

**A Biological Survey of
Lower North Grasslands
of South Australia**



A Biological Survey of Lower North Grasslands of South Australia

Survey 836 Report

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Covering sites on the northern Adelaide Plains
and foothills between Smithfield and the
northern boundary of Light Regional Council

Adrian Shackley, Andrew Allanson and Janet Kuys
for
Irongrass Environmental Rehabilitation Services &
Gawler Environmental Heritage Association

Acknowledgments

This report is a joint effort of Adrian Shackley (Gawler Environmental Heritage Association) and Andrew Allanson and Janet Kuys (Irongrass Environmental Rehabilitation Services). The individual site reports are mainly written by Andrew Allanson and Janet Kuys and the historical background and analysis mainly by Adrian Shackley. The summaries and analysis are a joint responsibility. No doubt some errors will be found – hopefully not too many.

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Cover Photos. Front cover. Finding Behr's Swainson-pea, *Swainsona behriana* (River Road Bagot Well site) and Orange Swainson-pea, *Swainsona stipularis* (rail corridor south of Freeling) were highlights of the survey. Back cover. High quality grassland remnant at River Road Bagot Well site in spring 2013.

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Contents

1.	Report Summary	1
2.	Recommendations arising from the Survey	2
3.	Introduction – Historical information for Lower North grasslands	3
4.	How Survey Sites Were Chosen	15
5.	Survey Methodology	16
6.	Site Reports	
6.1	KAP HOR 01 Paddock off Thiele Highway Kapunda	20
6.2	KAP HOR 02 Thiele Highway road verge	24
6.3	KAP DUF 01 Duff Road, Kapunda/Bagot Well.....	28
6.4	KAP FLA 01 Flagstaff Hill Road, Kapunda/Bagot Well.	34
6.5	KAP MCK 01 River Road, Kapunda/Bagot Well	40
6.6	ROS MNR 01 Roseworthy Rail Reserve, off Main North Road.....	55
6.7	KAP FOR 01 Fords Road & Rail reserve, south of Kapunda	61
6.8	FRE SHA 01 Rail Reserve north of Shanahan Road, Freeling.....	69
6.9	FRE SHA 02 Rail Reserve north of Shanahan Road, Freeling.....	75
6.10	ROS RAI 01 Rail Reserve, south of Roseworthy township	80
6.11	GAW DMP 01 Dead Man’s Pass reserve, Gawler	86
6.12	GAW GOR 01 Gordon Road, Gawler/Evanston South.....	95
6.13	PLA STE 01 Stebonheath Road, Playford.....	99
6.14	Opportune site Spring Gully, Gawler East	103
6.15	BAR KER 01 Nature Foundation property, Allendale Road.....	111
6.16	BAR KER 02 Nature Foundation property, Allendale Road.....	115
7.	Summary of results over 14 project sites	119
8.	Discussion of results	128
9.	Historical information, <i>Swainsona</i> , <i>Blandowski</i> , <i>Acacia paradoxa</i>	132
10.	Bibliography and references	136

Appendices

Appendix 1	Overall flora data tables for survey (Tables 26-28).....	144
Appendix 2	EPBC irongrass grassland: Class A, B & C criteria	162
Appendix 3	Prescott & Turner State and Transition template for irongrass grassland	163
Appendix 4	National, state & regional conservation ratings used in Report.....	166
Appendix 5	Conservation rated species in Northern Lofty Herbarium Region by site	167
Appendix 6	Conservation rated species in Southern Lofty Herbarium Region by site	168
Appendix 7	Naturemaps Rail & Roadside vegetation mapping relevant to Survey sites	169
Appendix 8	Evidence of original vegetation from Surveyors’ notes in Survey Books	174
Appendix 9	Comparison of DEWNR Pre-European vegetation map with survey results	175

Maps

Map 1	Indicative Pre-European Lower North grasslands, LNG 836 sites, existing BDBSA sites	5
Map 2	Early explorers in the survey area - approximate routes	9
Map 3	Special Surveys map 1841, including Eyre's Light River station No. 32.....	11

Tables

Table 1	Lower North Grassland Survey site locations and survey type conducted.....	18
---------	--	----

Flora and fauna site data tables for each site

Table 2a – 2e	KAP HOR 01	Paddock off Thiele Highway Kapunda.....	22-23
Table 3a – 3b	KAP HOR 02	Thiele Highway road verge.	26-27
Table 4a – 4e	KAP DUF 01	Duff Road, Kapunda/Bagot Well.....	31-33
Table 5a – 5e	KAP FLA 01	Flagstaff Hill Road, Kapunda/Bagot Well.....	37-39
Table 6a – 6f	KAP MCK 01	River Road, Kapunda/Bagot Well	49-54
Table 7a – 7c	ROS MNR 01	Roseworthy Rail Reserve, off Main North Road.....	58-60
Table 8a – 8f	KAP FOR 01	Fords Road & Rail reserve, south of Kapunda	65-68
Table 9a – 9h	FRE SHA 01	Rail Reserve north of Shanahan Road, Freeling	72-74
Table 10a – 10d	FRE SHA 02	Rail Reserve north of Shanahan Road, Freeling	78-79
Table 11a – 11e	ROS RAI 01	Rail Reserve, south of Roseworthy.....	82-85
Table 12a – 12i	GAW DMP 01	Dead Man's Pass reserve, Gawler	90-94
Table 13	GAW GOR 01	Gordon Road, Gawler/Evanston South.....	97-98
Table 14a – 14c	PLA STE 01	Stebonheath Road, Playford.....	101-102
Table 15a – 15h	Opportune	Spring Gully, Gawler East	106-109
Table 16a – 16c	BAR KER 01	Nature Foundation property, Allendale Road	112-114
Table 17a – 17c	BAR KER 02	Nature Foundation property, Allendale Road	116-118

Summary Tables of flora and fauna

Table 18	Native flora species – most commonly occurring	119
Table 19	Introduced flora species – most commonly occurring.....	120
Table 20	Native and introduced plant families - most commonly occurring.....	120-121
Table 21a – 21b	Fauna data summaries: Birds.....	121-124
Table 22a	Fauna data summaries: Reptiles	124-125
Table 22b	Fauna data summaries: Mammals	125
Table 22c	Fauna data summaries: Amphibians.....	125
Table 23a – 23b	Summary of native and introduced species	126
Table 24a	Summary of suggested EPBC Class A, B and C for sites	127
Table 24b	Summary Prescott & Turner State & Transition Model	127
Table 25	Summary of native flora species occurring on one site only	127

Tables with full 14 site survey flora data

Table 26	Full data of native flora occurrence for 14 sites. Species on one site only	144-150
Table 27	Full data of introduced flora occurrence for 14 sites	151-154
Table 28	Full data of native flora for EPBC class A, B & C assessment	155-161

1. Lower North Grasslands Survey BS 836 Report Summary

In June 2012 the Gawler Environment and Heritage Association obtained a State NRM Community Grant to record information from remnant grassland areas and enter the survey data into the Biological Database of South Australia (BDBSA).

Over the last 30 years considerable work has occurred to identify, understand and record remnant native grasslands in South Australia. This work has mostly focussed on the Mid North and further north. Combined with similar work in Victoria and NSW, this has been invaluable in highlighting the significance of grassland ecosystems.

Work over several years in the Lower North, however, has revealed that survey data in the state's BDBSA had a paucity of information on one of the major original ecosystems of the Adelaide Plains and foothills of the adjacent ranges – native grasslands. No biological survey site has previously recorded a grassland ecosystem in the region. The only close BDBSA grassland site is for Ben Lomond station towards Eudunda in the Northern and Yorke NRM/DEWNR region. One reason for this deficiency has been the inaccurate mapping of original vegetation of the region which since the early 20th century has mainly depicted the relevant Lower North vegetation as open woodland or mallee.

Survey 836 focused on 13 Lower North grassland sites and one rare *Eucalyptus largiflorens* open grassy woodland site on a mixture of public and private land plus two somewhat higher rainfall grassland sites on a block being added to Para Woodland conservation reserve.

The results of the survey have far exceeded expectations with the 14 sites producing an average of about 34 native plant species per survey quadrat and many more opportune records. A total of 188 native species in total for the 14 sites (including opportune collections). This has increased to 192 after new species were identified in water catchments in summer 2014/15 after heavy rain. Some 95 introduced species were also recorded. Some sites were classed as Iron-grass Natural Temperate Grassland of South Australia - a Critically Endangered ecological community listed under the *Environment Protection and Biodiversity Conservation Act 1999* - clearly of very high conservation significance. Other sites were described as tussock grasslands – also of major conservation significance given their rarity now. Some of these sites may also fit the criteria for Iron-grass Natural Temperate Grassland of South Australia

Twelve plant species of State conservation significance were recorded from 12 of the 14 sites. About one third of species recorded were of regional conservation significance. 84 of the native flora species were only recorded at a single site indicating high conservation risk.

The highlight of the flora survey was a grassland remnant at Bagot Well which is privately owned with a history of moderate grazing. The surveyed quadrat recorded 64 native species and only 10 introduced species. The three remnants of about 14 hectares in the 70 hectare paddock have recorded 116 native species to March 2015 (and the list is expected to grow further).

