CONSERVATION AREA MONITORING AND BIOMETRIC CONDITION ASSESSMENT

Southern Highlands Regional Shooting Complex (Hill Top Conservation Area)

February 2022

Lesnok ENVIRONMENTAL

Cover photograph: Characteristic structure of native vegetation, as exemplified in Plot 5, massive regeneration in the shrub strata since the December 2019 'Black Summer' bushfires and 2021-22 rain.

Report produced at the request of:

NSW Office of Sport

by

Lesryk Environmental Pty Ltd
PO Box 3001
Bundeena NSW 2230
Telephone: (02) 9523 2016
Mobile: 0408 25 8129
Email: admin@lesryk.com.au
www.lesryk.com.au

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Version	Authors	Reviewers	Approved For Issue	
Draft V1	Deryk Engel (Director) Patricia Nagle (Botanist) Peter Monsted (Botanist) Julia Veltrop (Field Assistant)	Deryk Engel Kirsty Bloomfield	Deryk Engel	1/3/2022
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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
ºC	Degrees Celsius
ASL	Above Sea Level
CEMP	Construction Environmental Management Plan
DEE	Commonwealth Department of the Environment and Energy
DPE	NSW Department of Environment
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
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 fourth monitoring study undertaken by Lesryk at the request of the NSW Office of Sport in regards to the ongoing development and use of the Southern Highlands Regional Shooting Complex (SHRSC) located on Wattle Ridge Road, Hill Top, NSW.

The monitoring involves the undertaking of six flora plots and seven 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

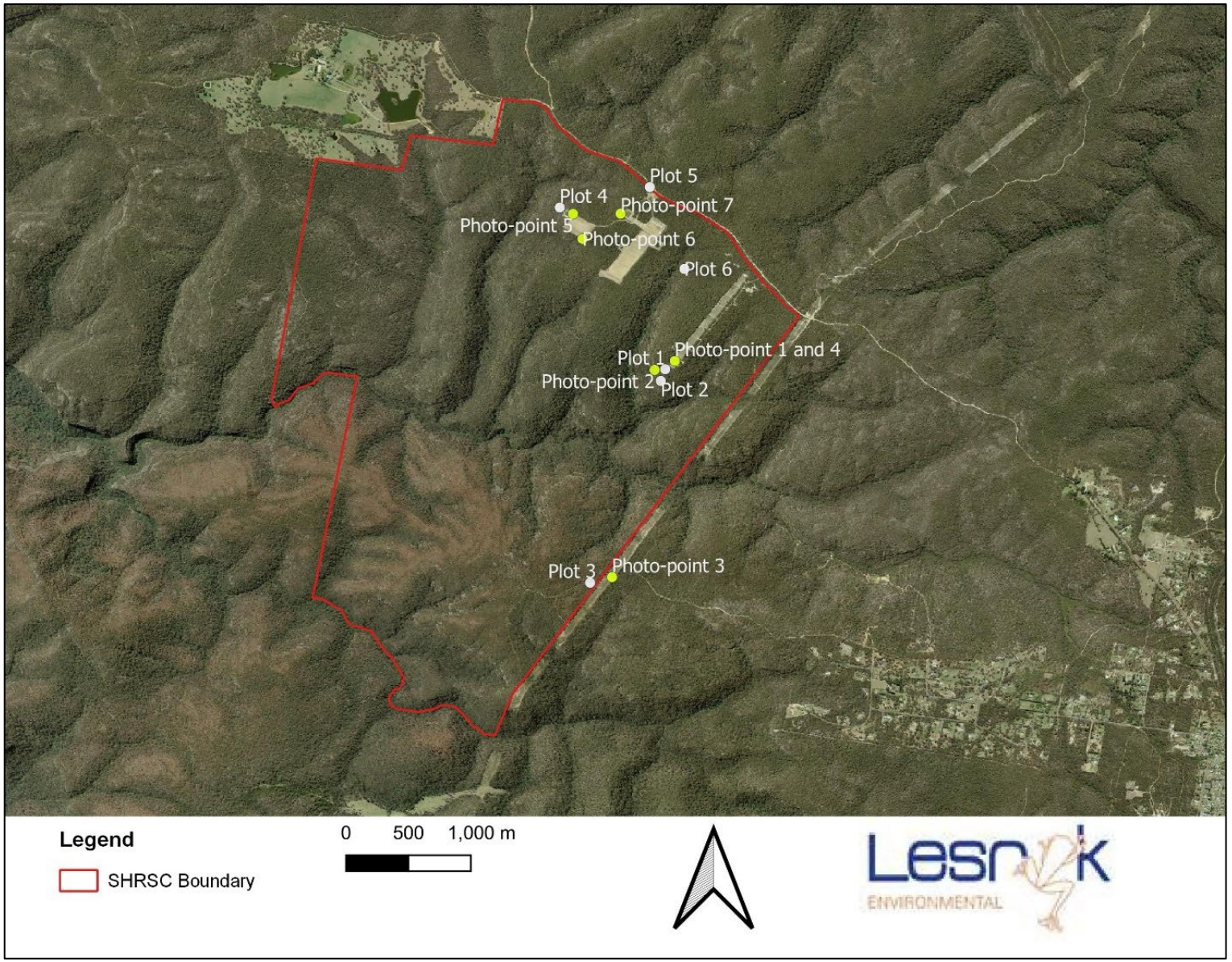
Plot No.	Grid Reference (GDA 94)		General location and description
	Easting	Northing	
1	265573	6199190	Southern end of the 800m range.
2	265546	6199096	230m south-west of the 800m range.
3	265119	6197472	Firetrail on the western side of a powerline easement, 1.8 km south of the 800m range.
4	264843	6200465	West of the 50m range
5	265435	6200643	On the southern side of Wattle Ridge Road.
6	265680	6199995	The gully between 500m and 800m ranges.

