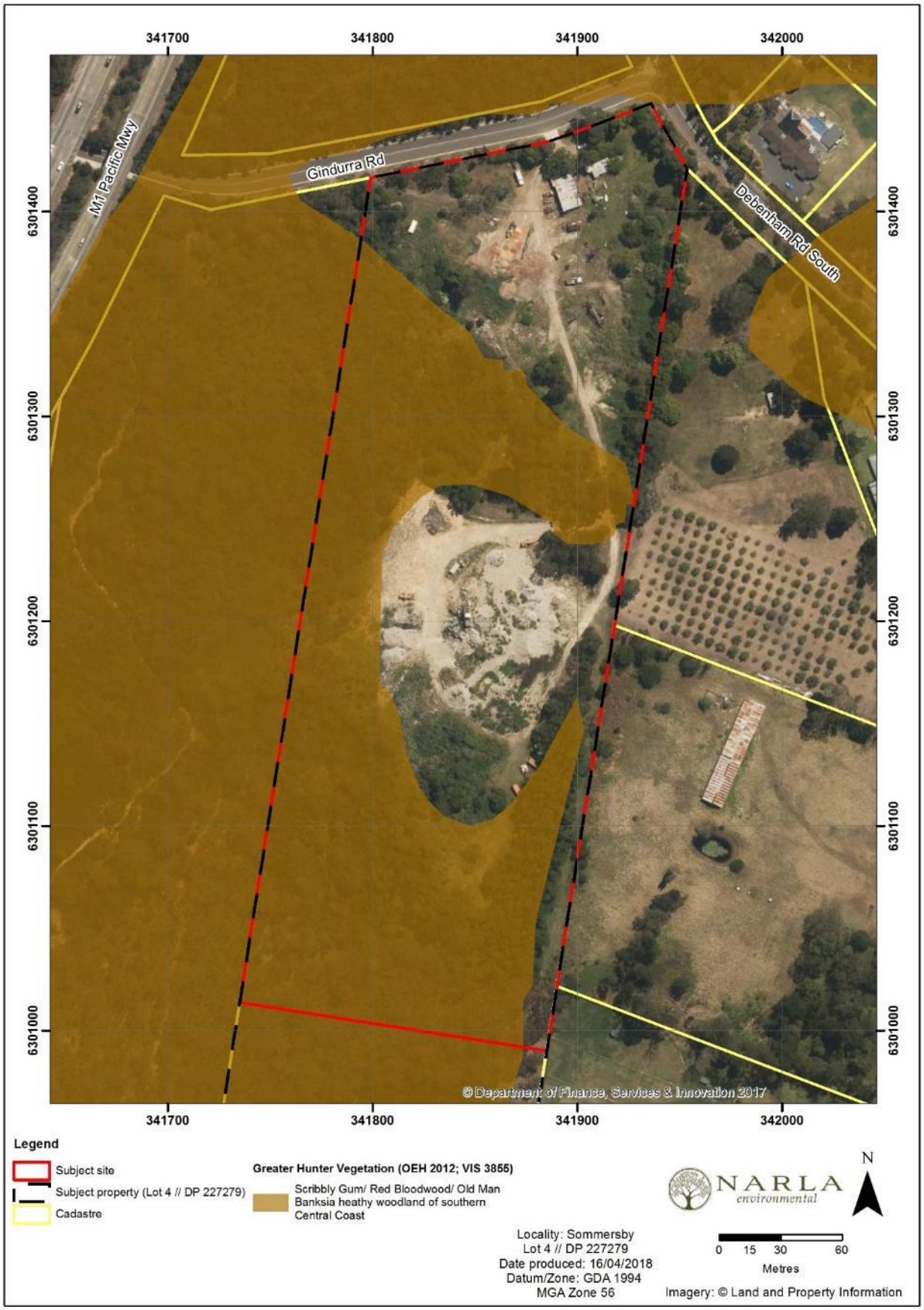

Figure 6: Mapped vegetation (Sivertsen et al. 2011)

4.2.1 PCT 1783 - Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast

Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (PCT 1783) was determined to be the dominant native vegetation community across much of the western boundary of the subject site (**Figure 6**). This community was represented within the subject site in two condition classes; low condition and moderate to good condition, based on structure, floristic assemblage and level of weed infestation.

- PCT 1783 low condition class was dominated by *Leptospermum polygalifolium* (Tantoon), *Acacia parramattensis* (Parramatta Wattle), *Acacia decurrens* (Black Wattle) with scattered *Eucalyptus punctata* (Grey Gum). This condition class was dominated by weeds and had a low native canopy overstory and groundcovers (shrubs, grasses and other). Condition class was calculated as per the Framework for Biodiversity Assessment (NSW OEH 2014b).
- PCT 1783 moderate to good condition class reflected the above floristic diversity, with a higher species richness of canopy species, including *Eucalyptus capitellata* (Brown Stringybark), *Angophora costata* (Sydney Red Gum) and *Corymbia gummidera* (Red Bloodwood), and a midstory of a broader range of Banksia sp. including Banksia ericifolia (Heath-leaved Banksia), *Banksia oblongifolia* (Fern-leaved Banksia), *Banksia marginata* (Silver Banksia) and *Banksia serrata* (Old-man Banksia) and a groundcover dominated by *Imperata cylindrica* (Blady Grass) with other scattered shrubs, grasses and herbs. This condition class contained some weed infestations on the outer edges, and smaller occurrences throughout. The community included patches of tall senescent Banksia ericifolia, reflecting the low fire frequency history within the subject site. Condition class was calculated as per the Framework for Biodiversity Assessment Guidelines (NSW OEH 2014b).

Refer to **Appendix 1** for a full species list.

Plate 1: Low condition PCT 1783 within the subject site

Plate 2. Moderate to good condition PCT 1783 within the subject site

4.2.2 PCT 1776 - Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast

Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast (PCT 1776) was represented by a small patch in the south-west corner of the Subject Site (**Figure 6**). This community was identified by a floristic assemblage dominated by *Syncarpia glomulifera* (Turpentine), Sydney Red Gum, Red Bloodwood, and Broad-leaved Scribbly Gum and *Allocasuarina littoralis* with a sparse shrub layer consisting of *Leucopogon juniperinus* (Prickly Beard-heath) with minimal groundcovers including *Xanthosia pilosa* (Woolly Xanthosia), *Xanthosia tridentata* (Rock Xanthosia), *Bossiaea obcordata* (Spiny Bossiaea), *Hovea linearis* among other shrubs, grasses and herbs. The vegetation was mapped in moderate to good condition.

Refer to **Appendix 1** for a full species list.

