

CONSERVATION AREA MONITORING AND BIOMETRIC CONDITION ASSESSMENT

Southern Highlands Regional Shooting Complex
(Hill Top Conservation Area)

October 2020



Lesn**k**
ENVIRONMENTAL

Cover photographs:

- Left: Sun-orchid located within area inspected.
- Top right: Severity and extent of December 2019 – January 2020 'Black Summer' fires. Photograph obtained near the 50 m range.

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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.

Contents

1. Introduction.....	2
2. Results.....	5
2.1. Vegetation plots	5
2.1.1. Plot 1.....	6
2.1.2. Plot 2.....	9
2.1.3. Plot 3.....	12
2.1.4. Plot 4.....	15
2.1.5. Plot 5.....	18
2.1.6. Plot 6.....	21
2.2. Photo-points.....	24
2.2.1. Photo-point 1.....	24
2.2.2. Photo-point 2.....	24
2.2.3. Photo-point 3.....	25
2.2.4. Photo-point 4.....	27
2.2.5. Photo-point 5.....	28
2.2.6. Photo-point 6.....	29
2.2.7. Photo-point 7.....	29
2.3. Weeds and pest animals	30
3. Summary of findings	31
4. Management actions.....	33
5. Recommendations	34
6. References	34

List of Figures

Page

Figure 1. Location of vegetation plots and photo-points	4
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List of Tables

Table 1. Vegetation plot coordinates	3
Table 2. Photo-point coordinates	3
Table 3. Summary of management issues	31
Table 4. Management actions required	33

List of Appendices

Appendix 1. Photographic record of the SHRSC	35
Appendix 2. Flora species recorded at each plot	42

Glossary

Abbreviation	Definition
°C	Degrees Celsius
CEMP	Construction Environmental Management Plan
DEE	Commonwealth Department of the Environment and Energy
DPI	NSW Department of Primary Industries
cm/m/km	Centimetres, metres, kilometres
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
SHRSC	Southern Highlands Regional Shooting Complex
TEC	Threatened Ecological Community
WoNS	Weeds of National Significance

1. Introduction

This report presents the findings of the third monitoring study undertaken by Lesryk at the request of the NSW Office of Sport (formerly Office of Sport and Recreation) in regards to the development of the SHRSC, located off Wattle Ridge Road, Hill Top, NSW.

The monitoring involves the undertaking of six flora plots and six photo-point locations within the SHRSC (Figure 1). For reference, the coordinates of these locations are provided in Tables 1 and 2.

Table 1. 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	265546	6199096	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).

Table 2. 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).
7 ¹	265196	6200362	Drainage below sediment dam west of the 500 m range (Zone 2)

The first monitoring report prepared by Lesryk (2018) provides further details on:

- the purpose and initiation of the study
- location and description of the SHRSC
- the conservation values of the SHRSC
- the methods employed.

The monitoring of the SHRSC site was conducted on 28 September and October 15, 2020 by Paul Burcher (B.App.Sc.), with John Speight (B.Sc.) assisting on 28 September 2020.

For reference, the weather conditions experienced during the monitoring sessions were:

- 28 September - moderate temperatures (19 °C), partly cloudy skies (<50% cloud cover) and no wind or rain
- 15 October - moderate temperatures (23 °C), partly cloudy skies (20%) and no wind or rain.

¹ Photo-point 7 has been added as it was noticed that sediment control fencing below the dam had been damaged by fire and not repaired since.