Table 2. Photo-point coordinates

Photo-points	Grid Reference (GDA 94)		General location and description
	Easting	Northing	
1	265635	6199258	South end of 800m range.
2	265503	6199183	Intact woodland.
3	265263	6197520	Powerline easement crossing, 1.8km south of the 800m range.
4	265635	6199258	South end of 800m range
5	264932	6200416	Northern boundary of the 50m range
6	265000	6200218	South-east of the 50m range.
7	265196	6200362	Drainage below sediment dam west of the 500m range

The initial monitoring report (Lesryk 2018) provides details on the full project, including:

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


Plot 5
Plot 4
Photo-point 7
Photo-point 5
Photo-point 6
Plot 6
Plot 1
Photo-point 1 and 4
Photo-point 2
Plot 2
Plot 3
Photo-point 3
Legend
SHRSC Boundary
0 500 1,000 m
Lesryk
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This fourth monitoring session was conducted over several days, detail on these provided below (Table 3).

Table 3. Survey details

PM: Peter Monsted B.Sc. M.Sc
PN: Patricia Nagle B.Sc, Grad.Dip., Cert IV Conservation and Land Management
JV: Julia Veltrop

Date (2022)	Researcher	Weather	Activity
17 January	PM, PN	humid and hot 30 from 9am-4pm.	Plots 4 & 5 and Photopoints 5 & 7
18 January	PM, PN	raining and cool 22 C from 9-11am.	Photopoint 6
28 January	PM, PN	dry and warm 25 C from 8-10am.	Plots 1-3 and Photopoints 1-4
1 February	PN, JV	dry and hot 28 C from 7-10am.	Plot 6

2. Results

2.1. Vegetation plots

The single photos of each plot were taken looking in from the north-western corner-post and have been included within the relevant sections below.

The 4 cardinal photos (taken looking north, east, south and west from the north-western corner-post) have been provided in Appendix 1.

Lists of flora species identified at each plot are given in each section but are collated and analysed in Appendix 2.

It is noted that a number of the steel (star) pickets established during the initial monitoring session were not relocated during the current study even though extensive searches were undertaken. The density of the post-fire understorey regeneration has had an adverse impact on site visibility, reducing the ability to relocate several of these. As such, using the GPS coordinates provided in Tables 1 and 2, approximate locations of the monitoring and photo-points were determined and used in several of the sites monitored during the course of the current study. The replacement of the star pickets with similar features that are more easily located (e.g. taller stakes) is recommended.

2.1.1. Plot 1

Plot 1 Floristic Site Survey Form Hill Top

Date: 28/01/2022 **Recorder:** P.Monsted & P.Nagle

Location: Southern end of the 800 m rifle range, Hill Top Conservation Area, NSW

Plot Size: 20 m x 20 m

Easting: 265573 **Northing:** 6199190 **Position in quadrat:** north-west corner
Zone No.: 56

Altitude: 616 m asl **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	*Eucalyptus sieberi*, *E. piperita, Corymbia gummifera*
Mid-upper	6	10	*Corymbia gummifera*
Shrub	0.5-1.5	60	*Acacia suaveolens, Acacia terminalis, Banksia spinulosa, Hakea dactyloides, Pimelea linifolia*, Regenerating *Eucalyptus* spp..
Ground	0.1-0.5	40	*Gonocarpus teucrioides, Lomandra* spp., *Patersonia sericea, Caustis flexuosa, Poranthera ericifolia, Platysace ericoides, Xanthosia pilosa*

Total No. of native species recorded: 55 **Total No. of weed species:** 0

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	
Tree dieback	N	
Fire history	Y	Catastrophic wildfire (‘Green Wattle fire’) December 2019. Effect on vegetation composition and structure is very evident. Many canopy trees died and those surviving are dominated by epicormic growth. Shrub stratum is regenerating well after the 2021 rainfall and will remain the dominant stratum in cover and diversity for some years.
Erosion	N	
Other	Y	The NW and W portions of the plot have been affected by sediment runoff from upslope near the 800m range. Vegetation growth here is noticeably different to the rest of the plot.

