

CONSERVATION AREA MONITORING and BIOMETRIC CONDITION ASSESSMENT

Southern Highlands Regional Shooting Complex
(Hill Top Conservation Area)

OCTOBER 2018

Version 2.0



Cover photographs:

Top left: The works being undertaken at the 50 metre pistol range. Photograph taken looking north-west.

Top right: *Leucopogon setiger* in flower. Present at vegetation plot 5.

Bottom left: Character of the vegetation within vegetation plot 5. Photograph taken from the north-west corner of the plot looking into the quadrat.

Report produced at the request of:

NSW Office of Sport

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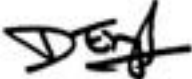
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Disclaimer

This document has been prepared in accordance with the brief provided by NSW Office of Sport ('the client'). This investigation has relied upon information collected during the course of a field investigation, and as available in current known literature and data sources. All findings, conclusions or recommendations contained within this document are based upon the abovementioned circumstances. The study has been prepared for use by the client, and no responsibility for its use by other parties is accepted by Lesryk Environmental Pty Ltd.

This report is prepared in accordance with both the 6th Edition of the Commonwealth of Australia (2002) Style Manual.

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Glossary

Abbreviation	Definition
°C	Degrees Celsius
ASL	Above Sea Level
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
CEMP	Construction Environmental Management Plan
DEE	Commonwealth Department of the Environment and Energy
DPI	NSW Department of Primary Industries
Epacris	Epacris Environmental Consultants Pty Ltd
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
mm/cm/m/km/m ²	Millimetres, centimetres, metres, kilometres, square metres
ha	Hectares
Lesryk	Lesryk Environmental Pty Ltd
LGA	Local Government Area
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
RoTAP	Rare or Threatened Australian Plant
SCA	State Conservation Area
SHRSC	Southern Highlands Regional Shooting Complex
TEC	Threatened Ecological Community
WoNS	Weeds of National Significance

1. Introduction

This monitoring report has been prepared at the request of the NSW Office of Sport (formerly Office of Sport and Recreation). This report has been prepared in regards to the development of the SHRSC, this being located off Wattle Ridge Road, Hill Top, NSW (Figure 1).

As the SHRSC is part of the Hill Top Conservation Area, a Conservation Agreement was entered into by the Minister for Sport and Minister for the Environment, on October 12, 2010. Both parties entered the agreement under Section 69B Part 4 Division 12 of the NSW *National Parks and Wildlife Act 1974*. The agreement details the conservation values of the SHRSC and the steps required to protect and manage these values. The management of these conservation values is to be consistent with the Nattai Reserves Plan of Management (NSW National Parks and Wildlife Service 2001) and all other subsequent plans.

Annexure C of the conservation agreement includes the following provisions regarding an ongoing monitoring program:

- w) A comprehensive, measurable monitoring program including baseline information and data to be implemented consistent with requirements under any development approval and best practice guidelines to ensure that any existing or potential pollution, sedimentation or contamination impacts from Zone 2 and 3 do not impact upon Zone 1, and that if any impacts are detected over time, that remediation is implemented immediately.
- x) Annexure B contains dated aerial photographs/maps showing the location of the conservation area, the conservation values and photo-points. Photographs have been taken at these photo-points during the preparation of the Agreement. This provides baseline information and data for ongoing monitoring and adaptive management of the conservation area. Further photo-point photographs should be taken when development is completed.
- y) Photographs at the identified (and future) photo-points should be taken from time to time in consultation with Department's officers for the purposes of ongoing monitoring of the conservation values.
- z) The owner to complete a monitoring report on an annual basis, including photo-point photos, noting changes occurring in the conservation area. This will form the basis for decisions about ongoing management actions. A copy of all monitoring reports should be forwarded to OEH.

To date, monitoring reports have been completed for the SHRSC by Epacris during December 2011, April 2015 and May 2017.

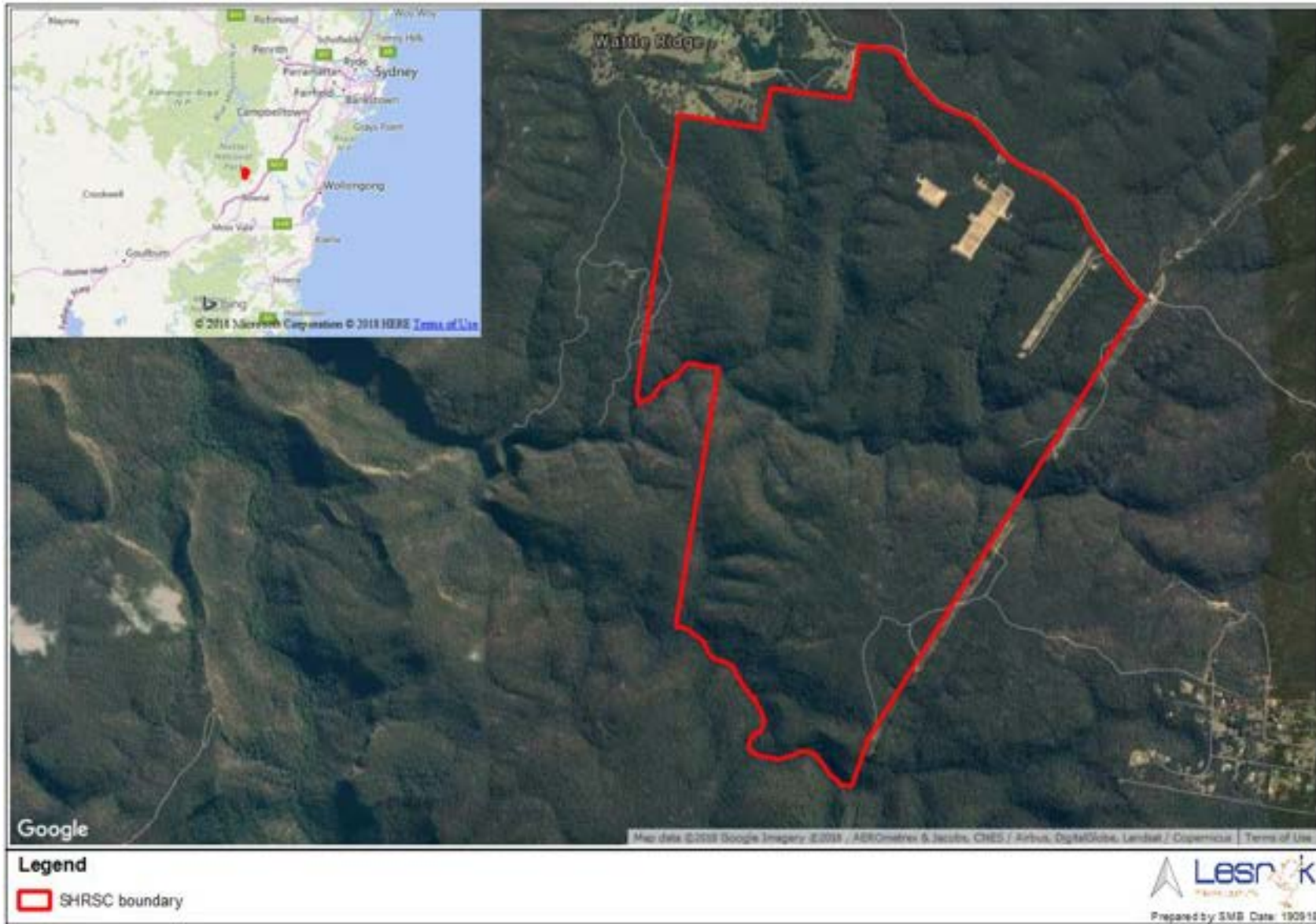


Figure 1. SHRSC boundary and location

2. Description of the SHRSC

The SHRSC is located on the north-western outskirts of the NSW township of Hill Top, this being part of the Wingecarribee LGA within the Southern Highlands region. Located approximately half way between Sydney and Goulburn (85 km south-west and 83 km north-east, respectively), the SHRSC is about 15 km north of Mittagong and 42 km west/north-west of the Wollongong CBD.

The SHRSC covers an area of about 1036 ha, and has three zones:

- Zone 1 - a natural area (900 ha).
- Zones 2 and 3 - proposed development area and existing developing area, respectively (136 ha).

The development areas contain those shooting facilities present, these being the 800 m range (Zone 3) and the (under construction) 50 m and 500 m ranges (Zone 2).

The SHRSC is generally bounded by Bargo SCA (this covering an area of 4618 ha) to the north, east and south, and Nattai National Park (48980 ha) to the north, west and south.

Apart from the areas that have been cleared for development of the rifle ranges, the SHRSC is heavily vegetated by woodland, heath woodland and mallee vegetation communities.