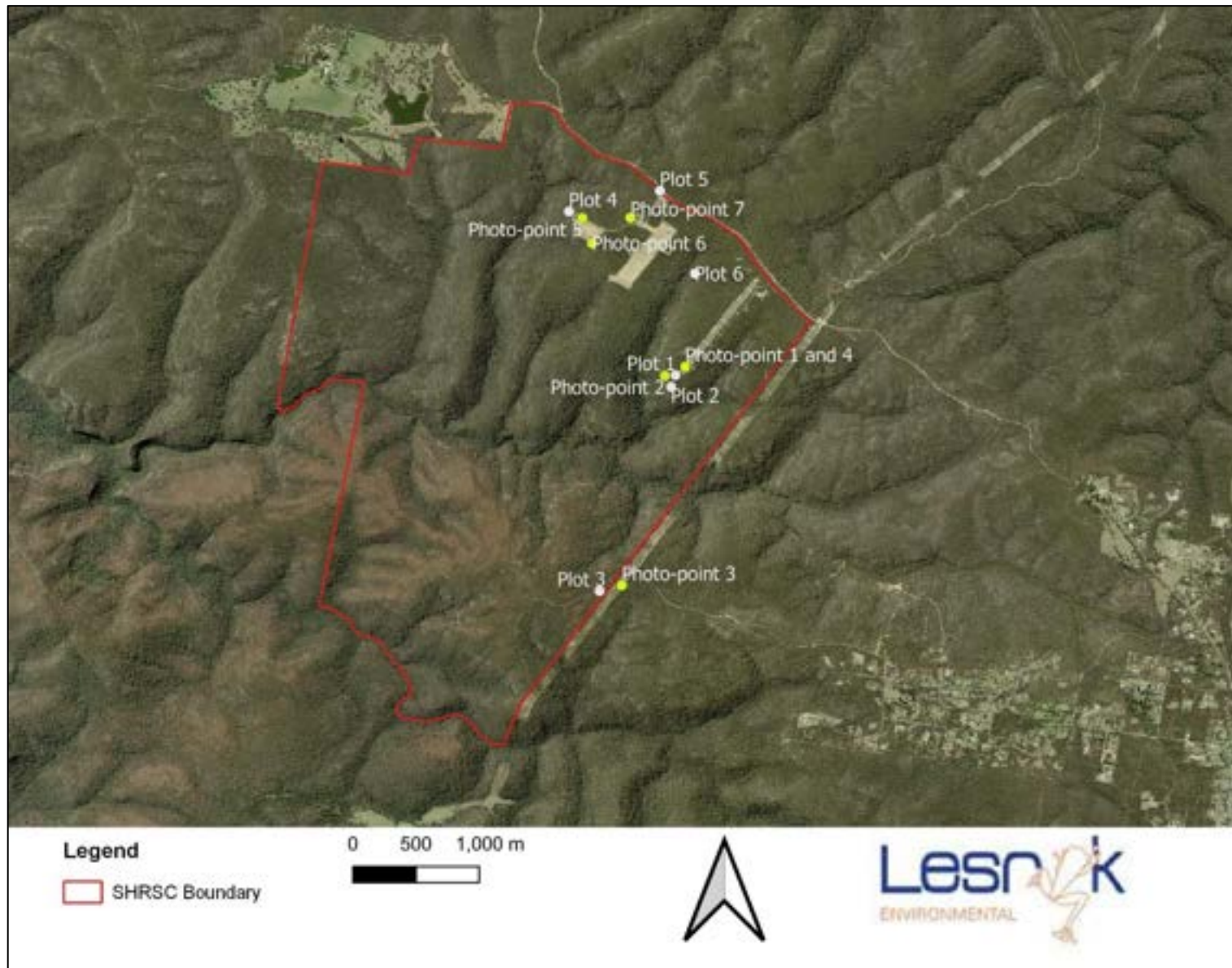


Figure 1. Location of vegetation plots and photo-points

2. Results

2.1. 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 have been provided in Appendix 1.

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

2.1.1. Plot 1

Plot 1 Floristic Site Survey Form Hill Top

Date: 28/09/2020 **Recorder:** P. Burcher and J. Speight

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	12	5 ²	<i>Eucalyptus sieberi</i> , <i>E. piperita</i> , <i>Corymbia gummifera</i>
Mid-upper	6	10	<i>Corymbia gummifera</i>
Ground	0.1-1	15	<i>Cyathochaeta diandra</i> , <i>Gonocarpus teucroides</i> , <i>Lomandra spp Lambertia formosa</i> , resprouting eucalypts.

Total No. of native species recorded: 47

Vegetation formation and class (Keith 2004): Sydney Hinterland Dry Sclerophyll Forests
Dry Sclerophyll Forests

Vegetation on-ground description: Open Forest - *Eucalyptus sieberi* – *Corymbia gummifera*

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	Overhanging.
Rock outcrop	Y	Very minor amount.
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	N	
Pest fauna	N	Pig rooting in drainage line upslope. Fox scat found nearby
Tree dieback	Y	A number of trees within the plot and surrounding area are affected.
Fire history	Y	Severe wildfire (named 'Green Wattle Creek' fire) December 2019
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). However, removal of groundcover vegetation and leaf litter by the bushfire and subsequent wet conditions have resulted in increased sedimentation and colonisation by the native sedge <i>Isolepis inundata</i> .