Floristic Composition		
No.	**Species**	**Cover Abundance**
1	*Acacia brownii*	2
2	*Acacia linifolia*	2
3	*Acacia myrtifolia*	2
4	*Acacia suaveolens*	3
5	*Acacia terminalis*	3
6	*Amperea xiphoclada* var. *xiphoclada*	2
7	*Anisopogon avenaceus*	1
8	*Banksia marginata*	1
9	*Banksia spinulosa*	3
10	*Boronia ledifolia*	1
11	*Bossiaea obcordata*	1
12	*Caustis flexuosa*	3
13	*Corymbia gummifera*	3
14	*Cyathochaeta diandra*	1
15	*Dampiera purpurea*	1
16	*Dampiera stricta*	2
17	*Dillwynia floribunda*	1
18	*Dillwynia retorta*	1
19	*Dodonaea triquetra*	1
20	*Entolasia stricta*	2
21	*Eragrostis brownii*	1
22	*Eucalyptus piperita*	3
23	*Eucalyptus sieberi*	4b
24	*Gompholobium grandiflorum*	1
25	*Gonocarpus teucrioides*	4a
26	*Goodenia bellidifolia* subsp. *bellidifolia*	2
27	*Grevillea arenaria*	1
28	*Grevillea sphacelata*	2
29	*Haemodorum planifolium*	2
30	*Hakea dactyloides*	3
31	*Hakea sericea*	1
32	*Hardenbergia violacea*	2
33	*Isolepis inundata*	1
34	*Isopogon anemonifolius*	1
35	*Lambertia formosa*	2
36	*Leptospermum parvifolium*	1
37	*Leptospermum trinervium*	2
38	*Lomandra confertifolia* subsp. *rubiginosa*	3
39	*Lomandra cylindrica*	2
40	*Lomandra obliqua*	2
41	*Lomatia silaifolia*	2
42	*Microlaena stipoides* var. *stipoides*	1
43	*Patersonia sericea*	3
44	*Persoonia levis*	1
45	*Persoonia pinifolia*	1
46	*Petrophile pulchella*	2
47	*Pimelea linifolia*	3
48	*Platysace ericoides*	2
49	*Poranthera corymbosa*	2
50	*Poranthera ericifolia*	3
51	*Pteridium esculentum*	1
52	*Smilax glyciphylla*	1
53	*Tetratheca thymifolia*	1
54	*Xanthosia pilosa*	3
55	*Xanthosia tridentata*	1

Plate 1. The vegetation within Plot 1.

2.1.2. Plot 2

Plot 2 Floristic Site Survey Form Hill Top

Date: 28/01/2022 **Recorder:** P.Monsted and P.Nagle

Location: 230 m south-west of the 800 m rifle range, Hill Top Conservation Area, NSW

Plot Size: 20 m x 20 m

Easting: 265540 **Northing:** 6199076 **Position in quadrat:** north-west corner
Zone No.: 56

Altitude: 602 m asl **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	15	*Eucalyptus piperita, Corymbia gummifera*
Shrub	0.5-1.5	60	*Acacia* spp. and regenerating *Corymbia gummifera* with *Banksia spinulosa, Grevillea arenaria, Leptospermum trinervium, Gompholobium latifolium* and *Lomatia silaifolia.*
Ground	0.5	20	*Hardenbergia violacea, Gonocarpus teucrioides, Poranthera ericifolia, Lomandra confertifolia* subsp. *rubiginosa*

Total No. of native species recorded: 47 **Total No. of weed species:** 0

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	Post fire dieback in canopy
Fire history		Y	Severe wildfire (Green Wattle Fire) December 2019. Effect on vegetation composition and structure evident. Some canopy trees have died and those surviving are dominated by epicormic growth. Shrub stratum now is the dominant stratum and will remain so for some years.
Erosion		N	
Other		N	

Floristic Composition		
No.	**Species**	**Cover Abundance**
1	*Acacia linifolia*	3
2	*Acacia longifolia* subsp. *longifolia*	3
3	*Acacia terminalis*	4a
4	*Acacia ulicifolia*	2
5	*Amperea xiphoclada* var. *xiphoclada*	1
7	*Anisopogon avenaceus*	1
8	*Banksia serrata*	1
9	*Banksia spinulosa*	1
10	*Billardiera scandens*	1
11	*Boronia ledifolia*	2
12	*Bossiaea obcordata*	1
13	*Caustis flexuosa*	2
14	*Corymbia gummifera*	4a
15	*Dampiera purpurea*	2
16	*Dillwynia retorta*	2
17	*Dodonaea triquetra*	2
18	*Entolasia stricta*	2
19	*Eriostemon australasius*	2
20	*Eucalyptus piperita*	3
21	*Eucalyptus sieberi*	3
22	*Gompholobium latifolium*	3
23	*Gonocarpus teucrioides*	3
24	*Goodenia hederacea* subsp. *hederacea*	1
25	*Grevillea arenaria*	3
26	*Haemodorum planifolium*	1
27	*Hardenbergia violacea*	4b
28	*Leptospermum trinervium*	2
29	*Lomandra confertifolia* subsp. *rubiginosa*	2
30	*Lomandra multiflora* subsp. *multiflora*	1
31	*Lomandra obliqua*	2
32	*Lomatia silaifolia*	3
33	*Patersonia sericea*	2
34	*Persoonia levis*	1
35	*Phyllanthus hirtellus*	1
36	*Platysace ericoides*	2
37	*Poranthera corymbosa*	1
38	*Poranthera ericifolia*	3
39	*Poranthera microphylla*	1
40	*Pteridium esculentum*	1
41	*Rytidosperma pallidum*	1
42	*Tetratheca thymifolia*	1
43	*Xanthosia tridentata*	2
44	*Xylomelum pyriforme*	1
45	*Zieria granulata*	1

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

2.1.3. Plot 3

Plot 3	Floristic Site Survey Form	Hill Top

Date: 28/01/2022 **Recorder:** P.Monsted and P.Nagle

Location: 50 m along the firetrail west of the powerline easement, 1.8 km south of the 800 m range, Hill Top Conservation Area, NSW

Plot Size: 20 m x 20 m

Easting: 265119 **Northing:** 6197472 **Position in quadrat:** north-west corner
Zone No.: 56

Altitude: 639 m asl **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	*Eucalyptus eugenioides, Eucalyptus sclerophylla*, *Corymbia gummifera*
Mid-lower	2.5	5	*Corymbia gummifera*
Shrub	0.5-1.5	30	*Acacia myrtifolia, Acacia linifolia, Bossiaea neo-anglica, Grevillea arenaria, Lomatia silaifolia, Pimelea linifolia* subsp. *linifolia*
Ground	0.5	10	*Lomandra* spp., *Gonocarpus teucrioides, Patersonia glabrata, Actinotus minor, Anisopogon avenaceus, Austrostipa pubescens*

Total No. of native species recorded: 42 **Total No. of weed species:** 0

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

Vegetation on-ground description: Open Forest - *Eucalyptus sclerophylla - 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	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 Fire) Dec 2019. Crown not as heavily burnt as other plots. Shrub stratum regenerating and now dominant.
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 (previously noted).