Rocky Waterholes Creek traverses the SHRSC in an east-west direction and is located around 800 m south-west and downslope of the 800 m rifle range. This creek flows west, through Nattai National Park, before discharging into the Nattai River. Nattai River eventually drains into Lake Burragorang to the north-west. A number of unnamed drainage lines are present that feed into this creek.

The SHRSC is part of the Warragamba Catchment.

The annual average rainfall in the region is around 911 mm with the greatest falls being experienced in February and March (Bureau of Meteorology 2018). Average temperatures range from a winter low of 2.2 °C to a summer high of 25.5 °C (Bureau of Meteorology 2018).

Natural elevations within the SHRSC are between 460 m ASL in association with Rocky Waterholes Creek and 620 m ASL in the north of the SHRSC. The SHRSC consists of a deeply incised sandstone plateau, with numerous steep slopes that fall to those drainage lines present.

With reference to OEH (2008), the soil landscapes of the SHRSC have been mapped as belonging to:

- Nattai Tablelands (erosional)
- Hawkesbury (colluvial)
- Hassan Walls.

The Nattai Tablelands and Hawkesbury landscapes dominate the SHRSC and are associated with the underlying Hawkesbury sandstone geology. The Nattai Tablelands occur at higher elevation and in association with those ridgetops and flats that are present within the SHRSC. The Hawkesbury landscape occurs on more sheltered slopes in association with those drainage lines that feed into Rocky Waterholes Creek, and contains more rock outcrop.

The Hassan Walls landscape is associated with cliffs and hillslopes within escarpments on Narrabeen Group Sandstone. Within the SHRSC this landscape is associated with Rocky Waterholes Creek, and as such, has only been indicated as occupying a small portion of the SHRSC.

3. Conservation values

The Conservation Agreement states that the conservation area:

- contains a high level of floristic diversity
- contains regionally rare and significant plant species
- contains potential habitat for other rare plant species
- is an integral component of a large wildlife corridor
- has important catchment and water quality values.

A number of these values are explored further below.

To assist in identifying the conservation values present within the SHRSC, the following sources were consulted:

- the Conservation Agreement
- the OEH BioNet database [Atlas of NSW Wildlife] (OEH 2018a)
- the OEH threatened biodiversity profiles (OEH 2018b).

When accessing the OEH database, the search area specified was a 10 km buffer around the SHRSC. The data search was carried out on 19/09/2018.

The conservation significance of those ecological communities, plants and animals known, or expected, to occur within the SHRSC is made with reference to:

- the RoTAP publication (Briggs and Leigh 1996)
- the EPBC and BC Acts
- vegetation mapping of the study region (Eco Logical Australia 2003)
- the NSW Master Plant Community Type Classification (OEH 2018c).

While reviewing these documents, particular attention was paid to identifying relevant ecological matters listed under the Schedules of the EPBC and/or BC Acts, plants, animals and ecological communities that have been recorded in the region and which may occur within, or in the vicinity of, the SHRSC.

The Biodiversity Values Map published under clause 7.3 of the NSW Biodiversity Conservation Regulation 2017, identifies land with high biodiversity value (as defined by the Regulation). With reference to this map, Rocky Waterholes Creek has been mapped as an area of high biodiversity value.

3.1. Vegetation

Vegetation mapping of the Wingecarribee Shire was undertaken as part of the Wingecarribee Biodiversity Strategy (Eco Logical Australia 2003). A component of the mapping encompasses the SHRSC (Figure 2).

The vegetation mapping indicates that the following vegetation communities dominate the SHRSC:

- Hawkesbury Sandstone Woodland
- Mittagong Sandstone Woodland
- Nattai Sandstone Gully Forest.

A small amount of Dry Nattai Escarpment Complex is also mapped as occurring in association with Rocky Waterholes Creek.

None of these communities are listed (or currently being considered for listing) as a threatened ecological community under the EPBC or BC Acts.

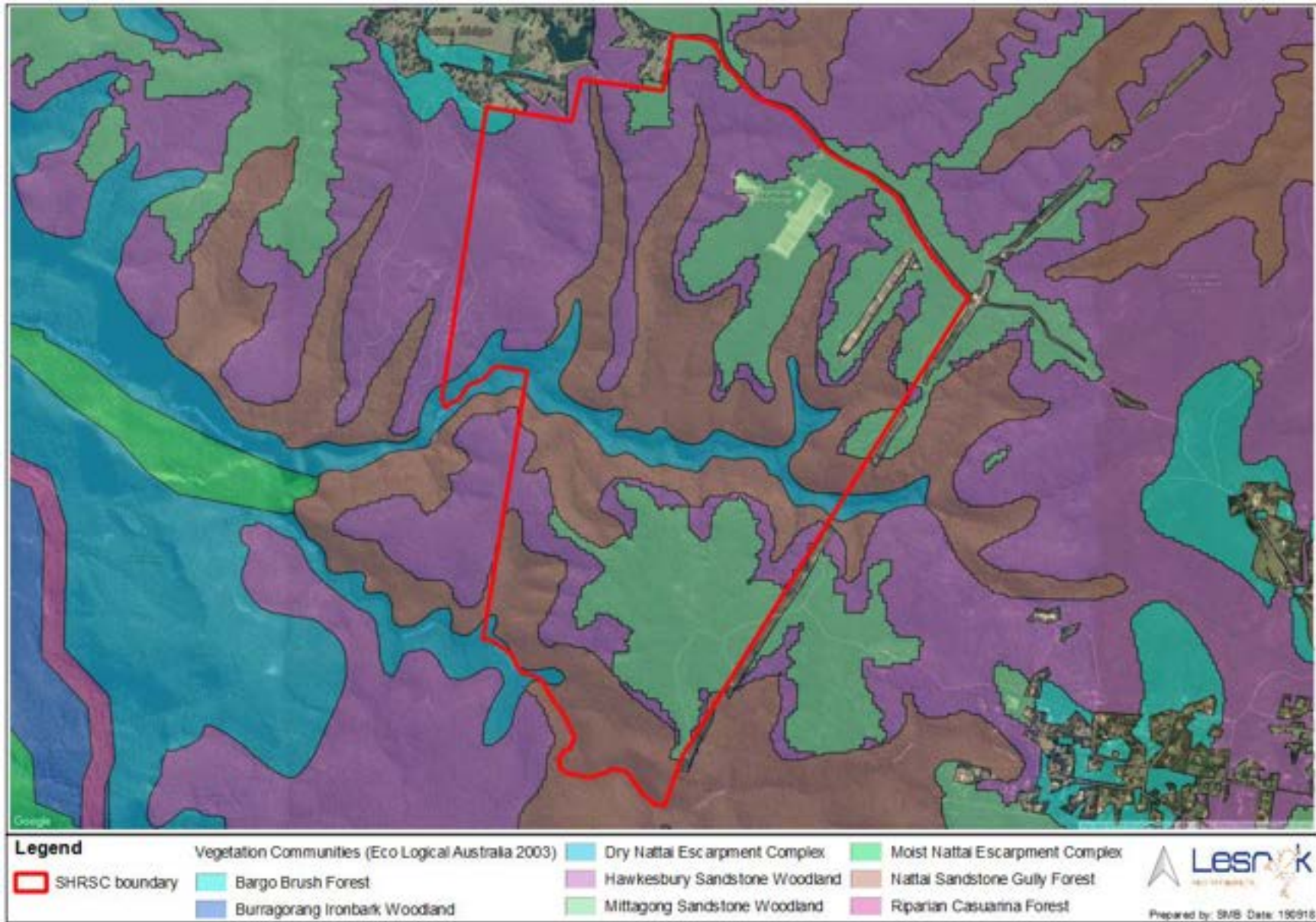


Figure 2. Vegetation mapping of the region

3.2. Threatened species

A review of the OEH database (OEH 2018a) and the Conservation Agreement identified seven threatened plants and 22 animals listed under the EPBC Act and/or the Schedules of the BC Act that have been previously recorded, or are considered to have habitat, within 10 km of the SHRSC (Table 1).