² Most of the canopy cover in the plots is post-fire epicormic growth

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	3
2	<i>Acacia suaveolens</i>	1
3	<i>Acacia terminalis</i>	3
4	<i>Acacia ulicifolia</i>	2
5	<i>Amperea xiphoclada</i>	3
6	<i>Austrostipa pubescens</i>	1
7	<i>Banksia marginata</i>	1
8	<i>Banksia serrata</i>	1
9	<i>Banksia spinulosa</i>	3
10	<i>Boronia ledifolia</i>	2
11	<i>Bossiaea obcordata</i>	2
12	<i>Corymbia gummifera</i>	4b
13	<i>Cyathochaeta diandra</i>	3
14	<i>Dampiera stricta</i>	2
15	<i>Dodonea triquetra</i>	2
16	<i>Entolasia stricta</i>	1
17	<i>Eriostemon australasius ssp. australasius</i>	3
18	<i>Eucalyptus piperita</i>	1
19	<i>Eucalyptus sieberi</i>	1
20	<i>Gonocarpus teucroides</i>	4a
21	<i>Goodenia bellidifolia</i>	1
22	<i>Grevillea sphacelata</i>	3
23	<i>Grevillea triternata</i>	2
24	<i>Hakea dactyloides</i>	3
25	<i>Hakea gibbosa</i>	1
26	<i>Hardenbergia violacea</i>	2
27	<i>Hibbertia rufa</i>	3
28	<i>Hybanthus monopetalus</i>	1
29	<i>Isolepis inundata</i>	3
30	<i>Isopogon anemonifolius</i>	1
31	<i>Lambertia formosa</i>	3
32	<i>Leptospermum trinervium</i>	3
33	<i>Lobelia dentata</i>	1
34	<i>Lomandra filiformis ssp. coriacea</i>	1
35	<i>Lomandra longifolia</i>	1
36	<i>Lomandra micrantha subsp. tuberculata</i>	3
37	<i>Lomandra obliqua</i>	2
38	<i>Lomatia silaiifolia</i>	1
39	<i>Monotoca scoparia</i>	0
40	<i>Patersonia glabrata</i>	1
41	<i>Persoonia levis</i>	1
42	<i>Petrophile pedunculata</i>	1
43	<i>Poranthera ericifolia</i>	4a
44	<i>Poranthera corymbosa</i>	1
45	<i>Pteridium esculentum</i>	1
46	<i>Tetratheca thymifolia</i>	2
47	<i>Xanthosia pilosa</i>	2



Plate 1. The vegetation within Plot 1.

2.1.2. Plot 2

Plot 2 Floristic Site Survey Form Hill Top

Date: 28/09/2020 **Recorder:** P. Burcher and J. Speight

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
Canopy	12	10	<i>Eucalyptus piperita</i> , <i>Corymbia gummifera</i>
Ground	0.5	5	<i>Lomandra micrantha</i> subsp. <i>tuberculata</i> , <i>Eriostemon australasius</i> ssp. <i>australasius</i> , <i>Gonocarpus teucroides</i> , <i>Poranthera</i> spp

Total No. of native species recorded: 37

Vegetation formation and class (Keith 2004): Sydney Hinterland Dry Sclerophyll Forests
Dry Sclerophyll Forests

Vegetation on-ground description: Open Forest - *Eucalyptus piperita* – *Corymbia gummifera*

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	Some loose boulders.
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	N	
Pest fauna	N	
Tree dieback	Y	Due to drought.
Fire history	Y	Severe wildfire (Green Wattle Creek) December 2019
Erosion	N	
Other	N	

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	2
2	<i>Acacia obtusifolia</i>	3
3	<i>Acacia terminalis</i>	3
4	<i>Acacia ulicifolia</i>	4a
5	<i>Austrostipa pubescens</i>	3
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>Corymbia gummifera</i>	4b
12	<i>Cymbonotus lawsonianus</i>	1
13	<i>Dampiera purpurea</i>	1
14	<i>Dodonea triquetra</i>	3
15	<i>Eriostemon australasius</i> ssp. <i>australasius</i>	4a
16	<i>Eucalyptus agglomerata</i> (seedling)	1
17	<i>Eucalyptus piperita</i>	4b
18	<i>Gonocarpus teucrioides</i>	3
19	<i>Grevillea spahecelata</i>	1
20	<i>Grevillea triternata</i>	1
21	<i>Hakea dactyloides</i>	1
22	<i>Hardenbergia violacea</i>	3
23	<i>Hibbertia rufa</i>	2
24	<i>Leptospermum trinervium</i>	1
25	<i>Lobelia dentata</i>	3
26	<i>Lomandra filiformis</i>	1
27	<i>Lomandra gracilis</i>	1
28	<i>Lomandra micrantha</i> subsp. <i>tuberculata</i>	3
29	<i>Lomandra obliqua</i>	2
30	<i>Lomatia silaifolia</i>	1
31	<i>Persoonia levis</i>	1
32	<i>Persoonia linearis</i>	1
33	<i>Poranthera corymbosa</i>	2
34	<i>Poranthera ericifolia</i>	3
35	<i>Pteridium esculentum</i>	3
36	<i>Xanthosia pilosa</i>	1
37	<i>Xylomelum pyriforme</i>	1



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

2.1.3. Plot 3

Plot 3	Floristic Site Survey Form	Hill Top
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Date: 28/09/2020		Recorder: P. Burcher and J. Speight	
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	10	<i>Eucalyptus sclerophylla</i> , <i>Corymbia gummifera</i>
Mid-lower	1-1.5	10	<i>Corymbia gummifera</i>
Ground	0.5	10	<i>Lomandra spp.</i>
Total No. of native species recorded: 40			
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	Y	Very minor amount.
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	N	
Pest fauna	N	
Tree dieback	N	
Fire history	Y	Severe wildfire (Green Wattle Creek) December 2019. Crown not as heavily burnt as other plots
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	Gate/fence is broken, permitting vehicle entry.