Floristic Composition		
No.	**Species**	**Cover Abundance**
1	*Acacia linifolia*	3
2	*Acacia myrtifolia*	4a
3	*Actinotus minor*	2
5	*Allocasuarina torulosa*	1
7	*Anisopogon avenaceus*	2
8	*Austrostipa pubescens*	2
9	*Banksia spinulosa*	2
10	*Billardiera scandens*	1
11	*Bossiaea neo-anglica*	3
12	*Bossiaea obcordata*	2
13	*Cassytha glabella*	1
14	*Corymbia gummifera*	4a
15	*Daviesia ulicifolia*	2
16	*Dianella caerulea*	1
17	*Entolasia stricta*	2
18	*Eucalyptus eugenioides*	2
19	*Eucalyptus sclerophylla*	2
20	*Gompholobium glabratum*	2
21	*Gonocarpus teucrioides*	3
22	*Goodenia bellidifolia* subsp. *bellidifolia*	2
23	*Goodenia hederacea* subsp. *hederacea*	2
24	*Grevillea arenaria*	3
25	*Lepidosperma laterale*	2
26	*Leptospermum trinervium*	1
27	*Lomandra filiformis*	2
28	*Lomandra micrantha* subsp. *tuberculata*	2
29	*Lomandra multiflora* subsp. *multiflora*	3
30	*Lomandra obliqua*	2
31	*Lomatia silaifolia*	3
32	*Monotaxis linifolia*	1
33	*Monotoca scoparia*	1
34	*Opercularia varia*	2
35	*Patersonia glabrata*	3
36	*Persoonia levis*	1
37	*Petrophile pulchella*	2
38	*Phyllanthus hirtellus*	2
39	*Pimelea linifolia* subsp. *linifolia*	3
40	*Poranthera ericifolia*	2
41	*Pultenaea flexilis*	1
42	*Stackhousia viminea*	1
43	*Tetratheca thymifolia*	1
44	*Thelionema caespitosum*	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: 17/01/22 **Recorder:** P.Monsted and P.Nagle

Location: West of the 50 m range, Hill Top Conservation Area, NSW

Plot Size: 20 m x 20 m

Easting: 264843 **Northing:** 6200465 **Position in quadrat:** north-west corner
Zone No.: 56

Altitude: 591 m asl **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	15	*Corymbia gummifera*, *Eucalyptus piperita, Eucalyptus agglomerata*
Mid-lower	2	5	Regenerating *Corymbia gummifera* and *Eucalyptus* spp.
Shrub	1.5	30	*Acacia* spp., *Banksia spinulosa, Hakea dactyloides Bossiaea obcordata, Eriostemon australasius, Telopea speciosissima, Xylomelum pyriforme*
Ground	0.5	15	*Gonocarpus teucrioides, Haemodorum planifolium, Hardenbergia violacea, Lepidosperma laterale, Dampiera purpurea*

Total No. of native species recorded: 56 **Total No. of weed species:** 3

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	Discharge from the upstream basin is providing opportunity for weeds to establish – e.g Scotch Thistle (*Cirsium vulgare*) & Fireweed (*Senecio madagascarensis*) - and should be controlled.
Pest fauna	N	
Tree dieback	N	
Fire history	Y	Severe wildfire (Green Wattle Fire) Dec 2019. Shrub and groundcover strata dominate the diversity and cover.
Erosion	Y	Water from the retention basins upstream is overspilling the rock platform with some volume and should be directed into a natural gully.

Floristic Composition		
No.	**Species**	**Cover Abundance**
1	*Acacia linifolia*	3
2	*Acacia myrtifolia*	4a
3	*Acacia suaveolens*	2
4	*Acacia terminalis*	3
5	*Acacia ulicifolia*	2
6	*Actinotus helianthi*	2
7	*Banksia serrata*	2
8	*Banksia spinulosa*	3
9	*Billardiera scandens*	2
10	*Bossiaea obcordata*	2
11	*Chrysocephalum apiculatum*	1
12	**Cirsium vulgare*	2
13	*Correa reflexa*	1
14	*Corymbia gummifera*	4a
15	*Cyperus rotundus*	2
16	*Dampiera purpurea*	1
17	*Dillwynia parvifolia*	1
18	*Dillwynia ramosissima*	1
19	*Dodonaea triquetra*	1
20	*Entolasia stricta*	2
21	*Eriostemon australasius*	2
22	*Eucalyptus agglomerata*	1
23	*Eucalyptus piperita*	4b
24	*Gonocarpus teucrioides*	4a
25	*Goodenia bellidifolia* subsp. *bellidifolia*	2
26	*Grevillea sphacelata*	1
27	*Haemodorum planifolium*	2
28	*Hakea dactyloides*	3
29	*Hakea sericea*	1
30	*Hardenbergia violacea*	3
31	*Hypochaeris radicata*	2
32	*Juncus usitatus*	2
33	*Lepidosperma laterale*	3
34	*Leptospermum polygalifolium*	1
35	*Lomandra confertifolia* subsp. *rubiginosa*	1
36	*Lomandra filiformis*	1
37	*Lomandra gracilis*	2
38	*Lomandra obliqua*	1
39	*Lomatia silaifolia*	1
40	*Persoonia levis*	1
41	*Persoonia pinifolia*	1
42	*Phyllanthus hirtellus*	2
43	*Platysace ericoides*	2
44	*Pomaderris andromedifolia*	3
45	*Poranthera ericifolia*	1
46	*Potentilla indica*	2
47	**Gamochaeta luteoalbum*	1
48	*Pteridium esculentum*	2
49	*Pteris tremula*	1
50	*Scaevola ramosissima*	1
51	*Senecio diaschides*	1
52	**Senecio madagascariensis*	1
53	*Senecio minimus*	1
54	*Smilax glyciphylla*	1
55	*Telopea speciosissima*	2
56	*Tetratheca thymifolia*	2
57	*Wahlenbergia stricta*	1
58	*Xanthorrhoea media*	1
59	*Xylomelum pyriforme*	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: 17/01/22 **Recorder:** P.Monsted and P.Nagle