Table 1. Threatened species recorded within 10 km of the SHRSC

Common Name	Scientific Name	EPBC Act	BC Act	Recorded in the SHRSC	Possible Occurrence
PLANTS					
Dwarf Phyllota	<i>Phyllota humifusa</i>	V	V		✓
Bynoe's Wattle	<i>Acacia bynoeana</i>	V	E		✓
Needle Geebung	<i>Persoonia acerosa</i>	V	V		✓
Bargo Geebung	<i>Persoonia bargoensis</i>	V	E		✓
Mittagong Geebung	<i>Persoonia glaucescens</i>	V	E		✓
Hairy Geebung	<i>Persoonia hirsuta</i>	E	E		✓
Leafless Tongue Orchid	<i>Cryptostylis hunteriana</i>	V	V		✓
ANIMALS					
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	V	V		✓
Red-crowned Toadlet	<i>Pseudophryne australis</i>		V		✓
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	V	E		✓
Rosenberg's Goanna	<i>Varanus rosenbergi</i>		V		✓
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>		V		✓
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>		V		✓
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>		V		✓
Swift Parrot	<i>Lathamus discolor</i>	E	E		✓
Turquoise Parrot	<i>Neophema pulchella</i>		V		✓
Barking Owl	<i>Ninox connivens</i>		V	✓	✓
Powerful Owl	<i>Ninox strenua</i>		V		✓
Sooty Owl	<i>Tyto tenebricosa</i>		V		✓
Masked Owl	<i>Tyto novaehollandiae</i>		V		✓
Varied Sittella	<i>Daphoenositta chrysoptera</i>		V	✓	✓
Scarlet Robin	<i>Petroica boodang</i>		V	✓	✓
Koala	<i>Phascolarctos cinereus</i>	V	V	✓	✓
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	E	V		✓
Southern Brown Bandicoot	<i>Isodon obesulus</i>	E	E		✓
Yellow-bellied Glider	<i>Petaurus australis</i>		V	✓	✓
Greater Glider	<i>Petauroides volans</i>	V			✓
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>		V		✓
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>		V		✓

Of these species, five have been recorded in the SHRSC (Table 1). Based on the review of standard texts (refer to bibliography) and vegetation mapping, there is the possibility that the SHRSC may provide potential habitat for the remaining species.

3.3. Corridors and linkages

The conservation area was previously part of, and adjoins, Bargo SCA. It is part of a regionally significant corridor that extends in all directions, reaching southern Sydney to the north, as well as skirting the western limits of the city and reaching the Hunter Valley region. It also extends well into the southern NSW coast and west across the Blue Mountains. This corridor incorporates a number of large conservation reserves, such as Nattai, Blue Mountains, Royal, Heathcote, Morton and Kanangra-Boyd National Parks, as well as catchment lands, crown land and other privately owned bushland properties.

The corridor is expected to be used by a wide variety of animals, including those listed in Table 1. As such, the conservation area is likely to be utilised by a number of these species.

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4. Methodology

As part of the initial monitoring report undertaken in 2011 (Epacris 2011), six monitoring plots and seven photo-point locations have already been established within the SHRSC.

As part of the current monitoring session:

- the plots and photo-points established by Epacris have been replicated
- additional and/or different photo-point locations have been established by Lesryk
- no additional vegetation plots have been established.

The monitoring of the previously established sites was carried out by Paul Burcher (B.App.Sc.) [Senior Botanist] and Stephen Bloomfield (B.App.Sc.) [Botanist], the investigations being conducted on 29 and 30 August, and 18 October 2018.

For reference, the weather conditions experienced during the current monitoring session were:

- 29 August - cool temperatures (14 °C), clear skies (<10% cloud cover) and calm conditions
- 30 August - mild temperatures (19 °C), clear skies and light winds
- 18 October - mild temperatures (20 °C), early fog to predominantly clear skies (less than 20% cloud cover) and light winds.

IMPORTANT NOTE: While the same plot locations established by Epacris have been used, for ease of reference in this and future monitoring reports, the numbering has been altered and made chronological to be consistent with the Conservation Agreement. In addition, the photo-points provided within the Conservation Agreement have been adhered to, while two additional points have been selected by Lesryk to illustrate specific impacts/issues. It is noted that Epacris included photo-point 3 within their report.

Table 2. A comparison of Lesryk's and Epacris' plot and photo-point referencing

Lesryk	Epacris
Plots	
1	1
2	2
3	4
4	5
5	6
6	7
Photo-points	
1 (as per Conservation Agreement)	N/A
2 ¹ (as per Conservation Agreement)	N/A
3 (as per Conservation Agreement)	3 (as per Conservation Agreement)
4 (as per Conservation Agreement)	N/A
5 (additional)	N/A
6 (additional)	N/A

4.1. Plots

The six vegetation survey plots established by Epacris are generally located close to the boundary of the development zones, one being near the powerline easement (Figure 3). Plots are typically 20 m by 20 m in size, except for Plot 3 which is a 6 m x 60 m plot, as its aim is to monitor the efficacy of the fence

¹ With reference to Map 2 in the Conservation Agreement it is considered that the mapping of photo-point 2 is incorrect. Use of GPS coordinates plots this to the east of its mapped location. As the purpose of the photo-points is to achieve the objectives of the Conservation Agreement, it is considered photo-point 2 in this report is more in line with the requirement.

blocking vehicle (including motorbike) access to the track. Plots are marked on all four corners with 40 cm steel star pickets which are topped by yellow plastic caps (all star pickets were located during the current monitoring session and found to be functioning in accordance with their purpose. As such, no star pickets needed replacement).

At each quadrat, floristic information was collected including vegetation structure covering height range, cover and dominant species for each plant stratum, full floristics and an estimate of cover/abundance using a modified Braun-Blanquet scale (1-7) (Table 3).

Table 3. Cover Abundance Scale (Modified Braun Blanquet)

1	cover less than 5% of site and 3 or less individuals
2	<5% - more than 3 sparsely scattered
3	<5% - common consistent throughout plot
4a	<5% very abundant (many individuals throughout plot)
4b	cover of 5-25% of site
5	cover of 25-50% of site
6	cover of 50-75% of site
7	cover of 75-100% of site

To assist in the identification of those plants recorded, the following field guides and standard texts were used:

- Harden (1992, 1993, 2000 and 2002)
- Fairley and Moore (2010)
- Robinson (2003).

The nomenclature of those species recorded or known for the region follows these texts, or that of the EPBC and BC Acts.

The location of the north-western corner of each quadrat was recorded with a handheld GPS, the coordinates being provided in Table 4.

Table 4. Vegetation plot coordinates

Plot No.	Grid Reference (GDA 94)		General location and description
	Easting	Northing	
1	265573	6199190	Southern end of the 800 m rifle range (Zone 3).
2	265540	6199076	230 m south-west of the 800 m rifle range (Zone 1).
3	265119	6197472	Firetrail on the western side of a powerline easement, 1.8 km south of the 800 m rifle range (Zone 1).
4	264843	6200465	West of the (under construction) 50 m gun range (boundary Zone 2).
5	265435	6200643	On the southern side of Wattle Ridge Road, 20 m north-west of the entry to Zone 2) (boundary of Zone 2).
6	265680	6199995	The gully between Zones 2 and 3 (Zone 1).

A photo was taken looking into each plot from the north-western plot marker. Additional photos were taken looking to the north, east, south and west of this plot marker.

As Plot 3 was 60 m by 6 m, photos looking east and west were taken from the start and end of the plot, and at the 30 m mark. The photos were taken from the north side of the track.

General notes were also made on habitat characteristics, disturbance and fire history at each plot.