Recording of native and introduced bird, reptile, mammal and amphibian species also occurred on all except two small road reserve sites. Native species recorded included 70 bird (four of State conservation significance), 16 reptile (including national Vulnerable rated Flinders Ranges Worm-lizard), five mammal and three amphibian species. This fauna data were all recorded as opportune records as the full processes for Biological Surveys were not practical with the resources available.

The survey is already spurring grassland conservation efforts in the region and will provide vital clues and resources such as identified seed sources to assist this work. Active management of grassland remnants is required to maintain or improve conservation values. The project will hopefully assist in providing better recognition of grassland ecosystems and direction for future management of remnants and restoration of grassland ecosystems in the region.

2. Recommendations arising from the Survey

1. Monitoring of the Lower North grassland remnants should continue to assess ongoing change and risks to their integrity.
2. An inventory and monitoring of additional Lower North grassland or near grassland remnants should also be instituted.
3. Studies should be conducted on an ongoing basis to assess the benefits and risks of various management practices affecting grassland remnants.
4. Weed control is a high priority in all of the grassland remnants observed. Experimentation needs to occur to identify cost effective weed control strategies. A mosaic of strategies will be needed given the different ecological needs of the species involved. Broadscale weed spraying will almost certainly cause degradation - low impact/localised strategies are needed.
5. Experimentation needs to occur to identify the potential for low temperature burning to assist those native species that would benefit from managed fire regimes. The spatial arrangement (e.g. patch burning) and fire interval could be manipulated depending on desired outcome.
6. Provision of good information about grassland management to landholders will greatly assist good management. Financial incentives will also be important, consistent with current NRM/DEWNR conservation work. Management plans for each of the sites involved would be useful for land managers.
7. DEWNR and AMLR NRM Board and Northern York NRM Board could work together to build awareness about grasslands and their management, including through a website allowing feedback experience. There is a lot of material and websites available to assist such work although much of it is from eastern states, often in areas of higher rainfall and different soils.
8. Further research on the better quality sites identified in the survey is important. Information on soils, soil organisms, mosses, lichens, liverworts, fungi and other like organisms would be very helpful in understanding the ecology of these vital remnants. There could be a number of higher degree research projects available on the River Road and other good quality sites to assist scientific understanding and management.
9. DEWNR could usefully develop some guidelines for managing grasslands under native vegetation heritage agreements.¹ Originally heritage agreements included “no grazing” regimes but can now be varied to include provision for appropriate management plans relating to grazing. For grasslands, significant levels of disturbance might need to occur to maintain biodiversity and this may need to be provided by human intervention where the natural providers are no longer playing the role. Careful grazing can be a valuable component.
10. The involvement of community based organisations such as Trees for Life’s ‘Bush for Life’ bushcare program and other well-trained volunteers should be encouraged to provide assistance for landholders struggling with a range of economic concerns and to assist in building community awareness of the unique role of grassland ecosystems in the region.
11. While the remnants surveyed were mostly small in area, there are larger areas of remnant native grasslands in the Koonunga, Bagot Well and Kapunda localities as well as north of the Light River towards Eudunda. Commercial grazing of these areas will no doubt continue and assistance and adaption to help promote biodiversity alongside commercial objectives has significant potential.
12. In some areas of remnant grassland there may be potential to re-introduce some of the missing flora and fauna species to assist in ecological outcomes and to provide insurance for the many species which currently survive in small numbers and fragmented localities.

¹ Native vegetation heritage agreements under the Native Vegetation Act, 1991 provide for areas of land containing important native vegetation to be set aside in perpetuity. Some incentives apply in relation to such heritage agreements.

3. Introduction – Historical information for Lower North grasslands

Natural forces affecting local ecosystems

Understanding the vegetation on the Adelaide Plains and adjacent hills pre-1836 is vital to thinking about what is needed today to remedy almost 200 years of environmental change. Understanding the dynamic forces which produced this change is the key.

Australia is an ancient land. The forces of continental drift which have moved Australia from the Antarctic to our current place, the separation as a continent from Gondwanaland millions of years ago, the succession of dry ice ages and wetter interludes with related sea level changes, the effects of erosion and leaching of soils and the arrival of Aboriginal peoples tens of thousands of years ago combined to produce a unique ecosystem by 1836.

Aboriginal history and the regions ecosystems

Prior to 1836 Aboriginal people of the Kaurna, Peramangk and Ngadjuri nations lived in the areas covered by this survey. These groups shared many cultural practices and language similarities. Historical records and current knowledge show trading and stories joining Aboriginal people across vast distances. While there are impressions of unchanging practices from time immemorial, in practice Aboriginal societies have shown much flexibility in surviving in difficult circumstances and adapting to change, none more so than in dealing with the almost incomprehensible changes forced by European colonisation.

For thousands of years Aboriginal people have lived and interacted with the environments of Australia. Human impacts on the plants and animals of the region were undoubtedly significant. The use of fire by Aboriginal people was a major impact. Fire was used as a means of manipulating the environment to reduce the build-up of senescent vegetation and to produce areas of fresh pick which could attract grazing kangaroos, wallabies and birds. Fire also no doubt affected soils. Fire management also evolved so that less intense burns were used to limit the risk of very extensive natural fires caused by lightning strikes in the drier months.

Aboriginal hunting of preferred species of animals and birds over many years had the potential to alter population balances. Impacts on plants also occurred. Aboriginal peoples used plants as a major part of their diet. For example, Yam Daisies provided a significant food supply where they grew. Records exist of forms of gardening of this valuable food supply. Aboriginal people played a role in the distribution of plants either deliberately by spreading seeds for desired species or accidentally as a result of collecting and carrying seeds while moving about the countryside.

European impacts

Europeans came to the local region soon after 1836 and the changes to natural ecosystems since have been massive. In the Adelaide Hills perhaps 10 to 12% of somewhere near original ecosystem remains. But the fraction that remains is very much biased towards land which was not wanted for farming – the low fertility sand scrubs at places like Sandy Creek, Altona, Tanunda and Moppa and the heathy woodlands on the often steep slopes with shallow stony soils such as Kaiser Stuhl, Para Wirra, Mount Crawford, Mount Gawler and Black Hill.

On the Adelaide plains there is as little as 2-3% of somewhere near-original ecosystem remaining and much of this is the coastal strip of sand dunes, mangroves and samphire wetlands. The small patches of remnant vegetation on the plains, such as the Reeves Plains and Linwood sand dunes, often tend to be areas that had low appeal for farming. Most of the areas of remnant vegetation on the plains and foothills have been significantly affected by timber removal or grazing.

So the first problem in understanding local vegetation is that the obvious remnants remaining are mostly unrepresentative of what existed originally in the area. The other problem is a sort of agreed scenario between pro-development farmers and enthusiastic environmentalists - the scenario that farmers rapidly cleared a lot of scrub soon after colonisation.

"The vast mallee box [*Eucalyptus porosa*] woodland at Peachey Belt [near Virginia and Penfield] was cleared early by settlers eager to obtain arable land for cereal cropping. It is really an indication of the vast impact the actions of these early pioneers had, that all but a few vestiges of this once large area (...) was cleared by 1848."²

We need accurate historical research to reveal the real picture. Intuitively, the lack of available workers and technology would have restricted farmers' ability to clear trees in those early days and settlement would have initially concentrated on open and arable areas with surface water. While early history has many stories about the dense scrub west and north-west of Willaston, to the west of Templers and the Peachey Scrub between Angle Vale and Penfield/Salisbury, there is little recorded except mostly open country to the south of Gawler and north through Freeling and Kapunda.

The image that the Adelaide plains were mostly covered with Mallee woodland has a fairly long history. Professor Wood in 1937 shows the Adelaide Plains as "Mallee", the lower rainfall Adelaide Hills as Savannah Woodland and the higher rainfall areas as Sclerophyll Forest.³ R. L. Specht in 1972⁴ produced a more detailed map showing a narrow strip of coastal shrubland, *Eucalyptus socialis-E. gracilis* Open Scrub on the Adelaide Plains north of Dry Creek and *Eucalyptus odorata* Woodland to Open Forest (with herbaceous understorey) in the foothills, but also extending on the plains to east of a line from about Salisbury to Wasleys and across to Port Wakefield. Open Forest/Low Open Forest/Open Scrub (Stringybark/Pink Gum/Long Leaf Box with heathy understorey) in the higher rainfall hills. Specht also commented that "the sparse vegetation of some agricultural areas has been destroyed before satisfactory surveys were initiated"⁵.

Boomsma and Lewis⁶ published a map, based on Specht, with the Adelaide plains mallee area allocated as 85% open scrub, 10% shrubland and 5% grassland, with the open scrub area divided between a more northern area allocated as 20% woodland and 80% open scrub and southern area including all of the main Adelaide metro area as 100% woodland and a higher rainfall area in the hills described as forest.

The next significant analysis and map is that prepared by Darrell Kraehenbuehl in 1986.⁷ That map (based on extensive historical research) re-introduces significant grasslands into the picture for the first time in many years.