Location: Southern side of Wattle Ridge Road, 20m north-west of the entry to the 50m range, Hill Top Conservation Area, NSW

Plot Size: 20 m x 20 m

Easting: 265417 **Northing:** 6200653 **Position in quadrat:** north-west corner
Zone No.: 56

Altitude: 606 m asl **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	*Eucalyptus sieberi*, *Corymbia gummifera*, *Eucalyptus agglomerata*
Mid-lower	2-2.5	25	Resprouting *Eucalyptus* spp. and *Corymbia gummifera*
Shrub	1.5	20	*Acacia* spp., *Bossiaea obcordata, Hakea dactyloides, Lomatia silaifolia, Pimelea linifolia, Pultenaea scabra*
Ground	0.5	30	*Hardenbergia violacea, Entolasia stricta, Austrostipa pubescens, Lomandra* spp., *Dampiera stricta, Goodenia bellidifolia, Goodenia hederacea* subsp. *hederacea, Opercularia hispida, Phyllanthus hirtellus, Platysace ericoides, Poranthera ericifolia, Scaevola ramosissima*

Total No. of native species recorded: 37 **Total No. of weed species:** 0

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	Present within plot
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 Fire) Dec 2019. Vigorous regeneration including canopy species and a high diversity of dicot species in the shrub and groundcover.
Erosion	N	
Other	N	

Floristic Composition		
No.	**Species**	**Cover Abundance**
1	*Acacia linifolia*	3
2	*Acacia myrtifolia*	4b
3	*Acacia terminalis*	4a
4	*Austrostipa pubescens*	2
5	*Billardiera scandens*	2
6	*Bossiaea obcordata*	3
7	*Corymbia gummifera*	4b
8	*Dampiera stricta*	2
9	*Daviesia ulicifolia*	1
10	*Entolasia stricta*	3
11	*Eucalyptus agglomerata*	3
12	*Eucalyptus sieberi*	4b
13	*Gompholobium grandiflorum*	1
14	*Goodenia bellidifolia* subsp. *bellidifolia*	2
15	*Goodenia hederacea* subsp. *hederacea*	2
16	*Hakea dactyloides*	3
17	*Hardenbergia violacea*	4b
18	*Hovea linearis*	1
19	*Lomandra filiformis*	3
20	*Lomatia silaifolia*	3
21	*Opercularia hispida*	2
22	*Patersonia glabrata*	1
23	*Persoonia levis*	1
24	*Phyllanthus hirtellus*	2
25	*Pimelea linifolia*	3
26	*Platysace ericoides*	2
27	*Poa affinis*	1
28	*Pomax umbellata*	2
29	*Poranthera ericifolia*	2
30	*Pultenaea mollis*	1
31	*Pultenaea scabra*	2
32	*Scaevola ramosissima*	2
33	*Senecio diaschides*	1
34	*Tetratheca thymifolia*	2
35	*Thysanotus juncifolius*	1
36	*Xanthosia tridentata*	1
37	*Xylomelum pyriforme*	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: 01/02/2022 **Recorder:** P.Nagle and J.Veltrop

Location: The gully between the 800 m and 500 m firing ranges, Hill Top Conservation Area, NSW

Plot Size: 20 m x 20 m

Easting: 265365 **Northing:** 6200056 **Position in quadrat:** north-east corner
Zone No.: 56

Altitude: 595 m asl **Slope:** 10° **Aspect:** 200 (SSW)

Mitchell Landscape: Nattai Plateau **CMA:** Hawkesbury-Nepean

Geology: Nattai Tablelands erosional

Vegetation Structure: (Walker & Hopkins 1983)

Stratum	Height (m)	% cover	Dominant species
Upper	10-15	30	*Eucalyptus punctata*, *E. agglomerata*, *E. piperita, Corymbia gummifera.*
Ground	3	80	*Acacia* spp.*, Eucalyptus* saplings*, Elaeocarpus, Telopea, Lomatia*

Total No. of native species recorded: 57 **Total No. of weed species:** 2

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

Vegetation on-ground description: Open Forest on edge of creekline rainforest

PCT: PCT 1181.

Feature	Y/N	Comment
Hollow-bearing trees	Y	Large dead trees providing hollows for roosting
Rock outcrop	Y	rock outcrops and overhanging shelters.
Mistletoe	N	
Water body	Y	Creek traversing the plot was full, running and pooling.
Threatened species	N	Not in plot. Giant Burrowing Frog (*Heleioporus australiacus*) tadpoles nearby.
Weeds	Y	In creekline.
Pest fauna	N	
Tree dieback	Y	Epicormic shoots falling off gums, permanent branches establishing.
Fire history	Y	Severe wildfire (Green Wattle Fire) Dec 2019.
Erosion	N	
Other	Y	After extensive searching the previous quadrat pegs could not be found so an approximate area was sampled. The plot surveyed traversed two aspects (S and W) and included a steep slope and now-full drainage line. A termite mound was still in the NW corner.