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	2
2	<i>Acacia myrtifolia</i>	2
3	<i>Acacia ulicifolia</i>	1
5	<i>Billiardiera scandens</i>	1
7	<i>Bossiaea obcordata</i>	3
8	<i>Caladenia sp</i>	1
9	<i>Corymbia gummifera</i>	3
10	<i>Dampiera purpurea</i>	1
11	<i>Daviesia ulicifolia</i>	1
12	<i>Dianella caerulea</i>	2
13	<i>Entolasia stricta</i>	1
14	<i>Eucalyptus eugenoides</i>	1
15	<i>Eucalyptus sclerophylla</i>	4b
16	<i>Eucalyptus sieberi</i>	1
17	<i>Gonocarpus teucroides</i>	1
18	<i>Goodenia bellidifolia</i>	2
19	<i>Goodenia heterophylla</i>	1
20	<i>Grevillea arenaria</i>	3
21	<i>Grevillea sphacelata</i>	1
22	<i>Haemadorum corymosum</i>	1
23	<i>Hovea linearis</i>	1
24	<i>Lindsaea microphylla</i>	1
25	<i>Lobelia dentata</i>	2
26	<i>Lomandra micrantha</i> subsp. <i>tuberculata</i>	3
27	<i>Lomandra filiformis</i>	1
28	<i>Lomandra multiflora</i>	2
29	<i>Lomandra obliqua</i>	2
30	<i>Lomatia silaifolia</i>	2
31	<i>Monotoca a scoparia</i>	1
32	<i>Patersonia glabrata</i>	3
33	<i>Persoonia oblongata</i>	1
34	<i>Phyllanthus hirtellus</i>	2
35	<i>Pimelea linifolia</i> ssp. <i>linifolia</i>	1
36	<i>Poranthera corymbosa</i>	2
37	<i>Poranthera ericifolia</i>	2
38	<i>Scaevola ramosissima</i>	1
39	<i>Xanthorrhoea media</i>	1
40	<i>Xylomelum pyriforme</i>	1



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

2.1.4. Plot 4

Plot 4 Floristic Site Survey Form Hill Top

Date: 28/09/2020 **Recorder:** P. Burcher and J. Speight

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	5	<i>Corymbia gummifera</i> , <i>Eucalyptus piperita</i>
Ground	1	10	<i>Pteridium esculentum</i> , <i>Lomandra</i> spp., <i>acacia myrtifolia</i>

Total No. of native species recorded: 46

Vegetation formation and class (Keith 2004): Sydney Hinterland Dry Sclerophyll Forests
Dry Sclerophyll Forests

Vegetation on-ground description: Open Forest - *Eucalyptus piperita* – *Corymbia gummifera*

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 Fleabane (<i>Conyza</i> sp) with cover abundance score of 1, is present.
Pest fauna	N	
Tree dieback	N	
Fire history	Y	Severe wildfire (Green Wattle Creek) December 2019.
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 linifolia</i>	2
2	<i>Acacia myrtifolia</i>	4a
3	<i>Acacia ulicifolia</i>	1
4	<i>Banksia serrata</i>	1
5	<i>Banksia spinulosa</i>	2
6	<i>Billiardiera scandens</i>	1
7	<i>Bossiaea obcordata</i>	1
8	<i>Brachyscome aculeata</i>	1
9	<i>Chrysocephalum apiculatum</i>	1
10	<i>Conyza sp*</i>	1
11	<i>Correa reflexa</i>	1
12	<i>Corymbia gummifera</i>	2
13	<i>Dampiera purpurea</i>	1
14	<i>Daviesia corymbosa</i>	1
15	<i>Entolasia stricta</i>	2
16	<i>Eriostemon australasius ssp. australasius</i>	1
17	<i>Eucalyptus agglomerata</i> (seedling)	2
18	<i>Eucalyptus piperita</i>	4b
19	<i>Eucalyptus sieberi</i>	1
20	<i>Gompholobium grandiflorum</i>	1
21	<i>Grevillea triternata</i>	1
22	<i>Grevillea sphacelata</i>	2
23	<i>Haemadorum planifolium</i>	1
24	<i>Hakea dactyloides</i>	2
25	<i>Hakea gibbosa</i>	3
26	<i>Hardenbergia violacea</i>	2
27	<i>Hibbertia rufa</i>	3
28	<i>Hovea linearis</i>	2
29	<i>Lepidosperma laterale</i>	2
30	<i>Leptospermum trinervium</i>	1
31	<i>Lobelia dentata</i>	2
32	<i>Lomandra confertifolia ssp. rubiginosa</i>	1
33	<i>Lomandra filiformis</i>	2
34	<i>Lomandra gracilis</i>	1
35	<i>Lomandra micrantha subsp. tuberculata</i>	2
36	<i>Lomandra obliqua</i>	2
37	<i>Lomatia silaifolia</i>	1
38	<i>Phyllanthus hirtellus</i>	1
39	<i>Pimelea linifolia</i>	1
40	<i>Pomaderris andromedifolia</i>	3
41	<i>Poranthera ericifolia</i>	1
42	<i>Pteridium esculentum</i>	4b
43	<i>Pteris tremula</i>	1
44	<i>Senecio diaschides</i>	1
45	<i>Wahlenbergia stricta</i>	2
46	<i>Xanthorrhoea ?media</i>	1