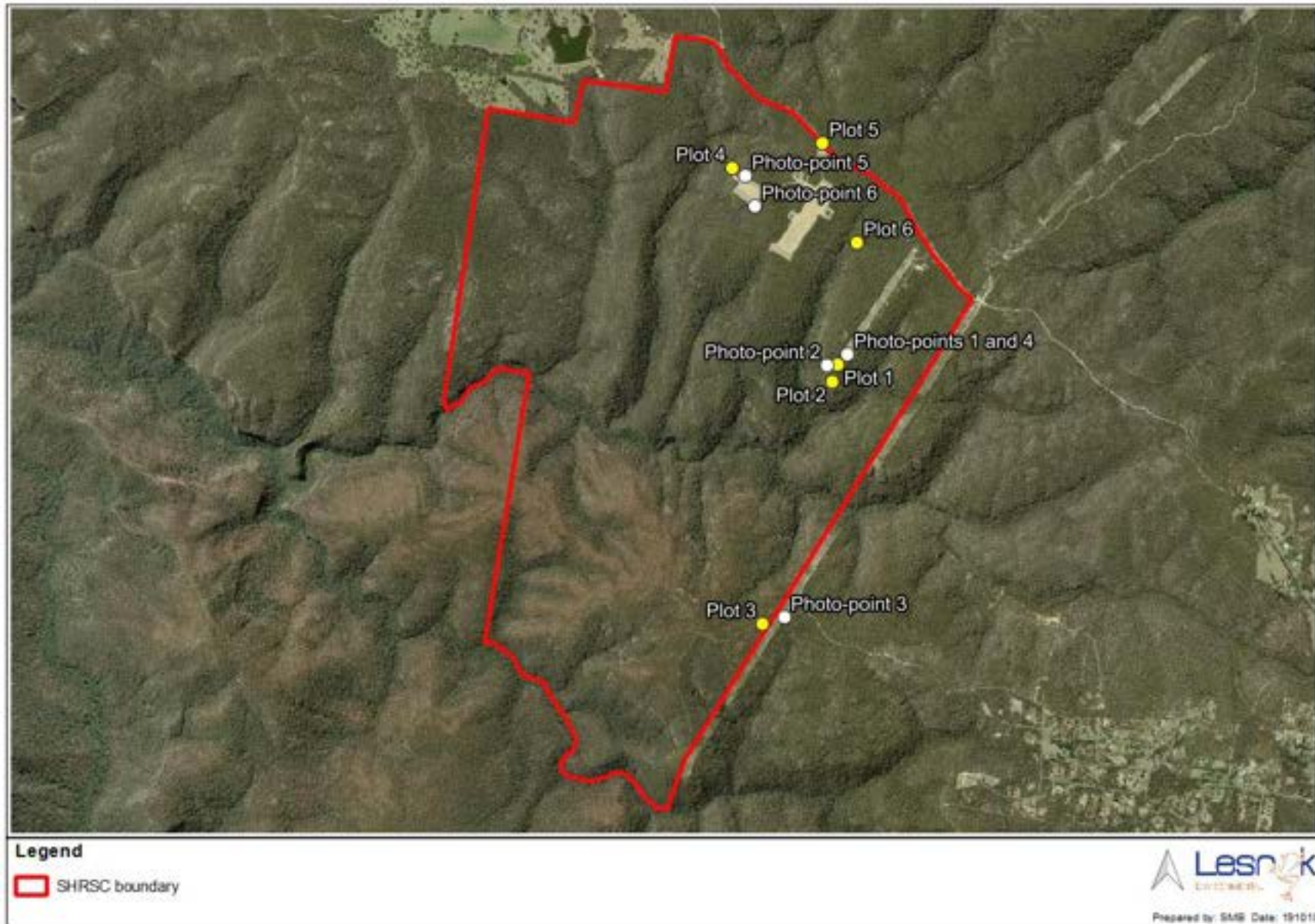


Figure 3. Location of vegetation plots and photo-points

4.2. Photo-points

Six photo-points were established, these consisting of:

- four photo-points as per the Conservation Agreement
- two additional photo-points to show specific impacts or issues.

The location of each photo-point was recorded with a handheld GPS, the coordinates being provided in Table 5. The location of each photo-point has also been illustrated on Figure 3.

Table 5. Photo-point coordinates

Photo-points	Grid Reference (GDA 94)		General location and description
	Easting	Northing	
1	265635	6199258	South end of 800 m rifle range (Zone 3).
2	265503	6199183	Intact woodland (Zone 1)
3	265263	6197520	Powerline easement crossing, 1.8 km south of the 800 m rifle range (Zone 1).
4	265635	6199258	South end of 800 m rifle range (Zone 3).
5	264932	6200416	Northern boundary of the 50 m range (Zone 2).
6	265000	6200218	South-east of the 50 m range (Zone 2).

4.3. Survey effort

By the completion of the field investigation, approximately 20 person hours had been accumulated.

4.4. Limitations

All plot markers were located and access to all parts of the SHRSC was possible, thereby ensuring that every plot was relocated and sampled. In addition, while no adverse weather conditions were encountered during the field investigation, the period of drought experienced by NSW may have inhibited the growth of some plants, particularly orchids, and render their identification futile. However, it is noted that more species were identified during the current monitoring session than the previous session.

This report is based upon data acquired from the current investigation; however, it should be recognised that the data gathered is indicative of the environmental conditions of the SHRSC at the time it was investigated.

The above mentioned constraints are not considered to compromise the objectives of the monitoring program.

5. Results

5.1. Vegetation plots

The photos that were taken looking into each plot from the north-western plot marker, or the 0 m mark in the case of Plot 3, have been included within the relevant sections below. The photos that were taken looking north, east, south and west from the north-western plot marker (and the remaining photos of Plot 3) have been provided in Appendix 1.

A list of all the flora species identified and their location has been tabulated in Appendix 2.

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5.1.1. Plot 1

Plot 1	Floristic Site Survey Form	Hill Top
---------------	-----------------------------------	-----------------

Date: 29/08/18		Recorder: P. Burcher and S. Bloomfield	
Location: Southern end of the 800 m rifle range (Zone 3) Hill Top Conservation Area, NSW			
Plot Size: 20 x 20 m			
Easting: 265573	Northing: 6199190	Position in quadrat: north-west corner	
Zone No.: 56			
Altitude: 616 m		Slope: 1°	
Mitchell Landscape: Nattai Plateau		CMA: Hawkesbury-Nepean	
Geology: Nattai Tablelands erosional			
Vegetation Structure: (Walker & Hopkins 1983)			
Stratum	Height (m)	% cover	Dominant species
Upper	15	20	<i>Eucalyptus sieberi</i> , <i>E. piperita</i>
Mid-upper	6	45	<i>Corymbia gummifera</i> , <i>Hakea dactyloides</i> , <i>Acacia terminalis</i> , <i>Leptospermum trinervium</i>
Mid-lower	1.5	25	<i>Lambertia Formosa</i> , <i>A. terminalis</i> , <i>Dillwynia elegans</i> , <i>H. dactyloides</i> , <i>Grevillea spp.</i> , <i>L. trinervium</i>
Ground	0.3	10	<i>Cyathochaeta diandra</i> , <i>Caustis flexuosa</i> , <i>Lomandra spp.</i>
Total No. of native species recorded: 49			
Vegetation formation and class (Keith 2004):		Sydney Hinterland Dry Sclerophyll Forests Dry Sclerophyll Forests	
Vegetation on-ground description:		Open Forest - <i>Eucalyptus sieberi</i> – <i>Corymbia gummifera</i>	
PCT:		1086. Red Bloodwood - Sydney Peppermint - Blue-leaved Stringybark heathy forest of the southern Blue Mountains, Sydney Basin.	

Feature	Y/N	Comment
Hollow-bearing trees	N	Not within the plot.
Rock outcrop	Y	Very minor amount.
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	N	
Pest fauna	N	
Tree dieback	Y	A number of trees within the plot and surrounding area are affected.
Fire history	Y	Between 6-10 years ago.
Erosion	N	
Other	Y	The north-west portion of the plot and adjacent to the west has been affected by sediment runoff from upslope in association with the 800 m gun range. Mulching and drainage works (i.e. placement of sandstone rocks) have been undertaken to address the issue (refer to section 5.1.8).

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	1
2	<i>Acacia suaveolens</i>	2
3	<i>Acacia terminalis</i>	3
4	<i>Acacia ulicifolia</i>	1
5	<i>Amperea xiphioclada</i>	2
6	<i>Banksia serrata</i>	1
7	<i>Banksia spinulosa</i>	3
8	<i>Billardiera scandens</i>	1
9	<i>Boronia ledifolia</i>	1
10	<i>Bossiaea obcordata</i>	3
11	<i>Caustis flexuosa</i>	2
12	<i>Corymbia gummifera</i>	4b
13	<i>Cyathochaeta diandra</i>	4b
14	<i>Daviesia ulicifolia</i>	1
15	<i>Dillwynia elegans</i>	3
16	<i>Dillwynia phyllicoides</i>	2
17	<i>Dodonea triquetra</i>	1
18	<i>Entolasia stricta</i>	1
19	<i>Eragrostis brownii</i>	1
20	<i>Eriostemon australasius ssp. australasius</i>	2
21	<i>Eucalyptus piperita</i>	4b
22	<i>Eucalyptus sieberi</i>	4b
23	<i>Gompholobium grandiflorum</i>	2
24	<i>Gonocarpus teucrioides</i>	3
25	<i>Goodenia bellidifolia</i>	2
26	<i>Grevillea sphacelata</i>	3
27	<i>Grevillea mucronulata</i>	1
28	<i>Hakea dactyloides</i>	4b
29	<i>Hakea gibbosa</i>	1
30	<i>Hibbertia rufa</i>	1
31	<i>Isopogon anemonifolius</i>	2
32	<i>Isopogon anemthifolius</i>	2
33	<i>Lambertia formosa</i>	3
34	<i>Lepidosperma laterale</i>	1
35	<i>Leptospermum trinervium</i>	4b
36	<i>Lomandra micrantha</i>	3
37	<i>Lomandra obliqua</i>	2
38	<i>Lomatia silaiifolia</i>	1
39	<i>Monotoca scoparia</i>	1
40	<i>Patersonia glabrata</i>	3
41	<i>Persoonia levis</i>	1
42	<i>Petrophile pedunculata</i>	2
43	<i>Poranthera ericifolia</i>	1
44	<i>Pteridium esculentum</i>	1
45	<i>Stylidium productum</i>	2
46	<i>Telopea speciosissima</i>	1
47	<i>Tetradthea thymifolia</i>	3
48	<i>Xanthosia pilosa</i>	2
49	<i>Xanthosia tridentata</i>	2



Plate 1. The character of the vegetation within Plot 1.