Based on recent research, however, the Kraehenbuehl map of original grassland needs to be altered somewhat in line with Map 1 on page 5. The basis for Map 1 is primary source documents on South Australia in the 20 years after 1836, combined with detailed on-ground assessment over recent years.

Map 1 shows the location of Survey 836 sites (red dots). It also shows green dots for the Biological Survey sites previously recorded. All of these green dot sites are in areas of woodland (including grassy woodland) or other non-grassland sites.

² Daniels Christopher B. and Tait, Catherine J. (Eds) (2004) *Adelaide: nature of a city* at page 42

³ Wood, J. G. (1937) *The Vegetation of South Australia* Government Printer at page 33

⁴ Specht, R. L. (1972) *Vegetation of South Australia* (2nd Ed) Government Printer at page 202

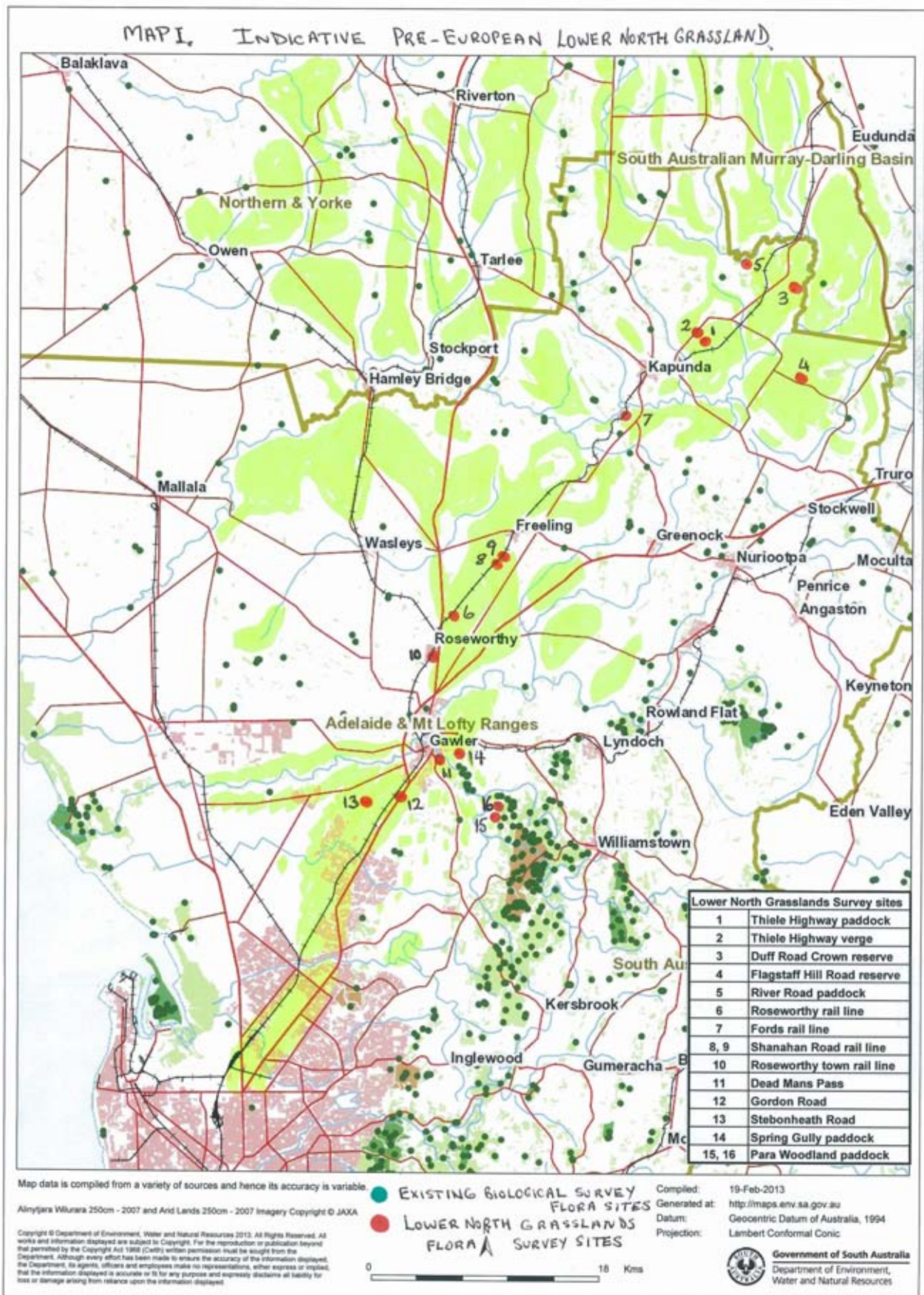
⁵ *ibid* at page 193

⁶ Boomsma, C.D. & Lewis, N. B. (1980) *The native forest and woodland vegetation of South Australia* SA Government Printer

⁷ Kraehenbuehl, Darrell N. (1986) *Pre-European Vegetation of Adelaide: a survey from the Gawler River to Hallett Cove* Nature Conservation Society of SA

Map 1. Indicative Pre-European grasslands in Lower North – (Adrian Shackley).

Grassland Survey Sites 1-16 (hand numbered red dots). Background map from naturemaps.sa.gov.au website maintained by SA Government. Grassland shown in yellow/light green.



Early historical accounts relevant to survey area – areas between Adelaide and Gawler

Map 2 on page 9 shows the routes of some early travellers and explorers as interpreted from their writings. Notes in [] in the following quoted writings are explanations/interpretation by Adrian Shackley.

William Light travelled from Adelaide to Gawler and to the Barossa in December 1837 and again in January 1839. He produced some paintings of the foothills near the Little Para river (Handcocks station) and near Rosedale, both showing scattered trees, grassy surrounds and descriptive passages.⁸

Eliza Reid (later **Mahony**) and Reid family travelled Adelaide to Gawler in early February 1939 - first Gawler settlers at Clonlea farm records (many years later) camping near Dry Creek the first night after leaving Adelaide:

"The grass was very high. We had been for the last 3 miles travelling through what looked like high corn, but was really kangaroo grass, now seldom seen, and when the fire was lit to show us the way to the camp the grass took fire, burning miles of the country, fortunately to the north. Even now I remember what a glorious sight it was."⁹

Ross Reid (Eliza Reid's brother) also recorded early experiences in Gawler.¹⁰

"In Gawler itself there was very little timber, except on the banks of the rivers. ... There was a fair quantity of timber east of Gawler, especially when Sandy Creek was reached. The Gawler Plains¹¹ were covered with kangaroo grass, and in lighting a fire on our way up the growth caught alight and there was an immense blaze".

Nathaniel Hailes wrote the following about his journeys from Adelaide to Gawler commencing in the latter half of 1839.¹²

"From Adelaide to Gawler, or vice versa, was at that time a disagreeable ride in extremely hot weather. The wayfarer traversed an open plain on which no human habitation had been erected between the two townships. To meet, overtake, or be overtaken by another traveller was a rare occurrence. In cool moist weather, when a grassy carpet variegated with flowers of diversified hues more gracefully distributed than could have been suggested than the most skilful designers of patterns was spread beneath you, the ride was pleasant enough. Then an emu, a kangaroo, but more frequently a bustard or two, would cross your path, and instantly retreat amid the belt of trees which continuously intervened between the apparently interminable plain and the shore of St. Vincent's Gulf; and drinkable water could be found at convenient intervals. But when the soil was bare and dusty, an unveiled sun scorching from above, and water only obtainable at distant intervals, the ride was somewhat trying."

Edward John Eyre travelled through Gawler on several occasions. In 1839 he described the area between Adelaide and Gawler as follows. Leaving Adelaide 1 May 1839:¹³

"The day was fine, the road good and the country open, pretty and fertile, so that we proceeded cheerily along as far as the little Para, a distance of about 12 miles. There was no water where we crossed it but by leading the horses two miles up amongst the hills plenty was found for them and some kegs full we brought back for our own use. On the following day we advanced about thirteen miles [to Gawler] thro' the same kind of open plains, skirted with trees to the west and by undulating lightly timbered hills to the east."

⁸ Light, William. *William Light's Brief Journal and Australian Diaries* (Reprinted 1984)

⁹ Mahony, Eliza (1928) "The first settlers at Gawler" *Proc. of the Royal Geographical Society of Australia (South Australian branch)* Vol 28: 53-82

¹⁰ Reid, Ross interview in the *Gawler Bunyip* 25 June 1909

¹¹ area south of Gawler to Smithfield and beyond to south-west from the foothills in this case excluding the Peachey Belt scrub

¹² Hailes, Nathaniel - "First glimpses of the bush" – *South Australian Register* 13.2.1878 column 5f and also reprinted in Hailes, Nathaniel – *Recollections* (1988) Wakefield Press at page 35

¹³ Edward Eyre's *Autobiographical Narrative 1832-1839* Caliban 1984 at page 195

The Editor of the *South Australian Register* produced a colourful description of the plains south of Gawler in 1846:¹⁴

"Some evil-disposed person or persons during the last week cut down a tree long known as "The Five-mile Tree," on the Gawler Plain. This tree, so remarkable from its isolated position, served the double purpose of a halting-place, and a visual relief to those travelling on this very monotonous portion of the North Road, where for miles around scarcely anything but the dreary plain is visible. The good folk of the North are very wrath on the subject of this vandal spoliation, and could they catch the wanton depredators would doubtless give them a severe drubbing."