Plate 3. Moderate to good condition PCT 1776 within the subject site

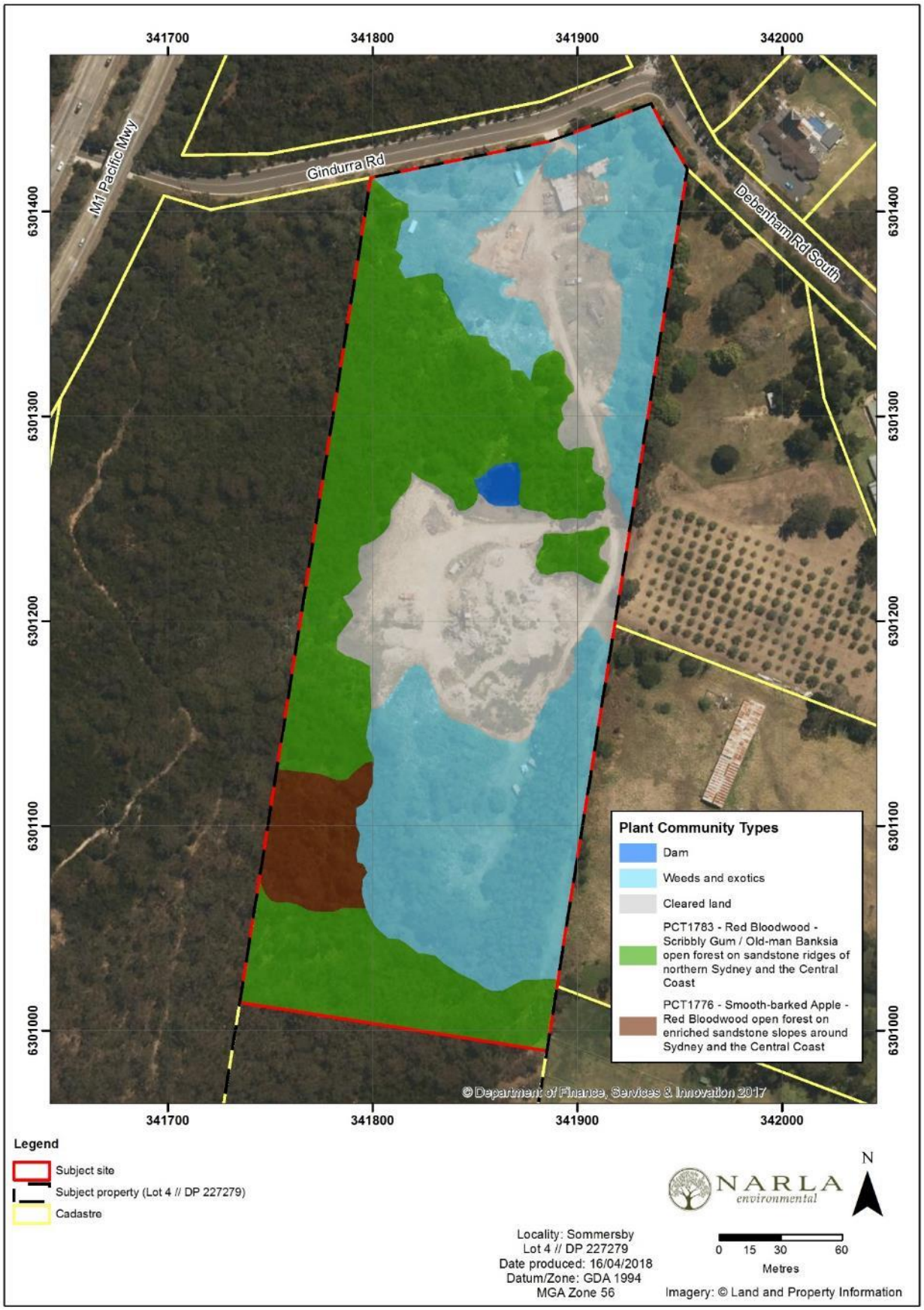

Figure 7: Field Validated Plant Community Types

4.3 Identifying Vegetation Zones

Three (3) vegetation zones were identified based on the PCT classification described above and an assessment on condition consistent with the requirements of the FBA (OEH 2014b) (**Table 3; Figure 8**). Condition class was determined by the Narla Environmental Ecologists, based on the definitions of 'Low condition' and 'Moderate-Good condition' vegetation within the FBA (OEH 2014b).

The Framework for Biodiversity Assessment defines 'Vegetation in Low Condition' as:

- *"Woody native vegetation with native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and where either:*
    - *Less than 50% of ground cover vegetation is indigenous species, or*
    - *Greater than 90% of ground cover vegetation is cleared*

OR

- *Native grassland, wetland or herbfield where either:*
    - *Less than 50% of ground cover vegetation is indigenous species, or*
    - *More than 90% of ground cover vegetation is cleared.*

Native vegetation that is not in low condition is in moderate to good condition"

The impact to each vegetation zone includes the construction of roads, stockpile areas and facilities, where complete clearing will be required. As described earlier this assessment is assuming total clearing of the site, except for a buffer area which is to be avoided due to the presence of *Melaleuca biconvexa* individuals. The total impact to native vegetation from complete clearing is 2.5 ha.

A total of 0.06 ha of vegetation will be retained within the subject site, within the buffer area protected due to the presence of *Melaleuca biconvexa* individuals. This is in addition to the 4.1 ha of native vegetation within the subject property which has been avoided, which lies south of the subject site.

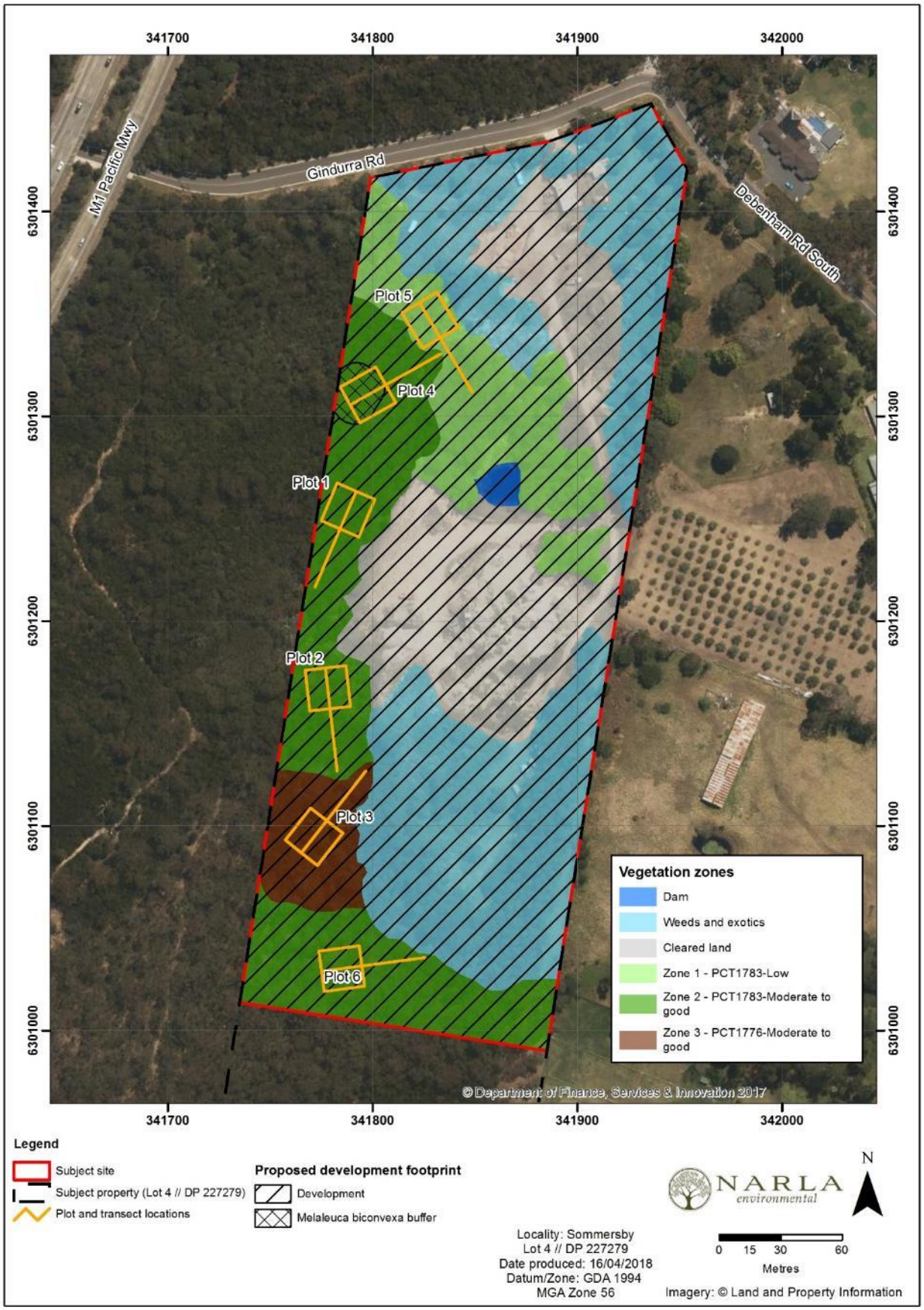

Figure 8: Vegetation zones and plot and transect locations

Table 3: Vegetation zones within the subject site

Vegetation zone ID	PCT ID	Common Name	PCT name	Condition	Area impacted (ha) - clearing
Zone 1: PCT 1783 – Low Condition	PCT1783	Sydney North Exposed Sandstone Woodland	Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	Low	0.78
Zone 2: PCT 1783 – Moderate to Good Condition	PCT1783	Sydney North Exposed Sandstone Woodland	Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	Moderate to Good	1.41
Zone 3: PCT 1776 – Moderate to Good Condition	PCT1776	Coastal Enriched Sandstone Dry Forest	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	Moderate to Good	0.31
				Total	**2.50**

4.4 Biometric Plots and Transects

Site assessment was undertaken by Narla Environmental Ecologists Emily Benn and Nathan Banks over the course of three days; 16th January 2018, 13th February 2018 and 10th April 2018, including plot and transect based surveys (as per the FBA - OEH 2014b). Both Ecologists were experienced in the undertaking of field assessment and environmental restoration works within the Sydney Basin region, particularly in sandstone woodland vegetation.