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

2.1.5. Plot 5

Plot 5 Floristic Site Survey Form Hill Top

Date: 28/09/2020 **Recorder:** P. Burcher and J. Speight

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: 265417 **Northing:** 6200653 **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	15	<i>Eucalyptus sieberi</i> , <i>Corymbia gummifera</i> , <i>Eucalyptus sparsifolia</i>
Mid-lower	1	15	Resprouting eucalypts
Ground	0.5	30	<i>Cyathochaeta diandra</i> , <i>Lomandra</i> spp., <i>hardenbergia</i> <i>Entolasia stricta</i> <i>hardenbergia</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 - *Eucalyptus piperita* – *Corymbia gummifera* – *E. sieberi*

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	Potential <10 cm diameter spout.
Rock outcrop	Y	
Mistletoe	N	
Water body	N	
Threatened species	N	
Weeds	N	
Pest fauna	N	
Tree dieback	Y	
Fire history	Y	Severe wildfire (Green Wattle Creek) December 2019.
Erosion	N	
Other	N	North-eastern corner of plot affected by rebuilding of fence post-fire

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	3
2	<i>Acacia myrtifolia</i>	3
3	<i>Acacia terminalis</i>	3
4	<i>Austrostipa pubescens</i>	1
5	<i>Billiardiera scandens</i>	1
6	<i>Bossiaea obcordata</i>	3
7	<i>Brachyscome aculeata</i>	1
8	<i>Caladenia sp</i>	1
9	<i>Corymbia gummifera</i>	4b
10	<i>Cyathochaeta diandra</i>	4b
11	<i>Dianella caerulea</i>	1
12	<i>Dianella longifolia</i>	1
13	<i>Entolasia stricta</i>	3
14	<i>Eucalyptus oblonga/sparsifolia</i>	4b
15	<i>Eucalyptus sieberi</i>	4b
16	<i>Goodenia bellidifolia</i>	2
17	<i>Goodenia heterophylla</i>	1
18	<i>Grevillea arenaria</i>	3
19	<i>Hakea dactyloides</i>	1
20	<i>Hardenbergia violacea</i>	4a
21	<i>Lindsaea microphylla</i>	1
22	<i>Lissanthea strigosa</i>	1
23	<i>Lobelia dentata</i>	2
24	<i>Lomandra filiformis</i>	2
25	<i>Lomandra gracilis</i>	1
26	<i>Lomandra micrantha subsp. tuberculata</i>	4b
27	<i>Lomandra multiflora</i>	4a
28	<i>Lomandra obliqua</i>	2
29	<i>Lomatia silaifolia</i>	2
30	<i>Microlaeana stipoides</i>	1
31	<i>Monotoca scoparia</i>	1
32	<i>Opercularia hispida</i>	2
33	<i>Persoonia levis</i>	1
34	<i>Phyllanthus hirtellus</i>	4a
35	<i>Pimelea linifolia</i>	1
36	<i>Poranthera ericifolia</i>	3
37	<i>Prasophyllum sp</i>	1
38	<i>Pultenaea hispidula</i>	1
39	<i>Scaevola ramosissima</i>	1



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

2.1.6. Plot 6

Plot 6 Floristic Site Survey Form Hill Top

Date: 28/09/2020 **Recorder:** P. Burcher and J. Speight

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	5 epicormic	<i>Eucalyptus punctata</i> , <i>E. agglomerata</i> , <i>E. piperita</i> .
Ground	0.3	<5	<i>Lomandra</i> spp., <i>Schoenus melanostachys</i> , <i>Dodonaea acacia terminalis</i> <i>pteridium dianelaa opercularia</i>

Total No. of native species recorded: 45

Vegetation formation and class (Keith 2004): Sydney Hinterland Dry Sclerophyll Forests
Dry Sclerophyll Forests

Vegetation on-ground description: Open Forest - *Eucalyptus punctata* - *E. agglomerata* - *E. piperita*

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, which traverses the plot, had some pooling at the time of survey.
Threatened species	N	Giant Burrowing Frog (<i>Heleioporus australiacus</i>) tapoles observed in ephemeral drainage line just upstream of plot
Weeds	Y	<i>Coryza</i> sp. Probably will not persist beyond two years
Pest fauna	N	
Tree dieback	Y	Large <i>Eucalyptus cypellocarpa</i> , formerly in canopy, killed by fire
Fire history	Y	Severe wildfire (Green Wattle Creek) December 2019.
Erosion	N	
Other	Y	The plot traverses two aspects and includes a steep slope and an ephemeral drainage line. Large termite mound in NW corner.