Historical accounts of survey area - north of Gawler to Freeling, Hamley Bridge & Kapunda

Thomas Bewes Strangways and S. Blunden in November 1838 travelled from the Barossa across the country to the north-west and returned near Gawler.¹⁵

"Saturday 24th [November] After some difficulty we found a fordable passage across the Gawler [*the North Para in early days was called the Gawler River - this passage would be in the Rowland Flat to Tanunda area*], and proceeded towards the Hummock Hills. From the hills looking north and north-west, as the eye could reach we saw the same fine downs extending; and there is no doubt that for sheep runs this district is unequalled in Australia. In our opinion there is ample room and excellent feed for 100,000 sheep and nearer to the valleys excellent stations for any amount of cattle may be found. We were now about sixty miles from Adelaide; and our object, which was to find good runs for our stock, being obtained to our perfect satisfaction, we determined to return by a more westerly route."

George Stephen and T. B. Strangways travelled north in February 1839 from Gawler beyond present day Freeling and returned by a more westerly path to Gawler. The quote commences as the authors leave Gawler.¹⁶

"This day we followed the course of the Gawler [*North Para upstream of Gawler town*] to the N E for about two miles ... We then ascended the hills on the northern side of the flats through which we had ridden and proceeded due north for about twenty miles. [*This would pass between Freeling and Templers, closer to Freeling and north of Freeling towards the Light River*] We passed the old tracks of a cart which had gone a few miles north of Gawler, and travelled over a tableland of rotten, poor soil with scarcely a tree upon it, and presenting far and wide a melancholy landscape of burnt tufts of grass and charred bushes. [*Confirmation of the open grassland with scattered shrubs and trees in this area south and north of Freeling*].

After a scrutiny of the country, and seeing no appearance of a watercourse, we considered it imprudent to venture on, our horses having travelled for four and a half hours under a very warm sun. We accordingly turned back,in returning,and throughout this route there was an abundance of kangaroo grass, though the soil was generally poor and stony. On reaching the Gawler [*North Para*] we encamped about two miles lower than on the preceding night, During the day we had scarcely seen one bird, and but four kangaroos. However, the horse of one of our party crushed the head of a poor little bandicoot which had squatted in its hole too near the surface. This animal is smaller than the kangaroo rat [*bettong now extinct in the region*] with a long sharp nose, large round projecting ears, and a very short thin tail and, as I have been told by those not very delicate in their gastronomy, makes no despicable dish." [*sounds like a bilby, also now extinct in the region*].

¹⁴ *South Australian Register* Wednesday 8 April 1846

¹⁵ *South Australia Gazette and Colonial Register* 1 December 1838 at page 199 "Progress of Discovery – another fresh water river."

¹⁶ Stephen, George (1839) Discovery of a splendid tract at the Mouth of the Gawler River. *South Australian Gazette and Colonial Register* 28 February 1839 at page 8

Edward Eyre followed on his May 1839 diary for his journey north of Gawler:¹⁷

"On the 3rd May [1839] we fairly commenced our journey, leaving all tracks behind and striking out due north by compass. We passed thro' a fine open district consisting of grassy lightly wooded country and open downs, the soil for the most part rich and good with small pieces of quartz scattered over the surface - timber box and casuarinae. To the eastward high ranges extended, a continuation of the Mt Lofty chain, skirted by open grassy hills in the front, we encamped for the night, after a stage of about fifteen miles, upon a large creek under a scrubby sandhill [*Light River*] The next day, soon after starting, we came to another branch of the creek we had encamped upon which is called the Gilbert. The country extending from this to the northwards under the hills was very beautiful, lightly wooded, grassy and fertile. To the west of our route were high, bare and somewhat bleak downs, sprinkled with breccia [*stone/pebbles*]."

Map 3 contains a dotted line fairly directly north of Gawler which undoubtedly was a reconstruction of Eyre path. As Map 2 shows Eyre returned somewhat to the east travelling down the Light River valley and across the hills near Truro. Light took up a large sheep station as a reward for his 1839 exploration – shown approximately on Map 3 but the area taken up was apparently somewhat different to that drawn.

Edward Eyre made a second major exploration north of Adelaide in 1840 - the one where he crossed the Nullarbor to Albany. From a camp about five miles from Gawler on the North Para Eyre recorded on June 20 1840:¹⁸

"June 20. — Having a long stage before us to-day, I moved on the party very early, leaving all roads, and steering across the bush to my sheep stations upon the Light. We passed through some very fine country, the verdant and beautiful herbage of which, at this season of the year, formed a carpet of rich and luxuriant vegetation. Having crossed the grassy and well wooded ranges which confine the waters of the Light to the westward, we descended to the plain, and reached my head station about sunset, after a long and heavy stage of twenty miles — here we were to remain a couple of days to break up the station, as the sheep were sold, and the overseer and one of the men were to join the Expedition party." [*The ranges Eyre refers to fit with the Greenock Ranges as shown on Map 3 - this Map has some inaccuracies. The route shown on Map 2 for Eyre in 1840 needs a minor correction based on new 2014 research. Eyre's station head station has now been located thanks to David and Susan Shannon who reported that the owners of Anlaby knew an area north of the meeting of Blackhill and River roads at Bagot Well as Eyre's Flat. This was the place where Eyre had his station headquarters in 1839/40. David and Susan purchased this land some years ago and kindly located the area about 250 metres west of the road junction where ruins of a later stone building can be seen on Eyre's original site on the edge of the Light River floodplain*].

Daniel Brock collected census data and travelled to many of the early farms and stations in the survey region. Brock was one of many commentators who saw grasslands and reported dull and monotonous plains - tall trees and water were his European-centric preference. On 11 September 1843 he headed north from Gawler:¹⁹

"Left Gawler Town for the north. I passed over some very monotonous country, very little but immense plains. Scattered here and there were wattle and peppermints trees."

Brock's reports of his trip from Adelaide to Gawler were of similar tone. But his reports of the well-timbered higher rainfall country around the Clare hills and through the Adelaide Hills and southern districts read very differently.

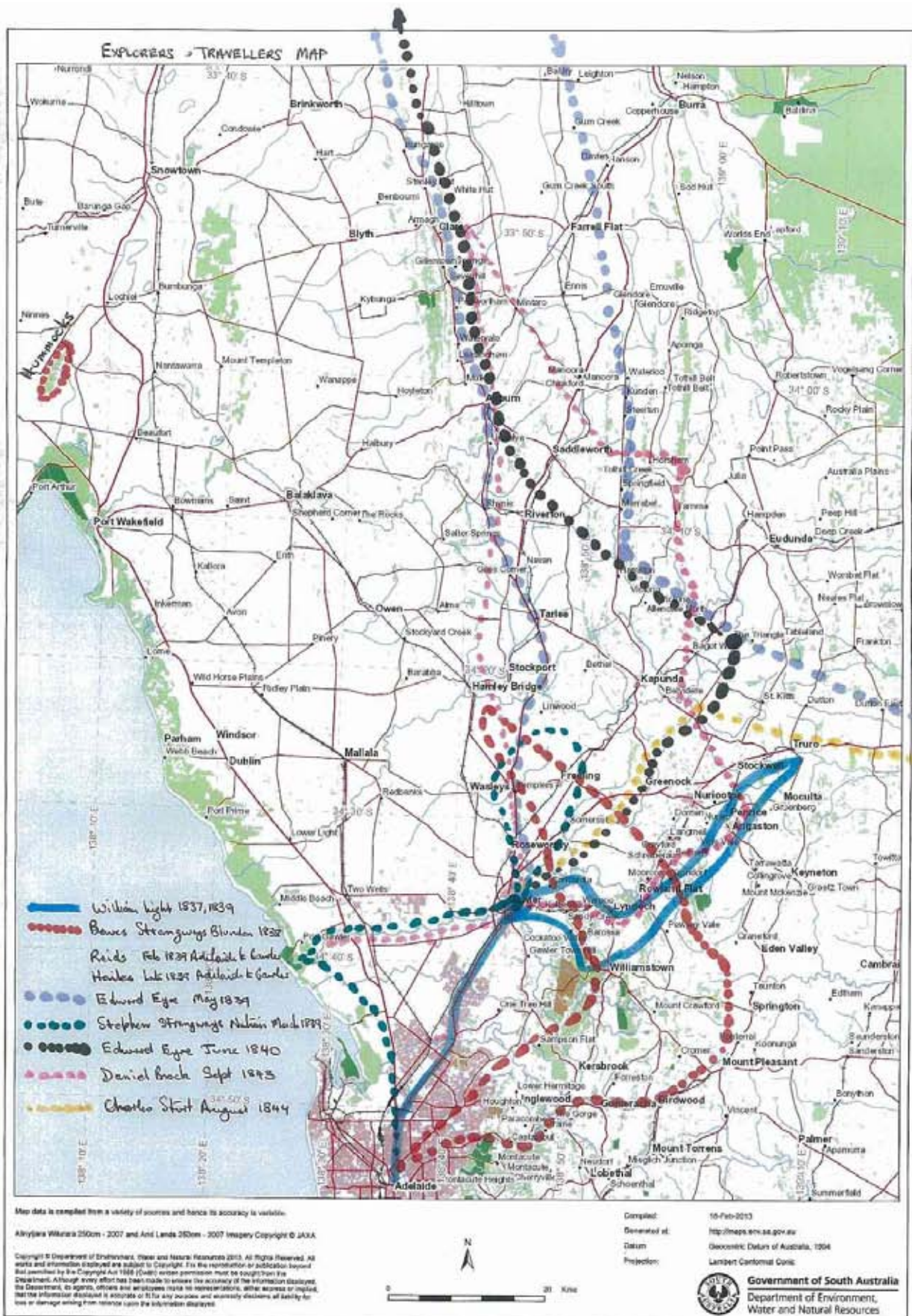
¹⁷ Edward Eyre's *Autobiographical Narrative 1832-1839* Caliban 1984 at pages 195-6

¹⁸ Eyre, E. J. *Journals of Expeditions of discovery into central Australia 1840-41* London 1845 at page 28

¹⁹ Brock, Daniel George (1843) *Recollections of D.G.B.* RGSSA at page 19

Map 2. Early explorers in the survey area - approximate routes.