Table 4: Weather conditions taken from the nearest weather station (Gosford) in the lead up and during the field survey (BOM 2018) (Survey dates in bold)

Survey date	Minimum Temp.	Maximum Temp. °C	Rainfall (mm)
9/1/18	21.7	29.8	18.2
10/1/18	20.1	23.5	2.8
11/1/18	17.7	24.8	0
12/1/18	20.1	29.4	0
13/1/18	23.4	35.8	0
14/1/18	16.2	23.1	0
15/1/18	16.4	23.8	0
16/1/18	**17.6**	**22.5**	**0.8**
6/2/18	16.5	26.9	0
7/2/18	16.1	27.1	0
8/2/18	15.8	29.3	0
9/2/18	18.1	30.8	0
10/2/18	20.5	29.1	1.0
11/2/18	21.5	34.0	0.4
12/2/18	20.2	28.5	0
13/2/18	**22.8**	**28.7**	**0**
3/4/18	19.3	24.2	40.6
4/4/18	19.1	24.7	0.2
5/4/18	16.8	26.8	1.6
6/4/18	15.3	25.7	0
7/4/18	16.1	28.3	0
8/4/18	16.0	27.6	0
9/4/18	16.3	34.2	0
10/04/18	**18.3**	**24.2**	**0**

Six (6) plots and transects were established within the Subject Site to best sample the natural variation of the vegetation across the Subject Site. This exceeds the requirements of the FBA (OEH 2014b), which sets the minimum as 1 plot and transect per 2 ha (or part thereof), increasing proportionally with the size of the vegetation zone.

Plots were randomly stratified to attain best coverage across the Subject Site. Due to the relatively small impact from the proposed development plots and transects were completed across the subject site as to not bias the assessment. An example of the plot sheets used is provided in **Appendix 2**.

The summarised results obtained from each plot are provided in **Table 5**. The (6) six plot and transect locations are shown in **Figure 8**.

Table 5: Biometric plot and transect results

Plot No.	1	2	3	4	5	6
Vegetation zone	Zone 2	Zone 2	Zone 3	Zone 2	Zone 1	Zone 2
Coordinates (Easting)	341792	341776	341765	341787	341822	341777
Coordinates (Northing)	6301262	6301176	6301086	6301307	6301355	6301031
Native Plant Species Richness (%)	29	29	18	23	6	39
Native Over-storey Cover (%)	24	20.5	20.5	5	1.1	43.5
Native Mid-storey Cover (%)	16.5	12.2	11.7	12	18.2	5.5
Native Ground Cover (Grasses) (%)	4	50	24	40	16	40
Native Ground Cover (Shrubs) (%)	18	32	14	6	6	18
Native Ground Cover (Other) (%)	56	8	2	2	4	6
Exotic Plant Cover (%)	16	12	0	49.6	88	0
Number of Trees with Hollows	0	3	0	0	1	18
Over-storey Regeneration (score) (%)	1	1	0.66	1	0	1
Fallen Logs (m)	27	41	26	14	26	57

4.5 Current and Future Site Value Scores

The current and future site value scores for the vegetation zones assessed were calculated based on the data from the six plots and transects collected on site and entered into the BCC. As described above, the complete clearing of the subject site site (apart from the *Melaleuca biconvexa* population and associated 10 m buffer) has been assessed.

The current site value scores range between 45.31 / 100 to 83.85 / 100 (Table 6). For areas of complete clearing the future site value score is 0 / 100.

Table 6: Current and future site value scores

Vegetation zone ID	PCT ID	PCT name	Condition	Area impacted - (ha)/	Current site value	Future site value - clearing
Zone 1: PCT 1783 – Low Condition	PCT1783	Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	Low	0.78	45.31	0
Zone 2: PCT 1783 – Moderate to Good Condition	PCT1783	Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	Moderate to Good	1.41	83.85	0
Zone 3: PCT 1776 – Moderate to Good Condition	PCT1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	Moderate to Good	0.31	48.96	0

5. Assessing Threatened Species and Populations

5.1 Species Credit Species

5.1.1 Geographic and Habitat Features

Species credit species are those species that cannot be reliably predicted by habitat surrogates, the PCT or distribution, and therefore require additional assessment, and potentially targeted survey.

A component of preparing a candidate species list for survey includes the completion of geographic and habitat questions required by the BCC. The question posed and responses are provided below (**Table 7**). No impact will occur through the proposal to any species or habitat type listed in the geographic/habitat questions in the BCC.

Table 7: Assessment of geographic and/or habitat features

Common name	Scientific name	Feature	Impacted?
Rosenberg's Goanna	*Varanus rosenbergi*	Land within 250 m of termite mounds or rock outcrops	Yes
Red-crowned Toadlet	*Pseudophryne australis*	Heath or eucalypt forest on sandstone with a build-up of litter or other debris and containing, or within 40 m of, ephemeral or intermittent drainage lines	Yes
Giant Barred Frog	*Mixophyes iteratus*	Land below 1000 m in altitude and within 40 m of rainforest or eucalypt forest with deep leaf litter	No – the nearest rainforest/eucalypt forest with, suitablem deep leaf litter is substantially further from the subject site than 40m.
Large-eared Pied Bat	*Chalinolobus dwyeri*	Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	No – No sandstone escarpments, rock crevices or flat sandstone rocks on exposed cliff edges or sandstone outcropping were present within or near the subject site.
Giant Burrowing Frog	*Heleioporus australiacus*	Land within 40 m of heath, woodland or forest	Yes
Broad-headed Snake	*Hoplocephalus bungaroides*	Land within 500 m of sandstone escarpments with hollow-bearing trees, rock crevices or flat sandstone rocks on exposed cliff edges and sandstone outcropping	No – No sandstone escarpments, rock crevices or flat sandstone rocks on exposed cliff edges or sandstone outcropping were present within or near the subject site.

Common name	Scientific name	Feature	Impacted?
Eastern Osprey	*Pandion cristatus*	Land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters	No – Whilst one small ephemeral dam occurs within the subject site, it is not large enough to contain foraging habitat for the species. The closest water body that may provide intermittent foraging habitat for the species is substantially further than 40m from the subject site.
Squirrel Glider population, Barrenjoey Peninsula	*Petaurus norfolcensis* - endangered population Barrenjoey Peninsula	High nectar-producing shrubs & trees (including Acacias, Banksias, Corymbias, Eucalypts, mistletoes and Xanthorrhoeas)	No – The subject site is outside the species distribution for this population.
Koala population, Pittwater Local Government Area	*Phascolarctos cinereus* - endangered population Pittwater	Land within 40 m of eucalypt forests and woodlands	No –the subject site is outside the Pittwater Local Government Area.
Lasiopetalum joyceae	*Lasiopetalum joyceae*	Lateritic to shaley ridgetops	Yes

5.1.2 Candidate List for Survey

5.1.2.1 Fauna Species

Narla Environmental performed specialised surveys to target all potentially occurring threatened fauna (**Table 3**). These targeted surveys were undertaken during the same period as the collection of the BioMetric Plot data, between 16th January 2018 to 10th April 2018. After answering the geographic and habitat questions the BCC produces a candidate species list for further consideration. Consistent with Section 6.5.1.3 of the FBA (OEH 2014b), each species listed was reviewed and a habitat assessment conducted to determine if the species required further assessment, including targeted survey.