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5.1.2. Plot 2

Plot 2	Floristic Site Survey Form	Hill Top
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Date: 29/08/18		Recorder: P. Burcher and S. Bloomfield	
Location: 230 m south-west of the 800 m rifle range (Zone 1) Hill Top Conservation Area, NSW			
Plot Size: 20 x 20 m			
Easting: 265540	Northing: 6199076	Position in quadrat: north-west corner	
Zone No.: 56			
Altitude: 602 m		Slope: 2°	
Mitchell Landscape: Nattai Plateau		CMA: Hawkesbury-Nepean	
Geology: Nattai Tablelands erosional			
Vegetation Structure: (Walker & Hopkins 1983)			
Stratum	Height (m)	% cover	Dominant species
Upper	15-20	20	<i>Eucalyptus piperita</i> , <i>Corymbia gummifera</i>
Mid-upper	8	5	<i>Corymbia gummifera</i>
Mid-lower	2.5-3	60	<i>Acacia obtusifolia</i> , <i>Dillwynia retorta</i> , <i>Acacia terminalis</i>
Ground	0.5	5	<i>Lomandra</i> spp., <i>Caustis flexuosa</i> , <i>Eriostemon australasius</i> ssp. <i>australasius</i>
Total No. of native species recorded: 44			
Vegetation formation and class (Keith 2004):		Sydney Hinterland Dry Sclerophyll Forests Dry Sclerophyll Forests	
Vegetation on-ground description:		Open Forest - <i>Eucalyptus piperita</i> – <i>Corymbia gummifera</i>	
PCT:		1086. Red Bloodwood - Sydney Peppermint - Blue-leaved Stringybark heathy forest of the southern Blue Mountains, Sydney Basin	

Feature	Y/N	Comment
Hollow-bearing trees	Y	Hollows with diameters 11-20 cm and >20 cm are present.
Rock outcrop	N	
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	N	
Pest fauna	N	
Tree dieback	N	
Fire history	Y	Between 6-10 years ago.
Erosion	N	
Other	N	

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	3
2	<i>Acacia obtusifolia</i>	3
3	<i>Acacia terminalis</i>	3
4	<i>Acacia ulicifolia</i>	1
5	<i>Amperea xiphoclada</i>	1
6	<i>Banksia oblongifolia</i>	1
7	<i>Banksia serrata</i>	1
8	<i>Banksia spinulosa</i>	3
9	<i>Boronia ledifolia</i>	3
10	<i>Bossiaea obcordata</i>	2
11	<i>Cassytha glabella</i>	1
12	<i>Caustis flexuosa</i>	3
13	<i>Corymbia gummifera</i>	4b
14	<i>Dampiera purpurea</i>	2
15	<i>Dampiera stricta</i>	2
16	<i>Daviesia ulicifolia</i>	1
17	<i>Dillwynia retorta</i>	4b
18	<i>Dodonea triquetra</i>	1
19	<i>Eriostemon australasius ssp. australasius</i>	3
20	<i>Eucalyptus piperita</i>	5
21	<i>Eucalyptus sieberi</i>	4b
22	<i>Exocarpos strictus</i>	1
23	<i>Gompholobium latifolium</i>	1
24	<i>Grevillea mucronulata</i>	2
25	<i>Hakea dactyloides</i>	3
26	<i>Hibbertia rufa</i>	1
27	<i>Hovea linearis</i>	2
28	<i>Leptospermum trinervium</i>	3
29	<i>Leucopogon setiger</i>	1
30	<i>Lomandra micrantha</i>	3
31	<i>Lomandra micrantha</i>	1
32	<i>Lomandra obliqua</i>	2
33	<i>Lomatia silaifolia</i>	1
34	<i>Monotoca scoparia</i>	1
35	<i>Patersonia glabrata</i>	1
36	<i>Persoonia levis</i>	2
37	<i>Persoonia linearis</i>	2
38	<i>Petrophile pedunculata</i>	2
39	<i>Phyllanthus hirtellus</i>	1
40	<i>Poranthera ericifolia</i>	1
41	<i>Pteridium esculentum</i>	1
42	<i>Tetradlea thymifolia</i>	2
43	<i>Xanthosia pilosa</i>	1
44	<i>Xylomelum pyriforme</i>	1



Plate 2. The character of the vegetation within Plot 2.

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5.1.3. Plot 3

Plot 3	Floristic Site Survey Form	Hill Top
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Date: 29/08/18		Recorder: P. Burcher and S. Bloomfield	
Location: Firetrail on the western side of a powerline easement, 1.8 km south of the 800 m rifle range (Zone 1) Hill Top Conservation Area, NSW			
Plot Size: 6 x 60 m			
Easting: 265119	Northing: 6197472	Position in quadrat: north-west corner	
Zone No.: 56			
Altitude: 639 m		Slope: 2°	
Mitchell Landscape: Nattai Plateau		CMA: Hawkesbury-Nepean	
Geology: Nattai Tablelands erosional			
Vegetation Structure: (Walker & Hopkins 1983)			
Stratum	Height (m)	% cover	Dominant species
Upper	15-20	25	<i>Eucalyptus sclerophylla</i> , <i>Corymbia gummifera</i>
Mid-upper	4	<5	<i>Corymbia gummifera</i>
Mid-lower	1-1.5	<5	<i>Corymbia gummifera</i> , <i>Grevillea arenaria</i>
Ground	0.5	20	<i>Lomandra</i> spp., <i>Patersonia glabrata</i> , <i>Bossiaea obcordata</i> , <i>Gonocarpus teucroides</i>
Total No. of native species recorded: 39			
Vegetation formation and class (Keith 2004):		Sydney Hinterland Dry Sclerophyll Forests Dry Sclerophyll Forests	
Vegetation on-ground description:		Open Forest - <i>Eucalyptus sclerophylla</i> - <i>Corymbia gummifera</i>	
PCT:		1086. Red Bloodwood - Sydney Peppermint - Blue-leaved Stringybark heathy forest of the southern Blue Mountains, Sydney Basin	

Feature	Y/N	Comment
Hollow-bearing trees	N	Not within the plot.
Rock outcrop	N	Very minor amount.
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	N	
Pest fauna	N	
Tree dieback	N	
Fire history	Y	Within the last 10 years.
Erosion	Y	The track has a history of use and appears to still be used. The surface of the track is hard-set.
Other	N	

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia myrtifolia</i>	2
2	<i>Acacia ulicifolia</i>	1
3	<i>Amperea xiphioclada</i>	2
4	<i>Bossiaea obcordata</i>	3
5	<i>Bossiaea rhombifolia</i>	2
6	<i>Corymbia gummifera</i>	3
7	<i>Dampiera purpurea</i>	1
8	<i>Daviesia ulicifolia</i>	2
9	<i>Dianella caerulea</i>	3
10	<i>Entolasia stricta</i>	1
11	<i>Eucalyptus oblonga/sparsifolia</i>	1
12	<i>Eucalyptus sclerophylla</i>	4b
13	<i>Eucalyptus sieberi</i>	1
14	<i>Gompholobium grandiflorum</i>	3
15	<i>Gonocarpus teucroides</i>	3
16	<i>Goodenia bellidifolia</i>	1
17	<i>Grevillea arenaria</i>	3
18	<i>Grevillea sphacelata</i>	2
19	<i>Hardenbergia violacea</i>	1
20	<i>Hovea linearis</i>	1
21	<i>Lepidosperma laterale</i>	1
22	<i>Lindsaea microphylla</i>	1
23	<i>Lomandra longifolia</i>	1
24	<i>Lomandra micrantha</i>	3
25	<i>Lomandra filiformis</i>	3
26	<i>Lomandra multiflora</i>	2
27	<i>Lomandra obliqua</i>	1
28	<i>Lomatia silaifolia</i>	2
29	<i>Monotoca scoparia</i>	1
30	<i>Patersonia glabrata</i>	2
31	<i>Persoonia linearis</i>	1
32	<i>Persoonia oblongata</i>	1
33	<i>Petrophile pedunculata</i>	1
34	<i>Pimelea linifolia ssp. linifolia</i>	1
35	<i>Pomax umbellata</i>	2
36	<i>Poranthera corymbosa</i>	1
37	<i>Poranthera ericifolia</i>	2
38	<i>Xanthorrhoea media</i>	1
39	<i>Xylomelum pyriforme</i>	1



Plate 3. The character of the vegetation within Plot 3.