Background map from naturemaps.sa.gov.au website maintained by SA Government.



Early accounts relevant to survey area - Kapunda and surrounds

When **Edward Eyre** returned from his first journey in late May 1839 [*interpreting his diary*] he travelled along the Light River for several miles towards current day Hamilton and further south recording a two to four mile wide open plain adjacent to the river with a lightly or heavily wooded tops of ranges [*the heavily wooded would include the southern parts of the Tothill Ranges*]. Eyre then travelled in an east/south-east direction through Koonunga and onto the Murray Plains. Eyre obviously liked the country he saw for grazing because he took up Special Survey 32 as approximately shown on Map 3 and set up a sheep station. The exact details of where Light set up his station buildings have now been found as noted on page 8. Map 3 is inaccurate as the place where Light had his head station is outside the boundary of Special Survey 32 as depicted.

Returning to Eyre's report of his 1840 journey. Having spent two days at his sheep station on the Light, Eyre headed further north.²⁰

"June 23. — ...About eleven I moved on the party up the Light for 8 miles, and then halted after an easy stage.....As we passed up the valley of the Light, we had some rich and picturesque scenery around us — the fertile vale running nearly north and south, backed to the westward by well wooded irregular ranges grassed to their summits, and to the eastward shut in by a dark looking and more heavily timbered range, beyond which rose two peaks of more distant hills, through the centre of the valley the Light took its course, but at present it was only a chain of large ponds unconnected by any stream; and thus, I believe, it remains the greater part of the year, although occasionally swollen to a broad and rapid current."

Charles Sturt travelled extensively in South Australia, commencing with his boat trip to the Murray mouth in 1830, overlanding cattle to from NSW in 1838, work as Surveyor-General and other public service positions from late 1838 to 1841. Map 2 records his route in August 1844 when he travelled from Adelaide through Gawler, to Charles Bagot's property at Koonunga and then through the Adelaide Hills to Moorundie on the Murray (and then north to the Simpson Desert and back in January 1846). The Narrative publication covered this journey but also contained commentary reflecting Sturt's extensive knowledge of South Australia. Sturt reported on part of the Lower North area as follows.²¹

"Beyond Gawler Town the country changes in character and appearance, whether you continue the northern road across the river, or turn more to the eastward, you leave the monotonous plain on which you have journeyed behind, and speedily advance into an undulating hilly country, lightly wooded withal, and containing many very rich, if not beautiful valleys. The Barossa Range and the districts round it are exceedingly pretty.....

I mean the copper mines of Kapunda, the property of Captain Bagot, who, with Mr. Francis Dutton, became the discoverer and purchaser of the ground on which the principal lode has been ascertained to exist.

Beyond this point [near *Kapunda*] to the north the coast range of Mt Lofty, which thus far preserves a northerly direction, throws off a chain to the westward of that point, but the main range still continues to run up into the interior on its original bearing, rather increasing than decreasing in height.

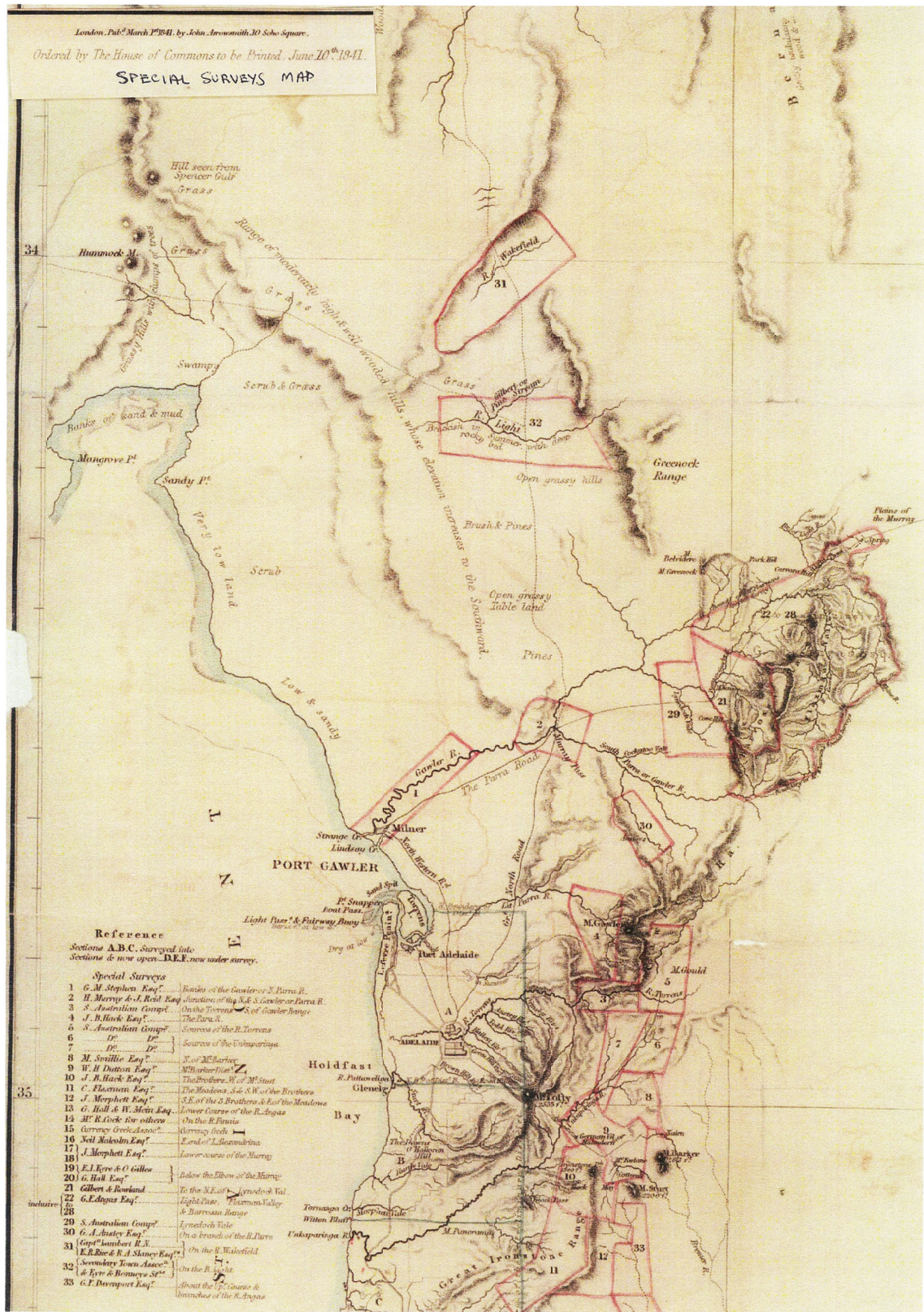
It is a remarkable fact, but one that I believe I have already adverted to, that the farther north, towards the valley of the Wakefield [River], the more denuded of timber the country becomes, until at last not a tree of any kind can be seen. These extensive and open downs are, nevertheless, well grassed, and covered with a profusion of orchidaceous plants. Whether, however, there is any salt present in the soil, to check the growth of the trees, it is impossible to say. Undoubtedly many of the ponds in the Wakefield, as well as other parts of the province are brackish, but the same denuded state of the country exists not anywhere else. These districts are far too valuable to be overlooked, and are therefore extensively occupied by cattle and sheep."

20 Edward Eyre's *Autobiographical Narrative 1832-1839* Caliban 1984 at page 197

21 Sturt, Charles (1849) *Narrative of an expedition into Central Australia*. Volume 1. at pages 365-8

Map 3. Special Surveys map 1841 (part of). Eyre's Light River station No 32. ²²

The dotted line north from Gawler is approximate route of Eyre May 1839. The Map has some major inaccuracies in terms of positions of ranges, rivers etc. north of Gawler.