Floristic Composition

No.	*Genus species*	Cover Abundance
1	*Acacia elata*	2
2	*Acacia linifolia*	2
3	*Acacia longifolia* subsp. *longifolia*	3
4	*Acacia terminalis*	4a
5	*Acacia ulicifolia*	1
6	*Amperea xiphoclada var. xiphoclada*	1
7	*Banksia spinulosa*	1
8	*Billardiera scandens*	1
9	*Blechnum cartilagineum*	3
10	*Bossiaea obcordata*	2
11	*Callicoma serratifolia*	2
12	*Calochlaena dubia*	3
13	*Centella asiatica*	1
14	*Clerodendrum tomentosum*	2
15	*Corymbia gummifera*	3
16	*Dampiera purpurea*	2
17	*Dianella caerulea*	2
18	*Dodonaea triquetra*	1
19	*Dracophyllum secundum*	1
20	*Elaeocarpus reticulatus*	4a
21	*Empodisma minus*	1
22	*Entolasia stricta*	2
23	*Eucalyptus agglomerata*	2
24	*Eucalyptus piperita*	3
25	*Eucalyptus punctata*	2
26	*Gamochaeta* sp.	1
27	*Gonocarpus teucrioides*	4a
28	*Grevillea arenaria*	3
29	*Hakea dactyloides*	2
30	*Hardenbergia violacea*	2
31	*Hypochaeris radicata*	1
32	*Lepidosperma laterale*	3
33	*Lindsaea microphylla*	1
34	*Lomandra filiformis*	2
35	*Lomandra longifolia*	2
36	*Lomandra micrantha* subsp. *tuberculata*	1
37	*Lomandra obliqua*	1
38	*Lomatia silaifolia*	3
39	*Microlaena stipoides* var. *stipoides*	1
40	*Notelaea venosa*	2
41	*Olearia argophylla*	3
42	*Opercularia diphylla* (or a small *O.aspera?)*	3
43	*Phyllanthus hirtellus*	1
44	*Pimelea linifolia* subsp. *linifolia*	1
45	*Platysace ericoides*	1
46	*Pomax umbellata*	2
47	*Poranthera corymbosa*	2
48	*Poranthera ericifolia*	2
49	*Pteridium esculentum*	3
50	*Pultenaea daphnoides*	1
51	*Smilax glyciphylla*	2
52	*Telopea speciosissima*	3
53	*Viola betonicifolia*	1
54	*Viola* sp.	1
55	*Wahlenbergia gracilis*	1
56	*Xanthosia tridentata*	2

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: 28/01/22).

2.2.2. Photo-point 2

Plate 8. Intact woodland near Plot 2 (date taken: 28/01/22).

2.2.3. Photo-point 3

Plate 9a. Looking north-east with the conservation area evident to the west of the powerline easement (left of photo) (date taken: 28/01/2022).

Plate 9b. Looking east (date taken: 28/01/2022).

Plate 9c. Looking south-west with the conservation area to the west of the powerline easement (right of photograph) (date taken: 28/01/2022).

Plate 9d. Looking west towards the conservation area and Plot 3 location (date taken: 28/01/2022).

2.2.4. Photo-point 4

The recommendation is to discontinue Photopoint 4 as it does not reveal any vegetation changes of any significance (being the bare ground on the 800 m rifle range).

Some weeds were observed in the vicinity – Scotch Thistle (*Cirsium vulgare*) and the increasingly common groundcover weed *Richardia* sp. in the eastern road easement adjacent to the range, but the Scarlet Pimpernel (*Lysimachia arvensis)* does not appear to have persisted since the 2020 survey observation.

The batter at the back of the 800 m range is however unestablished. Mulch was applied to this area in as noted in the previous monitoring period, however without topsoil or revegetation actions there has been no native regeneration of the batter. This is allowing sediments to mobilise which are then uncontrolled before entering the remnant vegetation.

Whilst the 800 m range was not being used at the time of the monitoring study, shots were heard. From a personnel a Work Health and Safety perspective, the continued monitoring of this site is not recommended.

Plate 10a. The disturbed area at the southern end of the 800 m rifle range (date taken: 17/01/2022).

2.2.5. Photo-point 5

Weeds were observed along the drainage line that need removal, including: Nut Grass *Cyperus rotundus,* Scotch Thistle *Cirsium vulgare* and Purple Top *Verbena bonariensis*.

Plate 11. Looking east along the northern boundary of the 50m range (date taken: 17/01/2022).

2.2.6. Photo-point 6

Plate 12. The character of the drainage pit and vegetation at the south-east corner of the 50m range (date taken: 18/01/22).

2.2.7 Photo-point 7

Runoff around the southern fence is bypassing the channels meant to divert it into the sediment control pond, so some earthworks are required to re-divert this surface flow. Sediment and water overflow is entering bushland at the western edge (as expected) but some weeds are establishing (Nut Grass, Thistles, Parramatta Grass, and Cudweeds) that need treatment.

Plate 13. The character of the sediment outbreak below Photo-point 7 (Photo taken 17/01/2022).

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.'