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5.1.4. Plot 4

Plot 4	Floristic Site Survey Form	Hill Top
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Date: 30/08/18		Recorder: P. Burcher and S. Bloomfield	
Location: West of the (under construction) 50 m gun range (boundary Zone 2) Hill Top Conservation Area, NSW			
Plot Size: 20 x 20 m			
Easting: 264843	Northing: 6200465	Position in quadrat: north-west corner	
Zone No.: 56			
Altitude: 591 m		Slope: 15°	
Mitchell Landscape: Nattai Plateau		CMA: Hawkesbury-Nepean	
Geology: Nattai Tablelands erosional			
Vegetation Structure: (Walker & Hopkins 1983)			
Stratum	Height (m)	% cover	Dominant species
Upper	15-20	30	<i>Corymbia gummifera</i> , <i>Eucalyptus piperita</i>
Mid-upper	6	5	<i>Corymbia gummifera</i> , <i>Banksia serrata</i> , <i>Hakea dactyloides</i>
Mid-lower	2-3	15	<i>Acacia terminalis</i> , <i>Banksia spinulosa</i> , <i>Pomaderris andromedifolia</i>
Ground	1	<5	<i>Pteridium esculentum</i> , <i>Lomandra spp.</i> , <i>Lepidosperma laterale</i>
Total No. of native species recorded: 35			
Vegetation formation and class (Keith 2004):		Sydney Hinterland Dry Sclerophyll Forests Dry Sclerophyll Forests	
Vegetation on-ground description:		Open Forest - <i>Eucalyptus piperita</i> – <i>Corymbia gummifera</i>	
PCT:		1086. Red Bloodwood - Sydney Peppermint - Blue-leaved Stringybark heathy forest of the southern Blue Mountains, Sydney Basin.	

Feature	Y/N	Comment
Hollow-bearing trees	Y	Hollows with diameters around 10 cm are present.
Rock outcrop	Y	Large areas of outcropping with numerous crevices, ledges, and exfoliated rock.
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	Y	Minor. The introduced Catsear (<i>Hypochaeris radicata</i>) and Sowthistle (<i>Sonchs oleraceus</i>), with cover abundance scores of 2 and 3, respectively, are present.
Pest fauna	N	
Tree dieback	N	
Fire history	Y	Between 6-10 years ago.
Erosion	N	
Other	Y	Areas of sediment have been deposited on top the rock shelf in the eastern portion of the plot from runoff upslope in association with the sedimentation basin development. Termite mound present.

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia myrtifolia</i>	2
2	<i>Acacia terminalis</i>	3
3	<i>Acacia ulicifolia</i>	1
4	<i>Banksia serrata</i>	4b
5	<i>Banksia spinulosa</i>	2
6	<i>Bossiaea obcordata</i>	3
7	<i>Corymbia gummifera</i>	4b
8	<i>Dampiera purpurea</i>	1
9	<i>Dillwynia phyllicoides</i>	2
10	<i>Entolasia stricta</i>	1
11	<i>Eriostemon australasius ssp. australasius</i>	3
12	<i>Eucalyptus piperita</i>	4b
13	<i>Eucalyptus sieberi</i>	1
14	<i>Gompholobium grandiflorum</i>	2
15	<i>Gonocarpus teucrioides</i>	1
16	<i>Goodenia bellidifolia</i>	1
17	<i>Grevillea sphacelata</i>	3
18	<i>Hakea dactyloides</i>	3
19	<i>Hakea gibbosa</i>	2
20	<i>Hypochaeris radicata</i> *	1
21	<i>Lepidosperma laterale</i>	2
22	<i>Leptospermum trinervium</i>	1
23	<i>Leucopogon setiger</i>	2
24	<i>Lomandra confertifolia ssp. rubiginosa</i>	1
25	<i>Lomandra filiformis</i>	2
26	<i>Lomandra micrantha</i>	1
27	<i>Lomandra obliqua</i>	1
28	<i>Lomatia silaifolia</i>	1
29	<i>Persoonia mollis</i>	1
30	<i>Phyllanthus hirtellus</i>	1
31	<i>Pomaderris andromedifolia</i>	3
32	<i>Poranthera ericifolia</i>	1
33	<i>Pteridium esculentum</i>	3
34	<i>Sonchus oleraceus</i> *	1
35	<i>Telopea speciosissima</i>	1
36	<i>Tetrateca thymifolia</i>	1
37	<i>Xylomelum pyriforme</i>	1



Plate 4. The character of the vegetation within Plot 4.

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5.1.5. Plot 5

Plot 5	Floristic Site Survey Form	Hill Top
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Date: 30/08/18		Recorder: P. Burcher and S. Bloomfield	
Location: On the southern side of Wattle Ridge Road, 20 m north-west of the entry to Zone 2) (boundary of Zone 2) Hill Top Conservation Area, NSW			
Plot Size: 20 x 20 m			
Easting: 265435	Northing: 6200643	Position in quadrat: north-west corner	
Zone No.: 56			
Altitude: 606 m		Slope: 1°	
Mitchell Landscape: Nattai Plateau		CMA: Hawkesbury-Nepean	
Geology: Nattai Tablelands erosional			
Vegetation Structure: (Walker & Hopkins 1983)			
Stratum	Height (m)	% cover	Dominant species
Upper	15	40	<i>Eucalyptus sieberi</i> , <i>Corymbia gummifera</i> , <i>Eucalyptus sparsifolia</i>
Mid-upper	6	10	<i>Corymbia gummifera</i> , <i>Hakea dactyloides</i>
Mid-lower	2	15	<i>Grevillea arenaria</i> , <i>Hakea dactyloides</i> , <i>Acacia spp.</i> , <i>Bossiaea obcordata</i>
Ground	0.5	45	<i>Cyathochaeta diandra</i> , <i>Lomandra spp.</i>
Total No. of native species recorded: 44			
Vegetation formation and class (Keith 2004):		Sydney Hinterland Dry Sclerophyll Forests Dry Sclerophyll Forests	
Vegetation on-ground description:		Open Forest - <i>Eucalyptus piperita</i> – <i>Corymbia gummifera</i> – <i>E. sieberi</i>	
PCT:		1086. Red Bloodwood - Sydney Peppermint - Blue-leaved Stringybark heathy forest of the southern Blue Mountains, Sydney Basin.	

Feature	Y/N	Comment
Hollow-bearing trees	N	
Rock outcrop	N	
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	N	
Pest fauna	N	
Tree dieback	N	
Fire history	Y	Between 6-10 years ago.
Erosion	N	
Other	Y	The majority of the plot and adjacent area appears to have been cleared in the past due to young nature of the woodland (approximately 20-30 years old).

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	2
2	<i>Acacia myrtifolia</i>	1
3	<i>Acacia obtusifolia</i>	2
4	<i>Acacia terminalis</i>	2
5	<i>Acacia ulicifolia</i>	1
6	<i>Acianthus sp.</i>	2
7	<i>Austrostipa pubescens</i>	1
8	<i>Banksia spinulosa</i>	1
9	<i>Billardiera scandens</i>	2
10	<i>Bossiaea obcordata</i>	3
11	<i>Cassytha glabella</i>	3
12	<i>Corymbia gummifera</i>	4b
13	<i>Cyathochaeta diandra</i>	5
14	<i>Daviesia ulicifolia</i>	2
15	<i>Dianella caerulea</i>	2
16	<i>Dianella longifolia</i>	2
17	<i>Entolasia stricta</i>	3
18	<i>Eucalyptus oblonga/sparsifolia</i>	4b
19	<i>Eucalyptus sieberi</i>	4b
20	<i>Gompholobium grandiflorum</i>	2
21	<i>Gonocarpus teucrioides</i>	2
22	<i>Goodenia bellidifolia</i>	1
23	<i>Grevillea arenaria</i>	4a
24	<i>Hakea dactyloides</i>	3
25	<i>Hovea linearis</i>	3
26	<i>Leptospermum trinervium</i>	1
27	<i>Lindsaea microphylla</i>	2
28	<i>Lissanthe strigosa</i>	1
29	<i>Lomandra filiformis</i>	3
30	<i>Lomandra micrantha</i>	4b
31	<i>Lomandra multiflora</i>	2
32	<i>Lomandra multiflora</i>	1
33	<i>Lomandra obliqua</i>	1
34	<i>Lomatia silaifolia</i>	3
35	<i>Monotoca scoparia</i>	2
36	<i>Opercularia diphylla</i>	1
37	<i>Patersonia glabrata</i>	3
38	<i>Persoonia levis</i>	1
39	<i>Persoonia mollis</i>	1
40	<i>Poranthera ericifolia</i>	1
41	<i>Pultenaea hispidula</i>	2
42	<i>Pultenaea scabra</i>	3
43	<i>Scaevola ramosissima</i>	1
44	<i>Tetradthea thymifolia</i>	2



Plate 5. The character of the vegetation within Plot 5.