²² Arrowsmith, John (1841) *Map shewing the Special Surveys of South Australia*. London. The above map is a selected part of the whole map.

Dr. Hermann Behr

Botanist Hermann Behr was in South Australia from September 1844 till October 1845 (also returning in 1848/49). During that time Behr collected hundreds of plant specimens around Gawler, Lyndoch and the Barossa Valley, through the Barossa ranges, in sandy scrub areas around Moppa, east of the Barossa/Adelaide Hills to the River Murray and in the Hahndorf/Onkaparinga River area and no doubt travelled elsewhere as well. His herbarium collections concentrate on the sandy scrub areas. On return to Germany in 1845 he published a brief but informative description of the flora of these parts of the State.²³

"The Flora of South Australia, and with it the physical character, may be divided into two widely separated forms, that of the Grass-land and that of the Scrub. In the hill-country [*Adelaide Hills*], and the plains lying to the westward of it, the grass-land prevails; yet so that extensive tracts, as well as small portions, of the other form of vegetation, likewise occur commonly enough. In the east [*of the Adelaide Hills*], the Scrub predominates.... The grass-land resembles for the most part European pastures in its physical character, as do also the individual plants.... A rather thick meadow-carpet is the essential characteristic of these regions, with which is associated in most cases a light park-like forest of gigantic Eucalypti, whose crowns, however, are never in contact with each other....

Where the soil is poorer, Casuarinas make their appearance here and there, whose brown-green crowns contrast strangely in spring with the sap-green of the turf. They reach the height of twenty, or at most of thirty feet, and stand like twigs among the Eucalypti.... But few shrubby species occur, and only where the poorer soil forms a transition to the Scrub vegetation.

One variety of the grass-land is the pit-land ("Bay-of-Biscay-land"), consisting of undulating plains or gently inclined slopes, which resemble a sea suddenly frozen during the beating of the waves.... The continual change of level produces a very broken surface, which, however, becomes effaced in the course of a few years under the plough. The Flora of these districts has some peculiarities. Whilst in other tracts which I have visited, grass-land destitute of trees is comparatively rare, these districts show a decided aversion to the elsewhere almost universally prevalent Eucalyptus, which here seldom occurs except as a border to the ravine-like water-courses, and even then only as a less robust species, Eucalyptus odorata. Casuarina is a more common shrub, but the commonest is Acacia pycnantha which here evinces an unusual tendency to unite in groves. Bursaria is also characteristic of these localities. [*this latter description is somewhat similar to the plains around Freeling although there is little evidence now of the wavelike appearance of the landscape Behr refers to*]

The generally treeless ground is peculiarly rich in Syngenesious plants [mainly daisy family]; but, with the exception of the Grasses, poor in Monocotyledons. Orchideae it does not produce at all."

Additional historical records – Surveyor Hundred plans and Diagram Book notes²⁴

Adelaide/Gawler plains. The early land survey records are accurate in describing soils and vegetation in most areas, especially for areas surveyed after about 1848. Land on the Gawler Plains around Smithfield and Angle Vale was not sold until the second half of the 1840s and occupation occurred gradually over a few years. The survey records and Diagram Books are incomplete but clearly show scrub around Heaslip Road and to the west. Surveys of Crown land on the Adelaide plains started in 1846/47 and continued for some years. Crown land sales in the area south of Gawler occurred from about 1847 and north of Gawler from about 1853. Land was divided into 80 acre lots on a grid pattern for the most part with exceptions near rivers and to some extent in the hills possibly based on road planning, although with many surveyed roads heading into rivers at places where crossing was next to impossible one wonders at how much planning went into some.

²³ Behr Dr H. (1847) On the character of the South Australia flora in general. *Linnaea* 20: 545-558 {Translated from the German by Richard Kippist, in *Hookers Journal of Botany and Kew Gardens Misc.* 1851 3:129-134

²⁴ Survey Diagram Books and Surveyors notes. Records are comprehensive but with some gaps. Available from the South Australian Land Titles Office, 101 Grenfell St Adelaide.

Adelaide Hills and foothills. Surveyor notes recorded the foothills as generally arable land with some timber and some areas of denser scrub such as around One Tree Hill and towards Para Wirra/Cockatoo Valley/Mount Gawler. The main areas where no surveyor notes exist are principally the areas described by early writers as the barren plains – so with nothing to report about water, timber, scrub etc. as usually noted for assistance to land buyers. This is relevant because a lot of Crown land was sold (potentially sight unseen) in Adelaide. The early Surveyor reports related to the land containing or adjacent the sites for this Biological Survey are shown in Appendix 8 together with some explanation and interpretation. There is excellent correlation with the findings in this survey.

Additional historical records – Land use records

Grazing licenses were issued for some of these areas of Crown land during the 1840s but these did not allow clearing of land and who would invest in clearing land on an annual license which had no tenure security. No doubt some “self-help” occurred with taking of timber but early comment on wood being carted into Adelaide only refers to it coming from the Adelaide Hills. When sale of Crown land did occur on the Adelaide plains it is interesting to record that land in the Peachey Belt woodland area was taken up at a similar rate as land in the open plains. That makes little sense from an agricultural point of view but is consistent with a big demand for wood from places such as the steam operated flour mills which were being established at Dry Creek and Port Adelaide.

Additional historical records - Council rating land use records

Records of the District Council of Munno Para West (for rate purposes), which date from 1854, record the pattern of land use for the Adelaide Plains.²⁵ By 1854 about a quarter of the 80 acre lots in the area had a residence. Most of the land that previously contained the Peachey Belt scrub is still recorded as part cleared or grazing into the mid-1850s. The open plains land is recorded with a variety of descriptors including arable land, fenced etc. Multiple land holdings of two or three lots were common. The number of farm dwellings did not increase greatly in the following years indicating that the typical economic farm size in the area was in the order of 200 acres. There is also a high turnover of land ownership indicative of relative difficulty of earning a living once the initial topsoil fertility was removed through cropping and lack of easily accessible water supplies combined with the opportunities to purchase land in other areas.

Summary of historical records

The detailed reports from early explorers and settlers give a consistent picture of a wide grassland plain between Gepps Cross and Gawler from the foothills to the Peachey Belt woodland which was centred at about Heaslip Road. The adjacent foothills themselves were mostly a mix of grassland and grassy woodland with some areas of denser woodland, especially in creeklines and gullies.

To the north of Gawler towards Freeling - east of the Main North Road to the Mount Lofty Ranges - open grasslands interspersed with patches of open woodland. Areas of thicker scrub on sandy soils.

Further north towards Kapunda - similar mix of grassland on the lower lying areas, open woodland in some areas and a mix of grassy and more wooded hilltops and tops of ranges.

Beyond Kapunda to the north - large areas of grassland interspersed with some open wooded areas (denser woodland on tops of some hills and ranges).

The analysis above is the basis for the areas of grassland depicted on Map 1. No doubt Map 1 is not 100% accurate but there is a lot of relevant information to support it.

²⁵ Munno Para West Council rate books (1854 on) available through State Records, Gepps Cross SA. Most old SA Council rates records are held at State Records. An exception is Barossa Council's records held at the Council office.

Assessment of percentage of remnant grasslands in survey area – south of Kapunda.

Based on Map 1 – the area of original grassland on the Adelaide Plains and foothills between Adelaide and the River Light south of Kapunda would be in the order of 500 sq. km or 50,000 hectares. The amount remaining today apart from roadsides is in the order of 25 hectares (estimate 0.05% of original area). The 25 hectares is mainly in the Gawler to Kapunda rail corridor with smaller areas on some uncultivated steeper banks of creeks running west from the hills.

There are several hundred kilometres of roadsides which were originally grasslands and which now contain varying mixtures of native species and weeds; almost always with dominant weeds although with some exceptions such as roadside cuttings. These roads show up well on Naturemaps Roadside Veg Mapping tab²⁶ as yellow although the extent is extended somewhat by roads where other shrub or tree layers have been removed to create the appearance of grassland.

Experience from driving along these roads would suggest a reasonable estimate might be 400kms of road averaging perhaps 5-8 metres of road verge width. That would equate to about 300 hectares of remnant grassland but realistically should be reduced by at least a third to remove areas of very low native species coverage. A figure of 200 hectares would comprise about 0.4% of original grassland based on the areas shown on Map 1. Many of these sections of road verge might have only two or three native species apart from *Austrodanthonia* (now *Rytidosperma*) and *Austrostipa* species. Some small areas of road verges have 10 or more native grassland species present. Many of these road verges with native grassland species continue to be damaged by grading, spraying, cultivating, tree planting and other human actions – usually with little understanding of the damage that is occurring.

While this picture may be (and is) dire, there are still some very good remnants remaining (including as set out in this survey) and the hills to the east of the grassland areas contain areas of grassy woodlands which have quite similar understorey species as the grasslands surveyed. The areas of grassy woodland remaining in the hills contribute to biodiversity support for isolated remnant grasslands.