Several introduced plant species were observed at or near the Plots and at the Photopoints or along access ways to these, including: Scotch Thistle, Fleabane, Purple Top, Catsear, Flatweed, Cudweed, Pampas Grass, Blackberry, Parramatta Grass, and Nut Grass, of which Pampas Grass and Blackberry are most significant and threatening as Weeds of National Significance (WONS) species.

No evidence of pigs, fox, rabbits or deer were observed.

3. Summary of findings

The results of the vegetation plots and photo-points has been summarised in Table 4, along with any of the management issues that were identified.

For a comparison the species richness results of the 2018, 2019, 2020 and 2022 monitoring sessions have been provided alongside each other.

The total species recorded during the current study was 139, compared with a total of 103, 119 and 108 during 2018, 2019 and 2020 surveys, respectively.

Table 4. Summary of management issues

Plot/Photo-point	PCT	Species Richness 2018/2019/2020/2022	TEC or threatened species	Management Issues
Plot				
1	1086	49/51/47/55	No	None.
2	1086	44/44/37/47	No	None.
3	1086	39/40/40/42	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	35/49/46/59	No	Discharge from the sediment basin is saturating the area and providing opportunity for the establishment of weeds including Scotch Thistle and Fireweed. Weed control should focus on this area beneath the basin.
5	1086	44/41/39/37	No	None.
6	1181	41/50/45/57	No	Three introduced species (Fleabane, Cudweed and Flatweed) were present in the creekline.
Photo-point				
1	N/A		No	None.
2	N/A		No	None.
3	N/A		No	None.
4	N/A		No	Erosion from batter at the end of the 800m range and absence of sediment controls is resulting in ongoing deposition of sediment in the remnant vegetation downslope.
5	N/A		No	None.
6	N/A		No	none.
7	N/A		No	Runoff around the southern fence is bypassing existing channels. Sediment and water overflow is entering bushland at the western edge. Weeds are establishing.
General	Weeds along the access roads, tracks and drainage lines have established over the wet seasons following the bushfires.			

When compared to the previous monitoring report (Lesryk 2020) the results of the fourth session illustrate that as a result of the 2019 bushfires, the vegetation structure and composition has changed dramatically.

Species composition is generally similar to pre-fire conditions but there are many new species emerging that have not been recorded before but are known from the region (i.e. species from the Hilltop locality via Royal Botanic Gardens PlantNet records as of February 2022).

Native vegetation structure has been substantially changed and it may take several years for canopy, mid-storey, shrub and groundcover strata to re-configure.

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 and have not (yet) regenerated, or were unseen in the survey.

Others that usually seed prolifically after a fire event such as peas (*Fabaceae* spp.) and some wattles (*Acacia* spp.) have re-established but were slow to emerge, so have benefitted from the 2021 rainfall and moderate 2021-22 summer temperatures.

Similarly, some Proteaceae species, such as the smooth-barked Geebung (*Persoonia mollis* and *P.oblongata*) have not re-emerged but *Hakea* spp., Waratah (*Telopea speciosissima*) and Woody Pear (*Xylomelum pyriforme*) have now become evident that were missing or minor in the 2019 survey.

There has been some increase in weed cover due to extensive post-fire rain that is affecting ponds, waterways, drainage lines, and road-edges that are to be treated before fruits, seeds, and other vegetative propagules spread into bushland.

4. Management actions

Management actions have been prescribed for those issues identified in Section 3 (Table 5).

Table 5. Management actions required

Plot/Photo-point	Action
Plot	
1	No further action required.
2	No action required.
3	The wire strand fence beside fire trail gate requires repair.?
4	The discharge from the operational basins is spreading out across the rock platform and saturating a larger area of vegetation than necessary. This discharge point should be modified to control the water into a single alignment to a natural gully.
5	No action required.
6	No action required.
Photo-point	
1	No action required.
2	No action required.
3	No action required.
4	An erosion and sediment control strategy is required for the batter at the end of the 800m range to prevent ongoing erosion and prevent sediment transportation into the remnant vegetation where it is being deposited facilitating the establishment of weeds.
5	No action required
6	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	Water channelling and weeds are to be mitigated in line with the CEMP.
General	Weeds present are to be controlled as per the management strategy prepared for the site and/or in accordance with Item 1 of Annexure C of the Conservation Agreement.

5. Recommendations

Remove Photo-point 4 requirement at southern end of the 800 m range (for personnel safety reasons) and ineffectual environmental assessment value.

New, highly visible steel (star) pickets or similar should be re-established at those plots and photo-points where these corner-markers were not relocated.

6. References

Department of the Environment and Energy 2020, *Weeds of national significance*, viewed February 2022, <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>

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Royal Botanic Gardens 2022, *PlantNet records for Hilltop locality within 10km of SHRSC*, viewed February 2022 <https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&spatquer=yes&forest=&npres=&cmas=&ibra=&lga=&nswsdiv=&maxy=&maxym=&maxyd=S&miny=&minym=&minyd=S&maxx=&maxxm=&maxxd=E&minx=&minxm=&minxd=E&near=Hilltop&state=NSW&range=0.09670&vasc=yes&threat=>

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Harden, G (Ed) 1992-2002, *Flora of New South Wales Vol 1,2,3 and 4,* NSW University Press, Kensington, NSW

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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 NW corner-postt

Plate 2. Looking east from NW corner-post

Plate 3. Looking south from NW corner-post

Plate 4. Looking west from NW corner-post

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. Cumulative flora species recorded at each plot