Ten (10) fauna species and one endangered population were identified by the BCC as requiring further consideration. Nine of these species were subject to targeted survey within the subject site utilising the described fauna detection methods.

Cercartetus nanus (Eastern Pygmy Possum) was confirmed on the subject site through targeted surveys (**Figure 9**). No other threatened fauna were observed within the subject site.

Figure 9. Eastern Pygmy Possums recorded within the subject site captured by Narla Environmental using remote cameras

Remote Camera Trapping

Ten (10) Remote Camera Traps were deployed across the Subject Site during the 16th January 2018 to 13th February 2018. These were installed in a range of vegetation communities, and microclimates; with the aim of capturing fauna which were utilising various habitat features, such as the escarpment, boulders, open ground and dense vegetation. Five cameras were set close to the ground, to target ground dwelling species such as Rosenberg's Goanna and Spotted-Tailed Quoll, whereby cameras were aimed at lures baited with meat. Five cameras were established facing Banksia flowers sprayed with a mixture of honey and water to attract Eastern Pygmy Possums, Squirrel Glider and other threatened nectarivorous birds and mammals.

Bat Acoustic Monitors

One bat acoustic monitor (*Song Meter SM4 Bat*) was installed within habitat most likely to be utilised by micro-bats. The SM4 was installed directed at a flyway, within material made up of a large pile of debris that contained several small anthropogenic caves and crevices. The unit was deployed within the field for a total of fifteen (15) nights. Analysis of the collected data was undertaken by a bat specialist Peter Knock (2018).

Spotlighting

Active spotlight fauna searches within the site were undertaken on two nights during the 16th January 2018 and 13th February 2018. Searches were initiated an hour or more after sunset and involved a meandering walk through the site, whilst also searching canopy, crevices, under logs and within dense foliage. Each spotlight search was of approximately 2 hours duration.

Fauna Call Playback

Call playback was undertaken to target a number of suspected threatened species with appropriate habitat available within the site. Red-crowned Toadlet, Giant Burrowing Frog, Giant Barred Frog and Green and Golden Bell Frog calls were played around the dam within the north of the subject site. These were undertaken both diurnally and during spotlighting. Call playback was performed over the course of two nights from two locations each night.

Opportunistic sightings and analysis of scats, tracks and traces

During all site visits, throughout the project opportunistic fauna observations including sightings, scats, tracks, characteristic scraps on trees, burrows and bone were collected. These were identified within the site, and/or used as focus areas to position additional targeted survey techniques to determine species presence.

5.1.2.2 Flora Species

Thirteen (13) threatened 'species credit' flora species were deemed as having potential to occur on the subject site. Targeted surveys were conducted for each of these species by Narla Ecologists Emily Benn and Nathan Banks during the field assessment on the 16th January 2018 and 10th April 2018. The Random Meander technique documented by Cropper (1993) was employed with maximum effort directed toward sampling areas likely to be directly affect by the proposal. This survey period aligned with the flowering period (when the species are most conspicuous) of most flora species, thereby having the greatest chance of displaying key diagnostic features.

During targeted surveys, Narla Ecologists identified the presence of one threatened flora species within the subject site, *Melaleuca biconvexa*, which is listed as Vulnerable under the TSC Act and EPBC Act. Fifteen (15) individual specimens were recorded on the subject site (**Figure 10**). The occurrence of *Melaleuca biconvexa* was restricted to the western boundary of the subject site, confined to a small patch of mature individuals with evidence of regeneration. This species will not be impacted by the proposed development, due to a 10m buffer being placed around the population and excluded from development. Please note that *Melaleuca biconvexa* was not initially identified by the BCC.

No other threatened flora species were identified within the subject site during site inspection.

Figure 10. *Melaleuca biconvexa* within the subject site

Table 8: Identifying candidate species for further assessment (species credit species)

Common name	Scientific name	TSC Act status	EPBC Act status	Further Assessment Required	Justification
Ancistrachne maidenii	*Ancistrachne maidenii*	Vulnerable	Not Listed	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered	Critically Endangered	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Thick-leaf Star-hair	*Astrotricha crassifolia*	Vulnerable	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Thick Lip Spider Orchid	*Caladenia tessellata*	Endangered	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Netted Bottle Brush	*Callistemon linearifolius*	Vulnerable	Not Listed	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Gang-gang Cockatoo population, Hornsby and Ku-ring-gai Local Government Areas	*Callocephalon fimbriatum population in the Hornsby and Ku-ring-gai Local Government Areas*	Endangered Population	Not Listed	No	The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area. The subject site is therefore outside of the expected range of this species, and holds no suitable foraging or nesting habitat. No previous records are found to occur on the subject site or immediate surroundings.
Eastern Pygmy-possum	*Cercartetus nanus*	Vulnerable	Not Listed	Yes	Targeted surveys confirmed that this species is present within the subject site. Credit calculations have been determined and are discussed in Section 6.
Large-eared Pied Bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Leafless Tongue Orchid	*Cryptostylis hunteriana*	Vulnerable	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.

Common name	Scientific name	TSC Act status	EPBC Act status	Further Assessment Required	Justification
Darwinia glaucophylla	*Darwinia glaucophylla*	Vulnerable	Not Listed	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Darwinia peduncularis	*Darwinia peduncularis*	Vulnerable	Not Listed	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Diuris bracteata	*Diuris bracteata*	Endangered	Extinct	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Giant Burrowing Frog	*Heleioporus australiacus*	Vulnerable	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Hibbertia puberula	*Hibbertia puberula*	Endangered	Not Listed	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Southern Brown Bandicoot (eastern)	*Isoodon obesulus subsp. obesulus*	Endangered	Endangered	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Lasiopetalum joyceae	*Lasiopetalum joyceae*	Vulnerable	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Deane's Paperbark	*Melaleuca deanei*	Vulnerable	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Grove's Paperbark	*Melaleuca groveana*	Vulnerable	Not Listed	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Giant Barred Frog	*Mixophyes iteratus*	Endangered	Endangered	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.

Common name	Scientific name	TSC Act status	EPBC Act status	Further Assessment Required	Justification
Squirrel Glider	*Petaurus norfolcensis*	Vulnerable	Not Listed	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Koala	*Phascolarctos cinereus*	Vulnerable	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Pimelea curviflora subsp. curviflora	*Pimelea curviflora subsp. curviflora*	Vulnerable	Vulnerable	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Red-crowned Toadlet	*Pseudophryne australis*	Vulnerable	Not Listed	No	No individuals were recorded on the subject site during the site assessment. Site assessment revealed that the subject site provided suboptimal habitat to the species.
Rosenberg's Goanna	*Varanus rosenbergi*	Vulnerable	Not Listed	No	A targeted survey was undertaken for this species following relevant guidelines, with no individuals found within the subject site or the immediately adjoining area. There are no previous records for this species within the subject site or immediate surrounds.
Biconvex Paperbark	*Melaleuca biconvexa*	Vulnerable	Vulnerable	Yes	Targeted survey conducted within the subject site revealed approximately 15 individuals within the subject site and were confirmed to be restricted to this patch of vegetation. As the area containing the individual *Melaleuca biconvexa* is outside the development footprint this species requires no further assessment.

5.1 Ecosystem Credit Species

5.1.1 Predicted Ecosystem Credit Species

Species that require ecosystem credits have a high likelihood of being present on the development site, based on the data entered into the BCC including PCT details, patch size and the location of the development.

Nineteen (19) ecosystem credit species were identified by the BCC (**Table 9**). A habitat assessment was conducted for each species to determine if the species should remain in the assessment or be removed consistent with Section 6.3.1.8 of the FBA (OEH 2014b).

One ecosystem credit species Barking Owl (*Ninox connivens*) was confirmed on site, with potential habitat for the other 18 species also considered present. Therefore, all ecosystem species were maintained in the assessment.