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5.1.6. Plot 6

Plot 6	Floristic Site Survey Form	Hill Top
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Date: 29/08/18		Recorder: P. Burcher and S. Bloomfield	
Location: The gully between Zones 2 and 3 (Zone 1) Hill Top Conservation Area, NSW			
Plot Size: 20 x 20 m			
Easting: 265680	Northing: 6199995	Position in quadrat: north-west corner	
Zone No.: 56			
Altitude: 592 m		Slope: 3°	
Mitchell Landscape: Nattai Plateau		CMA: Hawkesbury-Nepean	
Geology: Nattai Tablelands erosional			
Vegetation Structure: (Walker & Hopkins 1983)			
Stratum	Height (m)	% cover	Dominant species
Upper	30	60	<i>Eucalyptus punctata</i> , <i>E. cypellocarpa</i> , <i>E. agglomerata</i> , <i>E. piperita</i>
Mid-upper	10	40	<i>Ceratopetalum gummiferum</i> , <i>Acacia obstusifolia</i>
Mid-lower	3	40	<i>Dodonea triquetra</i> , <i>Grevillea arenaria</i> , <i>Hakea dactyloides</i> , <i>Acacia spp.</i>
Ground	0.3	<5	<i>Lomandra spp.</i>
Total No. of native species recorded: 41			
Vegetation formation and class (Keith 2004):		Sydney Hinterland Dry Sclerophyll Forests Dry Sclerophyll Forests	
Vegetation on-ground description:		Open Forest - <i>Eucalyptus punctate</i> - <i>E. cypellocarpa</i> – <i>E. agglomerata</i> - <i>E piperita</i>	
PCT:		1181. Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion.	

Feature	Y/N	Comment
Hollow-bearing trees	N	
Rock outcrop	Y	Large areas of outcropping with some crevices, ledges, and exfoliated rock.
Mistletoe	N	
Water body	Y	An ephemeral drainage line traverses the plot. This drainage line was dry at the time of survey.
Threatened species	N	
Weeds	N	
Pest fauna	Y	Accumulation of feathers indicates a kill, potentially by the introduced Fox (<i>Vulpes vulpes</i>).
Tree dieback	N	
Fire history	Y	Between 6-10 years ago.
Erosion	N	
Other	Y	The plot traverses two aspects, and includes a slope and an ephemeral drainage line.

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	1
2	<i>Acacia obstusifolia</i>	4b
3	<i>Acacia terminalis</i>	3
4	<i>Actinotus minor</i>	1
5	<i>Banksia spinulosa</i>	2
6	<i>Blechnum cartilaginem</i>	2
7	<i>Bossiaea rhombifolia</i>	2
8	<i>Calochlaena dubia</i>	2
9	<i>Ceratopetalum gummiferum</i>	3
10	<i>Corymbia gummifera</i>	2
11	<i>Dampiera purpurea</i>	1
12	<i>Dianella caerulea</i>	2
13	<i>Dodonea triquetra</i>	4b
14	<i>Entolasia stricta</i>	1
15	<i>Eucalyptus agglomerata</i>	4b
16	<i>Eucalyptus cypellocarpa</i>	2
17	<i>Eucalyptus piperita</i>	4b
18	<i>Eucalyptus punctata</i>	4b
19	<i>Gompholobium grandiflorum</i>	1
20	<i>Gonocarpus teucrioides</i>	1
21	<i>Grevillea arenaria</i>	4b
22	<i>Hakea dactyloides</i>	3
23	<i>Lepidosperma laterale</i>	1
24	<i>Leptospermum polygalifolium</i>	2
25	<i>Leptospermum trinervium</i>	2
26	<i>Leucopogon lanceolatus</i>	1
27	<i>Lomandra filiformis</i>	2
28	<i>Lomandra longifolia</i>	3
29	<i>Lomandra micrantha</i>	3
30	<i>Lomandra obliqua</i>	1
31	<i>Lomatia silaifolia</i>	2
32	<i>opercularia diphylla</i>	1
33	<i>Patersonia glabrata</i>	1
34	<i>Persoonia levis</i>	1
35	<i>Persoonia linearis</i>	2
36	<i>Persoonia mollis</i>	3
37	<i>Philotheca hispidula</i>	2
38	<i>Pomaderris elliptica</i>	1
39	<i>Pteridium esculentum</i>	1
40	<i>Schoenus melanostachys</i>	3
41	<i>Telopea speciosissima</i>	1



Plate 6. The character of the vegetation within Plot 6.

5.2. Photo-points

5.2.1. Photo-point 1



Plate 7. Looking south-west over the conservation area towards Mt Jellore (date taken: 18/10/2018).

5.2.2. Photo-point 2



Plate 8. Intact woodland within Zone 1 (date taken: 18/10/2018).

5.2.3. Photo-point 3

A small amount of erosion is evident in this area as a result of the access tracks that are being used (Plates 7a-7d). The vegetation within the powerline easement is regularly maintained and slashed (Plates 7a, 7c-d).

Some rock outcropping and loose rock is present (Plates 7a and 7d). No weeds are present.



Plate 9a. Looking north-east with the conservation area evident to the west of the powerline easement (left of photo) (date taken: 30/8/2018).



Plate 9b. Looking east (date taken: 30/8/2018).



Plate 9c. Looking south-west with the conservation area evident to the west of the powerline easement (right of photograph) (date taken: 30/8/2018).



Plate 9d. Looking west towards the conservation area and Plot 3 location (date taken: 30/8/2018).

5.2.4. Photo-point 4

Some mulching works have occurred alongside the rifle range.



Plate 10a. Looking north-east along existing 800 m rifle range (date taken: 18/10/2018).

Immediately south of this photo-point, the area has recently been contoured to divert and control water and sediment runoff. This has been achieved by placing sandstone boulders and rocks of differing sizes in a drainage formation, and layering mulch around this (Plate 10b). The works have been undertaken as scouring and erosion has occurred, and sediment has been deposited near Plot 1. Deposition of this sediment has resulted in the death of some small trees and shrubs.

No weeds were observed at this location.



Plate 10b. The disturbed area at the southern end of the 800 m rifle range. Note the attempted rehabilitation measures of mulching and rock placement (date taken: 29/08/18).

5.1.6. Photo-point 5

Minor erosion and sediment deposition along the boundary of the 50 m gun range area, adjacent to the woodland, has occurred. Sedimentation fencing has been erected in some areas but requires maintenance (Plate 12).

No weeds were observed at this location.



Plate 11. Looking east along the northern boundary of the 50 m gun range under construction (date taken: 29/08/18).

5.1.7. Photo-point 6

Sediment deposition is common at the toe of the batter slope and woodland boundary at the south-east corner of the 50 m gun range area (Plate 13) and along the entire eastern batter.

Sedimentation and erosion control must be implemented.



Plate 12. The character of the drainage pit and vegetation at the south-east corner of the 50 m gun range (date taken: 29/08/18).

Additionally, rehabilitation of the batter slopes with native grasses and shrubs is proposed to be undertaken.

No weeds were observed at this location.

5.2. Weeds and pest animals

Under the *Biosecurity Act 2015*, 'all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.'

Two introduced plant species, Catsear and Sowthistle, were recorded, neither of which are listed:

- under Schedule 3 of the NSW Biosecurity Regulation 2017
- as 'priority weeds' in the South East region (this incorporating the Wingecarribee LGA) (DPI 2018)
- as a WoNS (DEE 2018)².

Given the presence of the accumulation of feathers at Plot 6, there is the potential that a bird was preyed upon by the introduced Fox (*Vulpes vulpes*). Whilst no other indications of this species' presence were observed (i.e. tracks or scats), it is known to occur in the locality.

² The list of WoNS is part of a combined State and Commonwealth initiative to combat invasive species.

6. Summary of findings

The results of the vegetation plots and photo-points has been summarised in Table 6, along with any of the management issues that were identified.

Table 6. Summary of management issues

Plot/Photo-point	PCT	Species Richness	TEC or threatened species	Management Issues
Plot				
1	1086	49	No	The north-west portion of the plot and adjacent to the west has been affected by sediment runoff from upslope in association with the 800 m gun range.
2	1086	44	No	None.
3	1086	39	No	The track has a history of use and appears to currently be in use. The wire strand fence beside fire trail gate appears to have been folded back to allow access to the firetrail.
4	1086	35	No	Two introduced species Catsear and Sowthistle are present. Areas of sediment have been deposited on top the rock shelf in the eastern portion of the plot from runoff upslope in association with the sedimentation basin development.
5	1086	44	No	None.
6	1181	41	No	None.
Photo-point				
1		N/A	No	None.
2		N/A	No	None.
3		N/A	No	Minor erosion.
4		N/A	No	None.
5		N/A	No	Inadequate erosion and sedimentation controls.
6		N/A	No	Sediment deposition.
General	Exposed areas with little to no vegetation cover present within the development areas (Zones 2 and 3).			

When compared to the previous monitoring report (Epacris 2017), the results of the current monitoring session illustrates that, broadly, the vegetation structure and composition has remained the same. Some additional groundcover species were recorded during the current session while others were not. This is typical of this strata as it is influenced by climatic conditions (i.e. rain) more so that the shrub and tree layers.

No fire has affected any of the monitoring plots or photo-points since the 2017 survey.

7. Management actions

Management actions have been prescribed for those issues identified in Section 6 (Table 7).