Floristic Composition		
No.	Species	Cover Abundance
1	<i>Acacia linifolia</i>	4a
2	<i>Acacia obstusifolia</i>	1
3	<i>Acacia terminalis</i>	3
4	<i>Acacia ulicifolia</i>	1
5	<i>Actinotus minor</i>	1
6	<i>Banksia spinulosa</i>	1
7	<i>Blechnum cartilagineum</i>	2
8	<i>Brachyscome aculeata</i>	1
9	<i>Brunoniella australis</i>	1
10	<i>Callicoma serratifolia</i>	2
11	<i>Calochlaena dubia</i>	1
12	<i>Ceratopetalum gummiferum</i>	2
13	<i>Conyza sp*</i>	1
14	<i>Corymbia gummifera</i>	2
15	<i>Dianella caerulea</i>	1
16	<i>Dodonea triquetra</i>	4a
17	<i>Elaeocarpus reticulatis</i>	1
18	<i>Entolasia stricta</i>	1
19	<i>Eucalyptus agglomerata</i>	2
20	<i>Eucalyptus piperita</i>	4b
21	<i>Eucalyptus punctata</i>	2
22	<i>Gonocarpus teucrioides</i>	3
23	<i>Grevillea arenaria</i>	1
24	<i>Hakea dactyloides</i>	3
25	<i>Hardenbergia violacea</i>	2
26	<i>Leptospermum trinervium</i>	1
27	<i>Lindsaea microphylla</i>	1
28	<i>Lobelai dentata</i>	1
29	<i>Lomandra filiformis</i>	1
30	<i>Lomandra bracilis</i>	1
31	<i>Lomandra longifolia</i>	3
32	<i>Lomandra micrantha</i> subsp. <i>tuberculata</i>	2
33	<i>Lomandra multiflora</i>	1
34	<i>Lomandra obliqua</i>	1
35	<i>Lomatia silaifolia</i>	1
36	? <i>Olearia sp</i>	1
37	<i>Opercularia diphylla</i>	3
38	<i>Patersonia glabrata</i>	1
39	<i>Phyllanthus hirtellus</i>	1
40	<i>Philothea hispidula</i>	1
41	<i>Poranthera ericifolia</i>	2
42	<i>Pseuderanthemum variabile</i>	1
43	<i>Pteridium esculentum</i>	3
44	<i>Schoenus melanostachys</i>	2
45	<i>Smilax glycyphylla</i>	1



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

2.2. Photo-points

2.2.1. Photo-point 1



Plate 7. Looking south-west over the conservation area towards Mt Jellore (date taken: 28/09/2020).

2.2.2. Photo-point 2



Plate 8. Intact woodland within Zone 1 (date taken: 28/09/2020).

2.2.3. 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 9a-9d). The vegetation within the powerline easement is regularly maintained and slashed (Plates 9a, 9c-d).

Some rock outcropping and loose rock is present (Plates 9a and 9d). 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: 28/09/2020).



Plate 9b. Looking east (date taken: 28/09/2020).



Plate 9c. Looking south-west with the conservation area to the west of the powerline easement (right of photograph) (date taken: 28/09/2020).



Plate 9d. Looking west towards the conservation area and Plot 3 location (date taken: 28/09/2020).

2.2.4. Photo-point 4



Plate 10a. Looking north-east along existing 800 m rifle range (date taken: 28/09/2020).

Immediately south of this photo-point, the area has 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.

The weed Scarlet Pimpernel (*Lysimachia arvensis*), which is common in the cleared areas of the range, was observed amongst the sandstone boulders in the drainage line. However, this plant has not colonised areas of bare earth in the adjacent bushland.



Plate 10b. The disturbed area at the southern end of the 800 m rifle range. Note Scarlet Pimpernel amongst rocks (date taken: 28/09/20).

2.2.5. 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 11).



Plate 11. Looking east along the northern boundary of the 50 m gun range,(date taken: 28/09/2020).

Consideration should be given to rehabilitating the bare earth batter slope (evident in Plate 11) with native grasses and shrubs.

No weeds were observed at this location.

2.2.6. 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 12) and along the entire eastern batter. This has been exacerbated by the 2019 bushfire.