Table 9: Identifying candidate species for further assessment (ecosystem credit species)

Common name	Scientific name	TSC Act status	EPBC Act status	Species present in vegetation zone?
Barking Owl	*Ninox connivens*	Vulnerable	-	Yes – Species Confirmed on Site
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis subsp. gularis*	Vulnerable	-	Potential
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable	-	Potential
Eastern Freetail-bat	*Mormopterus norfolkensis*	Vulnerable	-	Potential
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Vulnerable	-	Potential
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Vulnerable	-	Potential
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Vulnerable	-	Potential
Little Eagle	*Hieraaetus morphnoides*	Vulnerable	-	Potential
Little Lorikeet	*Glossopsitta pusilla*	Vulnerable	-	Potential
Masked Owl	*Tyto novaehollandiae*	Vulnerable	-	Potential
New Holland Mouse	*Pseudomys novaehollandiae*	Not Listed	Vulnerable	Potential
Powerful Owl	*Ninox strenua*	Vulnerable	-	Potential
Scarlet Robin	*Petroica boodang*	Vulnerable	-	Potential
Sooty Owl	*Tyto tenebricosa*	Vulnerable	-	Potential
Spotted-tailed Quoll	*Dasyurus maculatus*	Vulnerable	Endangered	Potential
Square-tailed Kite	*Lophoictinia isura*	Vulnerable	-	Potential
Swift Parrot	*Lathamus discolor*	Endangered	Critically Endangered	Potential
Turquoise Parrot	*Neophema pulchella*	Vulnerable	-	Potential
Varied Sittella	*Daphoenositta chrysoptera*	Vulnerable	-	Potential

6. Impact Assessment and Credit Calculations

6.1 Final project footprint and assessment of impacts

The proposed development is restricted to the northern sections of 90 Gindurra Road, Somersby NSW (Lot 4 // DP 227279). The total area of the Subject Property is 10.75 ha, with the Subject Site (area proposed for development) totalling 6.57 ha. Total impacts to native vegetation total 2.50 ha, with the remainder of the Subject Site consisting of already cleared land, or dominated by exotic vegetation.

For the purposes of this assessment all lands within the Subject Site are assessed for complete clearing, except for a 10 m buffer surrounding the *Melaleuca biconvexa* individuals recorded on site. Assuming complete clearing will provide the proponent with maximum flexibility during the development of the site. The final project impact is provided in **Table 10,** and the footprint is displayed in **Figure 11**.

Table 10: Total impact on native vegetation

Vegetation zone ID	PCT ID	PCT name	Condition	Area impacted (ha) - clearing
Zone 1: PCT 1783 – Low Condition	PCT1783	Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	Low	0.78
Zone 2: PCT 1783 – Moderate to Good Condition	PCT1783	Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	Moderate to Good	1.41
Zone 3: PCT 1776 – Moderate to Good Condition	PCT1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	Moderate to Good	0.31
			Total	**2.50**

Two species credit species have been confirmed on site:

- Eastern Pygmy-possum, and
- *Melaleuca biconvexa*

Impacts to Eastern Pygmy-possum are anticipated within vegetation zone 2 (*Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast in moderate to good condition*). A total impact of 1.41 ha to Eastern Pygmy-possum is calculated. **Figure 12** contains the species polygon.

Fifteen (15) individuals of *Melaleuca biconvexa* have been identified on site. The population is restricted to the western edge of the Subject Site. As this area is to be excluded from development and will be protected within a 10 m buffer, no impacts are anticipated to this species as a result of the proposed development.