Table 7. Management actions required

Plot/Photo-point	Action
Plot	
1	Mulching and drainage works (i.e. placement of sandstone rocks) have been undertaken to address the sediment runoff issue. No further action required.
2	No action required.
3	The wire strand fence beside fire trail gate requires repair.
4	The occurrences of Catsear and Sowthistle are to be controlled as per the weed management strategy prepared for the site and/or in accordance with Item 1 of Annexure C of the Conservation Agreement. The batter slope on the western boundary of the sedimentation basin should be rehabilitated.
5	No action required.
6	No action required.
Photo-point	
1	No action required.
2	No action required.
3	No action required.
4	No action required.
5	Sedimentation and erosion control measures implemented as part of the CEMP require maintenance.
6	Sedimentation and erosion control must be implemented in line with the CEMP. Rehabilitation proposed to be undertaken at this location and on the batter slopes should include native plant species of local provenance and/or those specified in Appendix G of the Ecological Management Plan (GHD 2010).
General	Rehabilitation of the exposed surfaces of the development areas (Zones 2 and 3) is proposed to be undertaken and should include native plant species of local provenance and/or those specified in Appendix G of the Ecological Management Plan (GHD 2010). Any weeds present are to be controlled as per the weed management strategy prepared for the site and/or in accordance with Item 1 of Annexure C of the Conservation Agreement.

8. Recommendations

As works are underway and near completion for the 500 m range, it is recommended that a monitoring plot and photo-point be established near this area to monitor any changes.

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Appendix 1. Photographic record of the SHRSC

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Plot 1



Plate 1. Looking north



Plate 1. Looking east



Plate 3. Looking south



Plate 4. Looking west

Plot 2



Plate 1. Looking north



Plate 2. Looking east



Plate 3. Looking south



Plate 4. Looking west

Plot 3



Plate 1. Looking east from the east end of the transect



Plate 2. Looking west from the east end of the transect



Plate 3. Looking east from the west end of the transect



Plate 4. Looking west from the west end of the transect



Plate 5. Looking east from the 30 m mark of the transect



Plate 6. Looking west from the 30 m mark of the transect

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Plot 4



Plate 1. Looking north



Plate 2. Looking east



Plate 3. Looking south



Plate 4. Looking west

Plot 5



Plate 1. Looking north



Plate 2. Looking east



Plate 3. Looking south



Plate 4. Looking west

Plot 6



Plate 1. Looking north



Plate 2. Looking east



Plate 3. Looking south



Plate 4. Looking west

Appendix 2. Flora species recorded at each plot

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Key

* denotes introduced species

Scientific Name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
<i>Acacia linifolia</i>	✓	✓			✓	✓
<i>Acacia myrtifolia</i>			✓	✓	✓	
<i>Acacia obtusifolia</i>		✓			✓	✓
<i>Acacia suaveolens</i>	✓					
<i>Acacia terminalis</i>	✓	✓		✓	✓	✓
<i>Acacia ulicifolia</i>	✓	✓	✓	✓	✓	✓
<i>Acianthus sp.</i>					✓	
<i>Actinotus minor</i>						✓
<i>Amperea xiphoclada</i>	✓	✓	✓			
<i>Austrostipa pubescens</i>					✓	
<i>Banksia oblongifolia</i>		✓				
<i>Banksia serrata</i>	✓	✓		✓		
<i>Banksia spinulosa</i>	✓	✓		✓	✓	✓
<i>Billardiera scandens</i>	✓				✓	
<i>Blechnum cartilaginem</i>						✓
<i>Boronia ledifolia</i>	✓	✓				
<i>Bossiaea obcordata</i>	✓	✓	✓	✓	✓	
<i>Bossiaea rhombifolia</i>			✓			✓
<i>Calochlaena dubia</i>						✓
<i>Cassutha glabella</i>		✓			✓	
<i>Caustis flexuosa</i>	✓	✓				
<i>Ceratopetalum gummiferum</i>						✓
<i>Corymbia gummifera</i>	✓	✓	✓	✓	✓	✓
<i>Cyathochaeta diandra</i>	✓				✓	
<i>Dampiera purpurea</i>		✓	✓	✓		✓
<i>Dampiera stricta</i>		✓				
<i>Daviesia ulicifolia</i>	✓	✓	✓		✓	
<i>Dianella caerulea</i>			✓		✓	✓
<i>Dianella longifolia</i>					✓	
<i>Dillwynia elegans</i>	✓					
<i>Dillwynia phyllicoides</i>	✓			✓		
<i>Dillwynia retorta</i>		✓				
<i>Dodonea triquetra</i>	✓	✓				✓
<i>Entolasia stricta</i>	✓		✓	✓	✓	✓
<i>Eragrostis brownii</i>	✓					
<i>Eriostemon australasius ssp. australasius</i>	✓	✓		✓		
<i>Eucalyptus agglomerata</i>						✓
<i>Eucalyptus cypellocarpa</i>						✓
<i>Eucalyptus oblonga/sparsifolia</i>			✓		✓	
<i>Eucalyptus piperita</i>	✓	✓		✓		✓
<i>Eucalyptus punctata</i>						✓
<i>Eucalyptus sclerophylla</i>			✓			
<i>Eucalyptus sieberi</i>	✓	✓	✓	✓	✓	
<i>Exocarpos strictus</i>		✓				
<i>Gompholobium grandiflorum</i>	✓		✓	✓	✓	✓
<i>Gompholobium latifolium</i>		✓				
<i>Gonocarpus teucroides</i>	✓		✓	✓	✓	✓
<i>Goodenia bellidifolia</i>	✓		✓	✓	✓	
<i>Grevillea arenaria</i>			✓		✓	✓
<i>Grevillea mucronulata</i>	✓	✓				✓
<i>Grevillea sphacelata</i>				✓		
<i>Hakea dactyloides</i>	✓	✓		✓	✓	✓
<i>Hakea gibbosa</i>	✓			✓		
<i>Hardenbergia violacea</i>			✓			
<i>Hibbertia rufa</i>	✓	✓				
<i>Hovea linearis</i>		✓	✓		✓	

Scientific Name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
<i>Hypochaeris radicat</i> *				✓		
<i>Isopogon anemonifolius</i>	✓					
<i>Isopogon anethifolius</i>	✓					
<i>Lambertia formosa</i>	✓					
<i>Lepidosperma laterale</i>	✓		✓	✓		✓
<i>Leptospermum polygalifolium</i>						✓
<i>Leptospermum trinervium</i>	✓	✓		✓	✓	✓
<i>Leucopogon lanceolatus</i>						✓
<i>Leucopogon setiger</i>		✓		✓		
<i>Lindsaea microphylla</i>			✓		✓	
<i>Lissanthe strigosa</i>					✓	
<i>Lomandra longifolia</i>			✓			✓
<i>Lomandra micrantha</i>	✓	✓	✓	✓	✓	✓
<i>Lomandra confertifolia</i> ssp. <i>rubiginosa</i>				✓		
<i>Lomandra filiformis</i>			✓	✓	✓	✓
<i>Lomandra multiflora</i>			✓		✓	
<i>Lomandra obliqua</i>	✓	✓	✓	✓	✓	✓
<i>Lomatia silaifolia</i>	✓	✓	✓	✓	✓	✓
<i>Monotoca scoparia</i>	✓	✓	✓		✓	
<i>Opercularia diphylla</i>					✓	✓
<i>Patersonia glabrata</i>	✓	✓	✓		✓	✓
<i>Persoonia levis</i>	✓	✓			✓	✓
<i>Persoonia linearis</i>		✓	✓			✓
<i>Persoonia mollis</i>				✓	✓	✓
<i>Persoonia oblongata</i>			✓			
<i>Petrophile pedunculata</i>	✓	✓	✓			
<i>Philotheca hispidula</i>						✓
<i>Phyllanthus hirtellus</i>		✓		✓		
<i>Pimelea linifolia</i> ssp. <i>linifolia</i>			✓			
<i>Pomaderris andromedifolia</i>				✓		
<i>Pomaderris elliptica</i>						✓
<i>Pomax umbellata</i>			✓			
<i>Poranthera corymbosa</i>			✓			
<i>Poranthera ericfolia</i>	✓	✓	✓	✓	✓	
<i>Pteridium esculentum</i>	✓	✓		✓		✓
<i>Pultenaea hispidula</i>					✓	
<i>Pultenaea scabra</i>					✓	
<i>Scaevola ramosissima</i>					✓	
<i>Schoenus melanostachys</i>						✓
<i>Sonchus oleraceus</i> *				✓		
<i>Stylidium productum</i>	✓					
<i>Telopea speciosissima</i>	✓			✓		✓
<i>Tetratea thymifolia</i>	✓	✓		✓	✓	
<i>Xanthorrhoea media</i>			✓			
<i>Xanthosia pilosa</i>	✓	✓				
<i>Xanthosia tridentata</i>	✓					
<i>Xylomelum pyriforme</i>		✓	✓	✓		