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: 28/09/20).

Regeneration of the southern batter slope was evident; however, rehabilitation of the eastern batter requires attention.

No weeds were observed at this location.

2.2.7 Photo-point 7

A sediment control fence below an outlet of the sediment control pond west of the 500 m range has been destroyed by the 2019 fire. Subsequent rain and discharge from the pond have resulted in sediment depositing downslope.

Weeds were observed in the sediment including Parramatta Grass (*Sporobolus africanus*) and Cudweed (*Gamochaeta* sp).



Plate 13. The character of the sediment outbreak below Photo-point 7 (Photo taken 15/10/20).

2.3. 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, Fleabane and Catsear, 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 2019)
- as a WoNS (DEE 2019)³.

Near Photo Point 1 evidence of Feral Pig (*Sus scrofa*) rooting was observed in the deep moist mulch along the drainage line. A European Red Fox (*Vulpes vulpes*) scat also was observed nearby.

³ The list of WoNS is part of a combined State and Commonwealth initiative to combat invasive species.

3. Summary of findings

The results of the vegetation plots and photo-points has been summarised in Table 3, along with any of the management issues that were identified.

For a comparison the species richness results of the 2018, 2019 and 2020 monitoring sessions have been provided alongside each other.

The total species recorded during the current study was 108 compared with a total of 103 and 119 during the 2018 and 2019 monitoring studies, respectively.

Table 3. Summary of management issues

Plot/Photo-point	PCT	Species Richness 2018/2019/2020	TEC or threatened species	Management Issues
Plot				
1	1086	49/51/47	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	44/44/37	No	None.
3	1086	39/40/40	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	35/49/46	No	One introduced species Fleabane is 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	44/41/39	No	None.
6	1181	41/50/45	Giant Burrowing Frog recorded just upstream of plot	One introduced species Fleabane is present.
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.
7		N/A	No	Fire-damaged erosion and sedimentation controls.
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 (Lesryk 2019), the results of the current monitoring session illustrate that as a result of the 2019 bushfires, the vegetation structure and composition has changed dramatically. Whilst canopy density and composition are likely to be similar to pre-fire conditions in the medium term, there have been substantial changes to the shrub and groundcover strata that are likely to persist for some time. Many individuals of formerly common or dominant species such as the shrub paperbark Tea-tree (*Leptospermum trinervium*) which usually resprout post-fire have been killed. Others that usually seed prolifically after a fire event such as peas (*Fabaceae* spp) and some wattles (*Acacia* spp) were absent or in very low numbers. Numerous Proteaceae family species, notably the smooth-barked Geebung (*Persoonia mollis* and *P.oblongata*) and Waratah (*Telopea speciosissima*) were also absent.

There was some increase in weed cover due to fire-exposed soil being colonised by wind-borne seed. However, most if not all of these species are annual or biennial Asteraceae (Daisy family) species that in the medium to long-term will be out-competed by regenerating native species.

4. Management actions

Management actions have been prescribed for those issues identified in Section 3 (Table 4).

Table 4. 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 Fleabane and Catsear 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. Rehabilitation should be undertaken at this location on the batter slope and should include native plant species of local provenance and/or those specified in Appendix G of the Ecological Management Plan (GHD 2010).
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).
7	Sedimentation and erosion control measures damaged by fire must be repaired in line with the CEMP.
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.

5. Recommendations

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

6. References

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Appendix 1. Photographic record of the SHRSC

Plot 1



Plate 1. Looking north



Plate 2. 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 north from the west end of the transect



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



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



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

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

Key

* denotes introduced species

Scientific name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
<i>Acacia linifolia</i>	X	X	X	X	X	X
<i>Acacia myrtifolia</i>			X	X	X	
<i>Acacia obtusifolia</i>		X				X
<i>Acacia suaveolens</i>	X					
<i>Acacia terminalis</i>	X	X			X	X
<i>Acacia ulicifolia</i>	X	X	X	X		X
<i>Actinotus minor</i>						X
<i>Amperea xiphioclada</i>	X					
<i>Austrostipa pubescens</i>	X	X			X	
<i>Banksia marginate</i>	X					
<i>Banksia oblongifolia</i>						
<i>Banksia serrata</i>	X	X		X		
<i>Banksia spinulosa</i>	X	X		X		
<i>Billardiera scandens</i>			X	X	X	
<i>Blechnum cartilagineum</i>						X
<i>Boronia ledifolia</i>		X				
<i>Bossiaea neoanglica</i>						
<i>Bossiaea obcordata</i>	X	X	X	X	X	
<i>Brachyscome aculeata</i>				X	X	X
<i>Brunoniella australis</i>						X
<i>Caladenia sp</i>			X		X	
<i>Callicoma serratifolia</i>						X
<i>Calochlaena dubia</i>						X
<i>Ceratopetalum gummiferum</i>						X
<i>Conyza sp*</i>						X
<i>Correa reflexa</i>				X		
<i>Corybas sp</i>						
<i>Corymbia gummifera</i>	X	X	X	X	X	X
<i>Cyathochaeta diandra</i>	X				X	
<i>Dampiera stricta</i>	X					
<i>Dampiera purpurea</i>		X	X	X		
<i>Dampiera stricta</i>						
<i>Daviesia corymbose</i>				X		
<i>Daviesia ulicifolia</i>			X			
<i>Dianella caerulea var. caerulea</i>			X		X	X
<i>Dodonea triquetra</i>	X	X				X
<i>Elaeocarpus reticulatus</i>						X
<i>Entolasia stricta</i>	X		X	X	X	X
<i>Eragrostis brownii</i>	X					
<i>Eriostemon australasius ssp. australasius</i>	X	X		X		
<i>Eucalyptus agglomerata</i>		X		X		X
<i>Eucalyptus cypellocarpa</i>						X