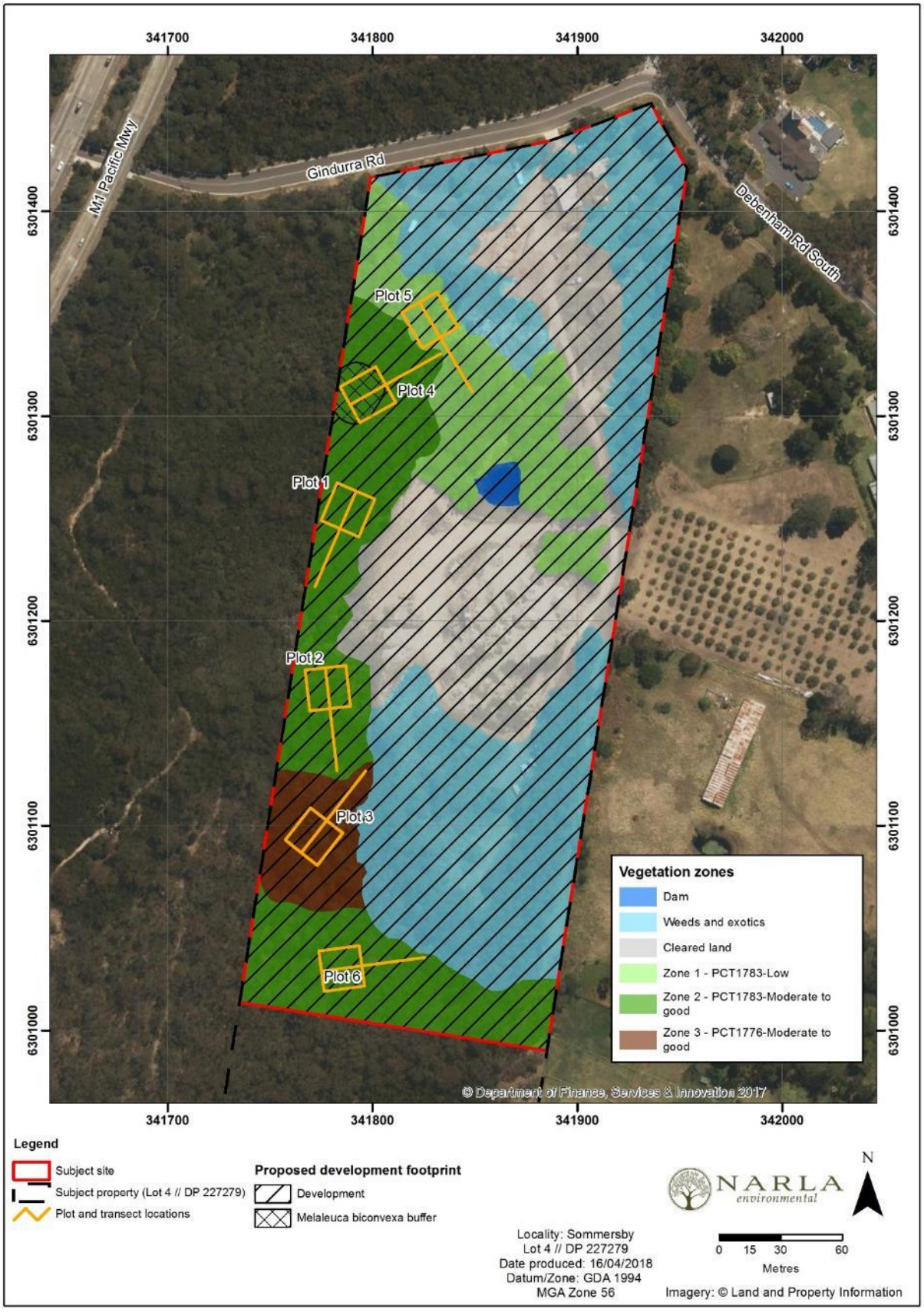

Figure 11: Development footprint and native vegetation extent

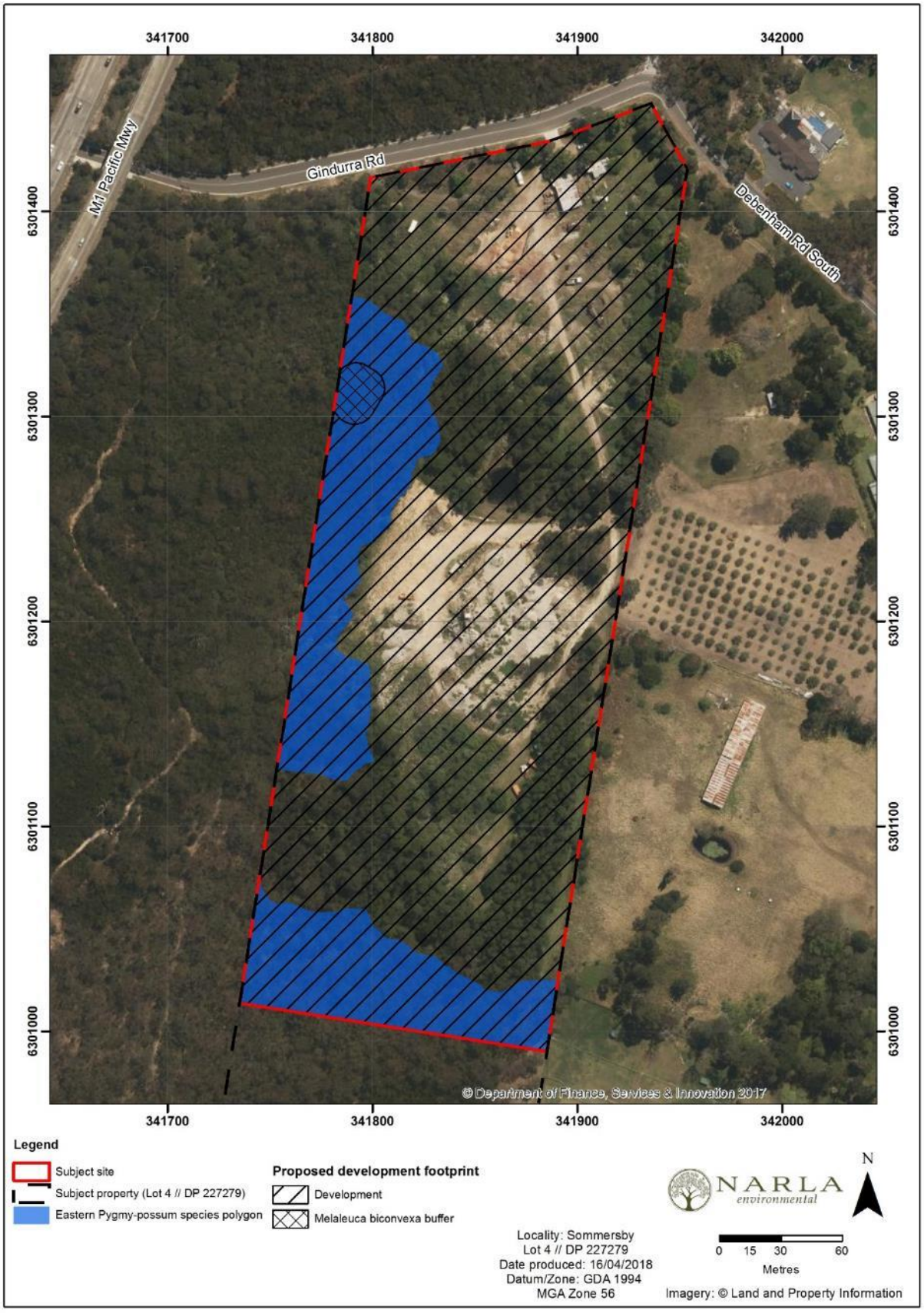

Figure 12: Eastern Pygmy-possum species polygon

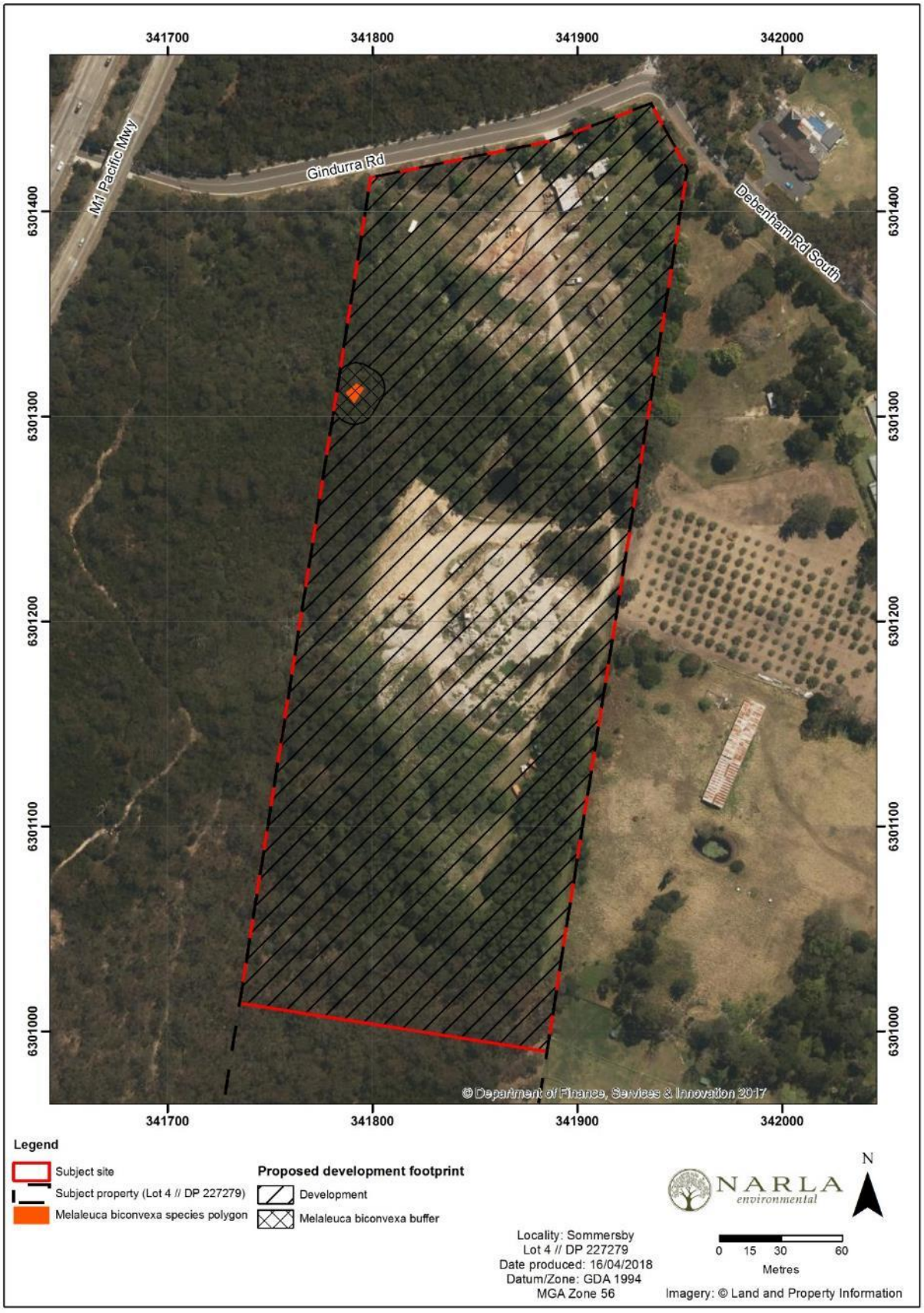

Figure 13: *Melaleuca biconvexa* species polygon

6.2 On-going Operations

Narla Environmental have undertaken a comprehensive assessment of the cumulative impacts from all clearing activities and operations, associated edge effects and other direct impacts on biodiversity in accordance with the EP&A Act 1979. Provided these recommendations are followed, impacts to biodiversity will be reduced.

6.2.1 Stormwater

Prior to any construction, areas of the site will need to be cleared and contoured to provide adequate drainage to the existing stormwater detention pond. Civil site works will need to ensure that there is appropriate drainage and stormwater capture at the site. There is an existing stormwater dam on the subject site. This will be modified and enlarged as a point for stormwater capture (along the western boundary of the site). The two dams located in the centre of the site shall be filled. The captured stormwater would be used for operational purposes at the site.