Assessment of percentage of remnant grasslands in survey area – Kapunda, north of Kapunda

Beyond the Light River (below Kapunda near Fords), north/north-east to Anlaby, Illawarra, Twin Creek, Wittunga and Ben Lomond farms, the picture is better because the original grasslands were often in hilly areas with large areas of stony soils, which have never been ploughed. The area of original grassland here might be in the order of 250 sq. km. or 25,000 hectares. The amount of remnant grassland (uncultivated land) could be as high as 5,000 hectares (20%), much of it on the five big farm/pastoral properties mentioned. Only a portion of these grassland remnants would potentially be EPBC classified *Lomandra effusa*/*L. multiflora ssp. dura* (irongrass) tussock grassland.

Most of the remnant grassland areas around Kapunda, Bagot Well and Koonunga and north towards Eudunda is in a degraded condition, particularly where superphosphate and clover seed has been spread but, as discussed in the report for the five survey sites in this region, there is still substantial grassland biodiversity remaining. Many of these remnants are not whole paddocks but only stony areas where cultivation has not occurred. As such they have often become degraded both from the effects of adjacent cropping as well as grazing. These areas have the potential to be much improved for biodiversity without major impacts on farm activities.

²⁶ Naturemaps is available on the internet at naturemaps.sa.gov.au with a range of digital layers able to be displayed including a significant number of road and rail vegetation surveys.

4. How Survey Sites Were Chosen

This report seeks to provide information, which can add to the information and discussion regarding both;

- the distribution of native grasslands,
- what species might be found in the original grassland areas.

Over a number of years, local conservationists (including Adrian Shackley for some years) have built up considerable knowledge of valuable areas of native vegetation, including grasslands and grassy woodlands. Whilst this knowledge has increased, it was poorly documented in relative comparison to the importance of grassland vegetation that remained.

Fieldwork began by assessing known sites as to suitability for surveying and therefore documenting valuable vestiges of native grassland habitats. This was achieved after several days by Adrian Shackley and Kate Graham, who inspected areas of public land, as well as private properties (after permission was gained). The number of sites considered was narrowed down following inspections by Adrian Shackley, Kate Graham, Andrew Philpott (Light Regional Council) and Andrew Allanson (Irongrass Environmental Rehabilitation Services). This was done due to budget limitations on the number of sites which could be surveyed.

In addition to the 14 main survey sites, an additional two sites were surveyed on a block of land recently purchased to add to the Para Woodland conservation reserve adjacent Allendale Road. These two sites were grassland sites as viewed today although possibly a mix of grassland and open grassy woodland historically.

Data is also included for a site called Spring Gully at Gawler East. This site is an approximate 1.5 hectare area of *Lomandra spp.*, (irongrass) grassland which was subject of an *Environment Protection Biodiversity Conservation Act* (EPBC Act) referral in 2011 and for which extensive data is available from the EPBC referral reports and related Gawler Environment and Heritage Association data and submissions. It was not possible to undertake a Biological Survey quadrat study at Spring Gully for this project but the opportune data provided is comparable.

One of the quadrat sites chosen is a *Eucalyptus largiflorens* grassy woodland site at Roseworthy. While not strictly comparable to the other grassland sites, this ecosystem/association has not been recorded in the BDBSA before in this region. It is likely that this ecosystem was fairly widespread in the Gawler Belt, Kangaroo Flat, Roseworthy, Wasleys and Reeves Plains area – there are still significant remnants of *Eucalyptus largiflorens* in these areas but in almost all cases the understorey is highly degraded. Apart from an area of rail corridor about two kms. south of the survey site (which has been more disturbed), no other areas with good understorey are known in the area (Adrian Shackley information)

The original commitment for the State NRM grant was to survey at least eight remnant grassland sites. The survey expanded to 15 flora quadrats as well as the Gawler East opportune only site. This expansion improved the survey outcomes but stretched the project resources and timing.

5. Survey Methodology

Quadrat Based Assessments

Over several days, sites were surveyed using the Biological Survey of South Australia methodology,²⁷ to gain information of the flora species composition across 13 sites. Sites that were surveyed are located from as far south as the Playford/Gawler area and north to the hills beyond Kapunda.

Predominantly the sites are located within the Light Regional Council, with one site located within the City of Playford and two sites in the Town of Gawler council area. The additional two Para Woodland sites are in The Barossa Council. Sites surveyed were on railway corridors, local government reserves, roadsides and on private property.

The Biological Survey of South Australia methodology involves sampling flora, estimating condition of vegetation, classifying soils, as well as the classification of the vegetation community within a 900 square metre quadrat. All 2012 flora species were sampled and Rosemary Taplin at the State Herbarium checked identification of more than 500 vouchers. Vouchers from 2013 are still to be processed.

Follow up survey days

In order to record as many as possible of the species on sites, at least two survey days were planned for each site. Mid October was a good time to record most herbaceous species but this is too early for accurate recording of grass species which need mature seed to give accurate species identification in many cases. A mid-November visit to sites provided a much increased species list for sites with many grass species added as well as *Arthropodium fimbriatum* on seven sites and better identification of Vittadinia daisies and other species.

Mid-October was, however, too late for some species. In late September when sites were visited for selection, several species were observed which were not recorded in mid-October, including *Hypoxis* sp., *Caesia calliantha*, *Drosera whittakeri* and *Microtis* sp.

In spring 2013 additional recording has occurred which has resulted in about 35 additional native species being added to the records. This additional work has added greatly to the survey outcomes and shown the benefit of a comprehensive survey of sites over an extended timeframe.

Additional voucher specimens collected in spring and summer 2013 have yet to be processed at the Herbarium. However, Rosemary Taplin undertook a site visit to the River Road and Duff Road in spring 2013 with Kate Graham, Don Helbig, Greg Donovan, Terri Bateman and Adrian Shackley to identify additional species and all but a couple of new species found have been given an initial identification by Rosemary Taplin. The species marked V in the Voucher columns are still to be confirmed but significant alterations are not expected. In early 2015 following heavy summer rain we located 5 additional native species in the River Road paddock and more in adjacent paddocks.

Fauna survey - Birds

Recording of birds occurred at most of the survey sites. The exceptions were two roadside sites south of Gawler where the area of remnant grassland was very small and the surrounding agricultural use, ornamental plantings and urban impacts would make the results of little significance in understanding grassland ecology. Survey records were made by Dragos Moise (employed at Para Woodland conservation reserve as a restoration ecologist), Chris Steeles (Freeling resident and one of the managers of the Eremaea Birds SA birding website) for some sites near Freeling, and Kate Graham and Adrian Shackley (including some earlier observations in 2011 while inspecting sites).

²⁷ Heard, L.M.B. & Shannon, B. (1997) *Guide to Native Vegetation Survey. Using the Biological Survey of South Australia.* DHUD 1997

The methods used were not the standard Biological Survey method which involves 20 minute observations in both morning and afternoon at a site. This survey resulted in at least one hour of recording at each site at a single time during the day while flora survey recording was being undertaken by other members of the team. The results obtained cover a number of areas where bird records in fauna databases are limited and will be valuable in building up knowledge of birds using grassland habitat in the region.

Fauna survey – Reptiles, Mammals and Amphibians

Surveying of reptiles mammals and amphibians also occurred at most of the survey sites. The exceptions again were two roadside sites south of Gawler where the area of remnant grassland was very small and isolated making the results of little significance in understanding grassland ecology.

Most surveying was undertaken by Peter Matejcic, an experienced herpetologist and Biological Survey participant. The methods used involved observation only with no trapping undertaken. This allowed the survey work to be carried out without the need for a permit associated with trapping.

Surveying consisted of moving around sites and observing any disturbed animals as well as looking under cover such as rocks, debris or in some cases bark or logs near sites. Additional incidental observations were added from other survey participants.

Both Peter Matejcic and Dragos Moise noted frog calls. These were mainly associated with creeks and waterholes near sites. With the wet 2013 winter, Eastern Banjo Frogs were recorded at Shanahan Road grassland areas which is an indication of the movement these frogs can achieve in wet conditions - none have been heard in this area in recent drier years. Similarly in sites near creek lines frog recordings in spring 2013 have been much higher than for the dry conditions of late spring 2012.

Records of mammals were made by Peter Matejcic at most sites plus incidental recordings by other survey participants.

Names of flora and fauna in report

This report avoids the use of “weed” as a name for native plants. For example, Caustic Weed is named as Caustic Spurge. It seems a bit insulting to have native plants described as weeds.

We also avoid common names that seem inappropriate. In the Atlas of Living Australia *Eucalyptus largiflorens* has Bastard Box as its common name and *Actinobole uliginosum* has Camel Dung. These are not common names used in South Australia BDBSA Vascular plants taxonomy guide but being in the Atlas of Living Australia brings a risk of importation. In our view names like these are best avoided.

We have also dropped Common from a name of native species. For example, “Common” Brushtail Possum which is now rated Rare in SA is Brushtail Possum.

In most cases we have followed the changes made by Ann Prescott in her second edition of “Its blue with five petals” with respect to plant names. There seems no good reason to persist with vernacular names that are not accurate. There are usually readily available alternatives.

We haven't updated name changes from the BDBSA Vascular plants taxonomy guide²⁸ where they have occurred since data tables were first prepared. We have also not updated plant names where they appear in older documents, such as set out in Appendices 3, 7 and 9.