Scientific name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
<i>Eucalyptus eugenioides</i>			X			
<i>Eucalyptus oblonga/sparsifolia</i>					X	
<i>Eucalyptus piperita</i>	X	X		X		X
<i>Eucalyptus punctata</i>						X
<i>Eucalyptus sclerophylla</i>			X			
<i>Eucalyptus sieberi</i>	X		X	X	X	
<i>Exocarpos strictus</i>		X				
<i>Gonocarpus teucrioides</i>	X	X	X	X		X
<i>Goodenia bellidifolia</i>	X		X		X	
<i>Goodenia heterophylla</i>			X		X	
<i>Grevillea arenaria</i>			X		X	X
<i>Grevillea sphacelata</i>	X	X	X	X		
<i>Grevillea triternata</i>	X	X		X		
<i>Haemodorum planifolium</i>			X	X		
<i>Hakea dactyloides</i>	X			X	X	X
<i>Hakea gibbosa</i>	X					
<i>Hardenbergia violacea</i>	X	X		X	X	X
<i>Hibbertia rufa</i>	X			X		
<i>Hovea linearis</i>			X	X		
<i>Hybanthus monopetalus</i>	X					
<i>Isolepis inundata</i>	X					
<i>Isopogon anemonifolius</i>	X					
<i>Lambertia formosa</i>	X					
<i>Lepidosperma laterale</i>				X		
<i>Leptospermum trinervium</i>	X			X	X	
<i>Lindsaea microphylla</i>					X	X
<i>Lissanthea strigose</i>					X	
<i>Lobelia dentata</i>	X	X	X	X	X	X
<i>Lomandra confertifolia</i> ssp. <i>rubiginosa</i>				X		
<i>Lomandra filiformis</i>	X	X	X	X	X	X
<i>Lomandra gracilis</i>		X		X	X	X
<i>Lomandra longifolia</i>	X					X
<i>Lomandra micrantha</i> subsp. <i>tuberculata</i>	X	X	X	X	X	X
<i>Lomandra multiflora</i>			X		X	X
<i>Lomandra obliqua</i>	X	X	X	X	X	X
<i>Lomatia silaifolia</i>	X	X	X	X	X	X
<i>Microlaeana stipoides</i>					X	
<i>Monotoca scoparia</i>			X		X	
<i>Olearia</i> sp						X
<i>Opercularia diphylla</i>			X		X	X
<i>Patersonia glabrata</i>	X		X		X	X
<i>Persoonia levis</i>	X	X				
<i>Persoonia linearis</i>		X				
<i>Petrophile pedunculata</i>	X		X			

Scientific name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
<i>Philothea hispidula</i>						X
<i>Phyllanthus hirtellus</i>			X	X	X	X
<i>Pimelea linifolia ssp. linifolia</i>			X	X	X	
<i>Poaceae sp</i>				X		
<i>Pomaderris andromedifolia</i>				X		
<i>Poranthera corymbosa</i>	X	X	X	X		
<i>Poranthera ericifolia</i>	X	X	X	X	X	X
<i>Poranthera microphylla</i>	X					
<i>Prasophyllum ?flavum</i>					X	
<i>Pseuderanthemum variabile</i>						X
<i>Pteridium esculentum</i>	X	X		X		X
<i>Pteris tremula</i>				X		
<i>Pultenaea hispidula</i>					X	
<i>Scaevola ramosissima</i>			X		X	
<i>Schoenus melanostachys</i>						X
<i>Senecio diaschides</i>				X		
<i>Smilax glyciophylla</i>						X
<i>Tetradlea thymifolia</i>	X					
<i>Xanthorrhoea media</i>				X		
<i>Xanthosia pilosa</i>	X	X				
<i>Xanthosia tridentata</i>	X					
<i>Xylomelum pyriforme</i>		X	X			