This needs to be considered in the stormwater management system design. The design will consider best practice guidelines in:

- Landcom (2004). Managing Urban Stormwater – Soils and Construction. Published by the NSW Government.
- Department of Environment and Conservation (2006). Managing Urban Stormwater – Harvesting and Reuse. Published by the NSW Department of Environment and Conservation.

Provided these measures are taken, and all control measures are in line with the two above mentioned documents, there should be no significant impact on biodiversity within the subject site.

6.2.2 Noise

A 5m constructed noise barrier will be constructed along the eastern boundary of the site, as well as two internal 3m noise barriers within the site to mitigate against noise impacts. Noise is not likely to further impact upon any threatened species within the subject site, as the subject site is already situated within close proximity to a number of busy roads and motorways.

6.2.3 Sewerage

The site is currently not connected to the sewerage system. There is currently no on-site sewage treatment system. A new on-site sewage treatment system (including an irrigation area) will need to be incorporated into the design prior to the development approval application being submitted to Council.

6.3 Biosecurity Risk Assessment

Biosecurity risks have the potential to impact native biodiversity unless reasonable control measures have been identified and implemented. Narla have identified such biosecurity risks and provided recommended control measures for pre and post development (**Table 11**).

Table 11. Biosecurity Risk Assessment Analysis

Identified Risk	Risk Analysis	Risk Rating Prior to Implementation of Control	Solution/ Control Measure	Residual Risk Rating Post Control
Pathogens	Infection by *Phytophthora cinnamomi* and *Puccinia psidii* (Myrtle Rust). These pathogens were not recorded within the subject site. Phytophthora and Myrtle Rust are pathogens which can be spread through infected soil, with potentially large detrimental impact.	High	Basic control principles include avoiding transport of sediment onto the vegetated areas of the property by cleaning all work clothing, gloves, tools and machinery that enter any protected, vegetated areas. In some cases, a solution of 70% ethanol or methylated spirits in 30% water may be sufficient to disinfect equipment prior to use. The report, 'Arrive Clean, Leave Clean' (Commonwealth of Australia 2015) provides further information and best practice methods to reduce spread of these pathogens between work Subject Sites.	Low
Pests	Vertebrate pests were recorded on the subject site, including *Oryctolagus cuniculus* (European Rabbit) and *Vulpes vulpes* (European Fox).	High	Vertebrate pests should be controlled on an annual basis (or more regularly as required). Control methods include 1080 fox baiting, trapping, den fumigation and shelter habitat removal.	Low
Weeds	The subject site (Development area) was heavily infested with environmental and priority weeds.	High	All environmental and priority weeds will be entirely eradicated from the subject site and then managed under a Vegetation Management Plan (VMP). The VMP will require an annual site visit by a team of qualified bush regenerators to ensure the control of weeds within the subject site.	Low

6.4 Avoiding and mitigating impacts

A total of 2.50 ha of native vegetation is proposed to be impacted by the project, with a further 4.12 ha of cleared land and exotic vegetation also to be impacted within the Subject Site. Although complete clearing has been used to calculate credits within the Subject Site, several avoidance measures have been implemented during project design. Several mitigation measures will also be implemented during development to reduce impacts as much as possible.

Avoidance and mitigation measures include:

- A 10 m buffer surrounding *Melaleuca biconvexa* individuals to ensure the species is not impacted by the development.
- Preparation of a Vegetation Management Plan (VMP) to guide the on-going protection and management of the *Melaleuca biconvexa*,

- Avoidance of the southern portion of the Subject Property, which totals 4.1 ha and contains habitat for *Prostanthera junonis* and *Hibbertia procumbens*. The area partially falls under Management Zone 1b and 1d of the Somersby Industrial Park Draft Plan of Management (Connell Wagner 2005) and the feasibility of entering into a Biodiversity Stewardship Agreement will be investigated.
- Assigning an Ecologist to undertake a pre-clearing survey of the vegetation prior to clearing and development. If any significant ecological values such as nests are found, clearing is to be delayed until the nest is vacated.
- Assigning an Ecologist to be present on site during the clearing events. The Ecologist will be able to guide works crews away from sensitive ecological features and will be on hand to capture and relocate displaced fauna. Where possible the clearing of mature trees will be avoided if they can be accommodated into the development footprint.
- Preventing the inadvertent introduction of exotic flora propagules by following the DEP (2015) 'Arrive Clean, Leave Clean' Guidelines.
- Ensuring appropriate erosion and sedimentation controls are maintained throughout the construction phase and the period immediately following as outlined in the 'Blue Book' (Landcom 2004).

The unavoidable impact of clearing vegetation will be completely offset based on the credit calculations provided in **Section 6.3**.

6.5 Credit calculations

Section 9: Table 4 of the FBA (OEH 2014b) provides thresholds for the assessment and offsetting for the unavoidable impacts of development. Four thresholds have been defined, including:

1. Impacts that require further consideration by consent authority
2. Impacts for which the assessor is required to determine an offset
3. Impacts for which the assessor is not required to determine an offset
4. Impacts that do not require further assessment by the assessor.

The proposed development meets the requirements of (2). Therefore, the credit requirements for the project has been calculated.

6.5.1 Ecosystem credits

Ecosystem credits were calculated based on the landscape value assessment, native vegetation assessment and threatened species assessment documented in this report.

In total 116 credits are required for the proposed impact of 2.50 ha. The ecosystem credit offset requirement is summarised in **Table 12**, and the final credit report is displayed in **Appendix 3**. The credit offset options are limited to only those types impacted by the development. NOTE: for one vegetation zone (Zone 1) no offset options are displayed. It is assumed this is an error in the BCC.

Table 12: Ecosystem credit requirement

				Offset options	
Plant community type	**Condition**	**Area impacted (ha)**	**Credits required**	**Plant community type(s)**	**IBRA subregion(s)**
PCT1783 Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (HN657)	Low	0.78	11	Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	Pittwater and any IBRA subregion that adjoins the IBRA subregion in which the development occurs
PCT 1783 Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (HN657)	Moderate to Good	1.41	93		
PCT 1776 Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast (HN654)	Moderate to Good	0.31	12	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	
	Total	**2.50**	**116**	**N/A**	**N/A**

6.5.1 Species credits

The impact to 1.41 ha of Eastern Pygmy-Possum habitat requires 28 species credits to be retired.

6.6 Biodiversity Offset Strategy

A total of 116 ecosystem credits and 28 Eastern Pygmy-Possum species credits must be retired in order to offset the impacts of the proposed development. The proponent has a number of options to satisfy the offset obligations of the project.

The proponent will investigate the feasibility of protecting the southern portion of the Subject Property under a Biodiversity Stewardship Agreement. This part of the Subject Property contains intact vegetation and habitat for Eastern-pygmy Possum and a number of threatened species, including *Prostanthera junonis* and *Hibbertia procumbens*.

The southern portion of the Subject Property is currently a management zone under the Somersby Industrial Zone Plan of Management (Connell Wagner 2005), and totals 4.1 ha. Due to the relatively small size of the potential Biodiversity Stewardship Agreement site additional credits are likely to be required in addition to those generated on-site.

A review of the credits currently available on the offsets market revealed that no credits matching either PCT or Eastern Pygmy-Possum are currently available. The proponent will consider completing a Credits Wanted request for the required credits as the project proceeds.

Landholders Expression of Interest (EOIs) details were also reviewed as part of this project. A number of EOIs are available for the credits required, including:

- PCT 1783 – No EOIs listed
- PCT 1776 – No EOIs listed
- Eastern Pygmy-Possum – EOI 187, EOI 189 and EOI 207

The landholders listed in the EOI register will be contacted to determine if interest to enter into a Biodiversity Stewardship Agreement still exists and, if still interested, the likely cost of the credits required to offset the project.

Finally, payment into the Biodiversity Conservation Fund (BCF), which is administered by the Biodiversity Conservation Trust (BCT), is also an option for the project. The current price to offset the credit requirement for the proposed project is $611,309.77 (ex GST), which includes $5,144.40 (ex GST) for each ecosystem credit and $521.42 (ex GST) for each species credit.

Further investigations will be completed to determine the most efficient and effective offset approach for the project.