Row Labels	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Acacia brownii	X					
Acacia elata						X
Acacia linifolia	X	X	X	X	X	X
Acacia longifolia subsp. *longifolia*		X				X
Acacia myrtifolia	X		X	X	X	
Acacia suaveolens	X			X		
Acacia terminalis	X	X		X	X	X
Acacia ulicifolia		X		X		X
Actinotus helianthi				X		
Actinotus minor			X			
Allocasuarina torulosa			X			
Amperea xiphoclada var. *xiphoclada*	X	X				X
Anisopogon avenaceus	X	X	X			
Austrostipa pubescens			X		X	
Banksia marginata	X					
Banksia serrata		X		X		
Banksia spinulosa	X	X	X	X		X
Billardiera scandens		X	X	X	X	X
Blechnum cartilagineum						X
Boronia ledifolia	X	X				
Bossiaea neo-anglica			X			
Bossiaea obcordata	X	X	X	X	X	X
Callicoma serratifolia						X
Calochlaena dubia						X
Cassytha glabella			X			
Caustis flexuosa	X	X				
Centella asiatica						X
Chrysocephalum apiculatum				X		
**Cirsium vulgare*				X		
Clerodendrum tomentosum						X
**Conyza canadensis*					X	X
Correa reflexa				X		
Corymbia gummifera	X	X	X	X	X	X
Cyathochaeta diandra	X					
**Cyperus rotundus*				X		
Dampiera purpurea	X	X		X		X
Dampiera stricta	X				X	
Daviesia ulicifolia			X		X	
Dianella caerulea			X			X
Dillwynia floribunda	X					
Dillwynia parvifolia				X		
Dillwynia ramosissima				X		

Row Labels	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Dillwynia retorta	X	X				
Dodonaea triquetra	X	X		X		X
Dracophyllum secundum						X
Elaeocarpus reticulatus						X
Empodisma minus						X
Entolasia stricta	X	X	X	X	X	X
Eragrostis brownii	X					
Eriostemon australasius		X		X		
Eucalyptus agglomerata				X	X	X
Eucalyptus eugenioides			X			
Eucalyptus piperita	X	X		X		X
Eucalyptus punctata						X
Eucalyptus sclerophylla			X			
Eucalyptus sieberi	X	X			X	
**Gamochaeta luteoalbum*			X			
Gompholobium glabratum			X			
Gompholobium grandiflorum	X				X	
Gompholobium latifolium		X				
Gonocarpus teucrioides	X	X	X	X		X
Goodenia bellidifolia subsp. *bellidifolia*	X		X	X	X	
Goodenia hederacea subsp. *hederacea*		X	X		X	
Grevillea arenaria	X	X	X			X
Grevillea sphacelata	X			X		
Haemodorum planifolium	X	X		X		
Hakea dactyloides	X			X	X	X
Hakea sericea	X			X		
Hardenbergia violacea	X	X		X	X	X
Hovea linearis					X	
**Hypochaeris radicata*				X		X
Isolepis inundata	X					
Isopogon anemonifolius	X					
Juncus usitatus				X		
Lambertia formosa	X					
Lepidosperma laterale			X	X		X
Leptospermum parvifolium	X					
Leptospermum polygalifolium				X		
Leptospermum trinervium	X	X	X			
Lindsaea microphylla						X
Lomandra confertifolia subsp. *rubiginosa*	X	X		X		
Lomandra cylindrica	X					
Lomandra filiformis			X	X	X	X
Lomandra gracilis				X		
Lomandra longifolia						X
Lomandra micrantha subsp. *tuberculata*			X			X
Lomandra multiflora subsp. *multiflora*		X	X			
Lomandra obliqua	X	X	X	X		X

Row Labels	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Lomatia silaifolia	X	X	X	X	X	X
Microlaena stipoides var. *stipoides*	X					X
Monotaxis linifolia			X			
Monotoca scoparia			X			
Notelaea venosa						X
Olearia argophylla						X
*Opercularia diphylla (*or a small *O.aspera?)*						X
Opercularia hispida					X	
Opercularia varia			X			
Patersonia glabrata			X		X	
Patersonia sericea	X	X				
Persoonia levis	X	X	X	X	X	
Persoonia pinifolia	X			X		
Petrophile pulchella	X		X			
Phyllanthus hirtellus		X	X	X	X	X
Pimelea linifolia	X				X	
Pimelea linifolia subsp. *linifolia*			X			X
Platysace ericoides	X	X		X	X	X
Poa affinis					X	
Pomaderris andromedifolia				X		
Pomax umbellata					X	X
Poranthera corymbosa	X	X				X
Poranthera ericifolia	X	X	X	X	X	X
Poranthera microphylla		X				
Potentilla indica				X		
Pteridium esculentum	X	X		X		X
Pteris tremula				X		
Pultenaea daphnoides						X
Pultenaea flexilis			X			
Pultenaea mollis					X	
Pultenaea scabra					X	
Rytidosperma pallidum		X				
Scaevola ramosissima				X	X	
Senecio diaschides				X	X	
**Senecio madagascariensis*				X		
Senecio minimus				X		
Smilax glyciphylla	X			X		X
Stackhousia viminea			X			
Telopea speciosissima				X		X
Tetratheca thymifolia	X	X	X	X	X	
Thelionema caespitosum			X			
Thysanotus juncifolius					X	
Viola betonicifolia						X
Viola sp.						X
Wahlenbergia gracilis						X
Wahlenbergia stricta				X		

Row Labels	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Xanthorrhoea media				X		
Xanthosia pilosa	X					
Xanthosia tridentata	X	X			X	X
Xylomelum pyriforme		X		X	X	
Zieria granulata		X				