7. Conclusion

The proposed development has been assessed consistent with the FBA, including the preparation of a site scale vegetation map and completion of the six Biometric plots and transects. The results of the assessment found that:

- 116 ecosystem credits area required
- 28 Eastern Pygmy-Possum credits are required.

The proponent will now explore the generation of credits from an on-site Biodiversity Stewardship site, before considering other options such as the purchase of credits from the market or payment to the BCT.

8. References

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9. Appendix

Appendix 1 – Flora inventory

Appendix 2 - Sample Survey Pro-forma

Appendix 3 - Biodiversity credit report

Appendix 1 -Flora list for the subject site

Table 13. Flora species recorded within the subject site

Scientific Name	PCT 1783 - Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	PCT 1776 - Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast
Acacia decurrens	x	
Acacia oxycedrus	x	
Acacia parramattensis	x	
Acacia ulicifolia	x	
Acacia suaveolens	x	
Adiantum hispida	x	
Ageratina adenophora	x	
Allocasuarina littoralis		x
Angophora costata	x	x
Anisopogon avenaceus	x	
Banksia ericifolia	x	
Banksia marginata	x	
Banksia oblongifolia	x	
Banksia serrata	x	x
Banksia spinulosa	x	
Bidens pilosa	x	
Billardiera scandens	x	
Bossiaea obcordata	x	x
Bouteloua dactyloides	x	
Breynia oblongifolia	x	
Callistemon linearis	x	
Calochlaena dubia	x	
Camphor laurel	x	
Cassytha glabella	x	
Casuarina glauca	x	
Conyza bonariensis	x	
Corymbia gummifera	x	
Cymbopogon refractus		x
Dianella caerulea	x	
Echinopogon caespitosus	x	
Echinopogon ovatus	x	
Ehrharta erecta	x	
Empodisma minus		
Entolasia stricta	x	x
Eragrostis curvula	x	
Eucalyptus capitellata	x	
Eucalyptus haemastoma	x	
Eucalyptus punctata	x	
Eurycorda complanata	x	
Gahnia sieberiana	x	
Grevillea sericea	x	
Glochidion ferdinandi	x	
Hakea dactyloides	x	
Hakea gibbosa	x	
Hakea teretifolia	x	
Hibbertia aspera	x	

Hovea linearis	x	x
Hydrocotyle bonariensis	x	
Imperata cylindrica	x	
Ipomea indica	x	
Isopogon anemonifolius	x	x
Kunzea ambigua	x	
Lambertia formosa	x	
Lantana camara	x	
Leptospermum polygalifolium	x	x
Leucopogon juniperina	x	x
Ligustrum sinense	x	
Lindsaea linearis	x	
Lomandra glauca	x	
Lomandra gracilis		x
Lomandra longifolia	x	
Lomandra obliqua	x	x
Lonicera japonica		
Melaleuca biconvexa	x	
Microlaena stipoides	x	
Nepholepis cordifolia	x	
Ochna serrulata	x	
Opercularia hispida	x	
Oplismenus aemulus	x	
Oplismenus imbicillus	x	
Ozothamnus diosmifolius		
Parsonsia straminea	x	
Patersonia sericea	x	
Paspalum dilatatum	x	
Pennisetum clandestinum	x	
Petrophile pulchella	x	
Persoonia isophylla	x	x
Persoonia levis	x	
Phyllanthus hirtellus	x	
Philotheca hispidula	x	
Pittosporum undulatum	x	
Platysace linearifolia		
Polyscias sambucifolia	x	x
Pteridium esculentum	x	x
Scaevola ramosissima		
Schizaea bifida	x	
Selaginella uliginosa	x	
Senecio madagascariensis	x	
Senna pendula	x	
Setaria sp.	x	
Stephania japonica	x	
Syncarpia glomulifera		x
Telopea speciosissima	x	
Veronica plebeia	x	
Woollsia pungens	x	
Xanthorrhoea sp.	x	x
Xanthosia pilosa		x
Xanthosia tridentata		x
Xylomelum pyriforme	x	

Appendix 2 - Sample BioMetric Plot and Transect Proforma

Monitoring Plot Data Sheet (Biometric)	Site Sheet No.	

Plot Information		Recorders	Nathan Banks.	Date	13/02/18
Site Name/Code	Plot 3 (Back Right corner)				
Start Easting	0341765 P3S	20m Easting	0341771 P3M	50m Easting	0341793 P3F
Start Northing	6301087	20m Northing	6301102.	50m Northing	6301127
Orientation of transect plot (direction and degrees)		Photo No. start		Slope (degrees)	
		Photo No. end of 50m transect			

* Record Easting and Northing of each stake, from the start, 20m mark and end of 50m transect

Vegetation Zone Identification	
Location	Back right corner of impact area
Vegetation Community	Turpentine & Casuanna open forest
Condition (Low or Mod-Good)	Moderate - Good (little - no weeds present).
Habitat Features (rocks etc.)	large logs + dense leaf litter + dense bark at base of trees
Comments	sparse ground cover (under-story), dense mid story of casuanna & juvenile turpentine, intmittent canopy A. Cobata. alle latente present

Average Canopy Cover (Specht)	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m	Sum /10	%
Native overstorey cover (%)	15	10	15	5	0	5	10	5	80	60		20.5
Native mid-cover (%)	10	25	20	20	15	5	2	10	-	10		11.7
Exotic overstorey cover (%)												
Exotic mid-cover (%)												

Point Intersect (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Sum x 2	%
Native Shrub							1		1			1				1										4	8
Native Grass	1	1	1																							3	6
Native Other					1																					1	2
Exotic																										0	0
Bare Earth (BE), Leaf (L)				L		BE		L		L	L		L	L	L		L	L	L	L	L	L	L	L	L		

Point Intersect (m)	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	Sum x2	%
Native Shrubs				1																			1	1		3	6
Native Grasses						1			1			1	1	1		1		1				1		1		9	18
Native Other																										0	0
Exotic																										0	0
Bare Earth (BE), Leaf (L)	L	L	L		L		L	L		L	L				L		L		L	L	L				L		

20m x 50m Quadrat	Number of individual trees with hollows (only hollow ≥5cm diameter):	Total length fallen logs in metres (only logs >10cm width)
	0	11+4+7+4=26m

Whole Veg. Zone	Over-storey regeneration	Over-storey Species		Regenerating (<5cm)	Comments
			Syncarpia glomerulifera Angophora costata Allocasuarina littoralis		
		Number	S 6+2 <5cm AC 1+1 <5cm AL 5+ <5cm		
		Stem Size Class DBH			

Cover: <1, 1,2,3,4,5, 15,20,25,30,35 etc foliage cover %

Appendix 3 – Biodiversity credit report

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 16/04/2018 Time: 4:43:27PM Calculator version: v4.0

Major Project details

Proposal ID:	224/2018/4792MP
Proposal name:	90 Gindurra Road Somersby (SSD8660)
Proposal address:	90 Gindurra Road Somersby NSW 2250
Proponent name:	
Proponent address:	90 Gindurra Road Somersby NSW 2250
Proponent phone:	02 9956 3866
Assessor name:	Kurtis Lindsay
Assessor address:	PO Box 406 Mona Vale NSW 2103
Assessor phone:	9986 1295
Assessor accreditation:	224

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	2.19	104.18
Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	0.31	12.00
Total	2.50	116

Credit profiles

1. Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast, (HN654)

Number of ecosystem credits created 12

IBRA sub-region Pittwater

Offset options - Plant Community types	Offset options - IBRA sub-regions
Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast, (HN654)	Pittwater and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast, (HN657)

Number of ecosystem credits created 93

IBRA sub-region Pittwater

Offset options - Plant Community types	Offset options - IBRA sub-regions
Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast, (HN657)	Pittwater and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast, (HN657)

Number of ecosystem credits created 11

IBRA sub-region Pittwater

Offset options - Plant Community types	Offset options - IBRA sub-regions
	Pittwater and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Eastern Pygmy-possum	Cercartetus nanus	1.41	28