²⁸ BDBSA (2013) *Vascular plants taxonomy guide* – available on DEWNR website. Update November 2013 used.

Table 1. Survey Site Locations and Survey Type. Q = quadrat, O = Opportune.

GPS Location	Location	Council	Site ID	Survey Type
E: 310973 N: 6200264	Paddock off Thiele Highway/Eudunda Road, Kapunda	Light	KAP HOR 01	Q & O
E: 311153 N: 6200673	Roadside verge adjoining Thiele Highway, south-east of Falland Road intersection	Light	KAP HOR 02	Q & O
E: 317976 N: 6202805	Duff Road, Kapunda/Bagot Well	Light	KAP DUF 01	Q & O
E: 318784 N: 6198246	Quarry/Road Reserve, Flagstaff Hill Road, Kapunda/Bagot Well.	Light	KAP FLA 01	Q & O
E: 314649 N: 6207274	Paddock off River Road, Kapunda/Bagot Well	Light	KAP MCK 01	Q & O
E: 293783 N: 6178227	Roseworthy Rail Reserve, Main North Road, Roseworthy	Light	ROS MNR 01	Q & O
E: 305622 N: 6194261	Fords Road, Rail reserve and Council reserve, Fords south of Kapunda	Light	KAP FOR 01	Q & O
E: 296591 N: 6181915	Rail Reserve north of Shanahan Road, Freeling	Light	FRE SHA 01	Q & O
E: 296718 N: 6182067	Rail Reserve north of Shanahan Road, Freeling	Light	FRE SHA 02	Q & O
E: 2912880 N: 6175408	Rail Reserve, south of Roseworthy township	Light	ROS RAI 01	Q & O
E: 293864 N: 6167855	Dead Man's Pass, Gawler	Gawler	GAW DMP 01	Q & O
E: 291348 N: 6164641	Gordon Road, Evanston South/Gawler	Gawler	GAW GOR 01	Q & O
E: 288148 N: 6164138	Stebonheath Road, Playford	Playford	PLA STE 01	Q & O
Additional grassland site at Gawler East – full plant species list based on Opportune records – EPBC Irongrass grassland referral site in 2011. Recording at this site was managed by Adrian Shackley				
E: 295005 N: 6167988	Spring Gully, Gawler East	Gawler	Sp G	O
Two additional sites in Hundred of Barossa, adjacent Allendale Road, a few kilometers north-west of Para Wirra reserve. Recording at these two sites was managed by Kate Graham, Dragos Moise, Leanne Rosser and Adrian Shackley				
E: 298852 N: 6163564	Nature Foundation SA property, Allendale Road	Barossa	BAR KER 01	Q & O
E: 299307 N: 6164407	Nature Foundation SA property, Allendale Road	Barossa	BAR KER 02	Q & O

Site reports for all sites surveyed

The Tables showing results over the following pages have Conservation ratings for each species where appropriate. "A" refers to national ratings under the EPBC Act (none applicable for individual plant species in survey results, only Flinders Ranges Worm-Lizard for fauna results - rating Vulnerable). "SA" refers to State ratings under the *National Parks and Wildlife Act* Schedules 7-9. Regional conservation ratings species for Herbarium regions based on Florlist are provided in Table 26 in Appendix 1 and reported briefly for each site. The explanation for the rating categories at a regional level are explained in Appendix 4. As noted in the Appendix, Florlist has not been updated for several years and the ratings are gradually becoming outdated.

Indicative regional ratings for flora and fauna have also been developed over recent years by DEWNR based on IBRA (Interim Biogeographic Regionalisation for Australia - now up to Version 7). These are available for the Northern Yorke and Murray regions but not for the Southern/Mount Lofty Ranges regions. With resource constraints it has not been possible to present these assessments.

The symbols for data presented for Life Form, Cover/Abundance and Life Stage are set out here.

Life Form/Height Class – LF

T	Trees > 30m	SB	Shrubs 1 - 1.5 m	VT	Sedges > 0.5 m
M	Trees 15 - 30 m	SC	Shrubs 0.5 - 1.0 m	VL	Sedges < 0.5 m
LA	Trees 5 - 15 m	SD	Shrubs 0 - 0.5 m	V	Vines (twiners)
LB	Trees < 5 m	P	Mat plants (single plant)	MI	Mistletoes
KT	Mallee (>3m)	H	Hummock grass	X	Ferns
KS	Low Mallee (<3m)	GT	Grass > 0.5 m	MO	Mosses, liverwort
S	Shrubs > 2m	GL	Grass < 0.5 m	LI	Lichens
SA	Shrubs 1.5 - 2.0 m	J	Herbaceous sp		

Cover / Abundance - CA

N - not many, 1 - 10 individuals

T - sparsely or very sparsely present; cover very small (less than 5%)

1 - plentiful but of small cover (less than 5%)

2 - any number of individuals covering 5-25% of the area

3 - any number of individuals covering 25-50% of the area

4 - any number of individuals covering 50-75% of the area

5 - covering more than 75% of the area

Life stage - LS

S - seedling record when any number of seedlings observed

B - budding plants have buds formed in varying stages of development for flowering

F - flowering plants are in flower

I - immature fruit immature fruits not shedding seed

M - mature fruit fruits ripe and/or shedding seed

X - recently shed plants are in a non-reproductive phase which show signs of having shed seed or fruits within the last 12 months

D - dead/dormant indicates above-ground material only is dead and includes plant species that may still have dormant below ground organs (e.g. orchids, lilies etc.)

V - vegetative only refers to plants in a non-reproductive phase i.e. no flowers, buds or unshed seed

R - regenerating woody perennial which is resprouting after significant loss of foliage

6. Site Reports

6.1 Paddock adjacent Thiele Highway

Local Government Area: Light Regional Council

Location: In paddock on eastern side of Thiele Highway, south-east of Falland Rd intersection

Site Identification: KAP HOR 01

Opportunistic Collection Site: Yes

AMG Zone: 54

Easting: 310973 Northing: 6200264

Date of Survey: 19/10/12

Follow-up opportune collection: 3/12/12. Spring 2013

Altitude: 280 metres

Estimated average rainfall: 500 mm

Site Description

This site is located in a large paddock which is regularly grazed by stock. The site is a 30 by 30 metre quadrat, located south-east of a small olive bush. The site contains quite a few weed species, many of which are grazed by stock. Palatable native species are less than in the adjacent roadside site. At the time of undertaking the main survey, the paddock was being grazed. The follow-up December collection occurred 3 weeks after stock were removed.

History of the site

The site is in a large section of some 100 hectares, although divided into a few paddocks. Most of the site paddock is rocky with outcrops of stone and shallow soil over rock which has meant that most of the paddock has been uncultivated over the last 150 years or so since farming commenced in the locality. Water for stock is only available from the creek on the east side of the paddock. The grazing pattern over recent years has been that sheep have grazed the paddock until harvesting of cereal crops on other parts of the farm has been completed. The sheep are then moved (this would usually be in November or December). Grazing pressure also occurs from rabbits and kangaroos.

This has resulted in the survival of large numbers of irongrass tussocks (principally *Lomandra effusa*) and also a fair range of native species - generally those able to withstand stock grazing pressure. The irongrass tussocks provide a haven for some native species. While the frequency of *Lomandra spp.* and tussock grass species was quite high, the frequency of herbaceous species was low.

General Description of Vegetation

The vegetation type within the overall paddock was irongrass and native tussock grassland. Being within a grazed paddock the surveyed site contained a more degraded form of tussock grassland than in the adjacent roadside reserve, with herbaceous and lily species infrequent or not present.

Survey Site Specific Vegetation Description

The surveyed site was classified as ***Lomandra effusa*/*L. multiflora ssp. dura* (irongrass) tussock grassland**. No regeneration was observed of palatable species on the October visit, reflecting the existing grazing regime. However, the December visit, after grazing ceased, revealed most native grass and herbaceous species present were flowering or seeding, providing ongoing seed for regeneration. Of note was the recording of three *Lomandra* (irongrass) species.

There was a high cover abundance of weed species, many of which are known to increase under grazing pressure, with palatable species heavily grazed, and non-palatable species increasing, aided by the continued grazing disturbance. Of note was the proliferation of Salvation Jane (*Echium plantagineum*) and Wild Sage (*Salvia verbenaca*) as well as feral Olives.

Landform Pattern:	low hills	Landform Element:	hill slope
Outcrop Cover:	< 10%	Outcrop Lithology:	shale
Surface Strew Size:	pebble (5 - 50 mm)	Surface Strew Cover:	< 10%
Surface Strew Lithology:	shale	Soil Texture Class:	light medium clay
Bare Earth Estimate:	3%	Litter Estimate:	5%
Vegetation Condition:	Degraded natural		

Summary of Conservation Values

Despite the degraded condition of the site, its classification as a *Lomandra effusa/L. multiflora ssp. dura* (irongrass) tussock grassland means that it is of high conservation value. This vegetation association has been classified under the Commonwealth EPBC Act, as Critically Endangered. Currently this site would be likely to be categorized as a Class B or C site. A class B site requires the following attributes in an area of 2500 square metres (0.25 hectares) - at least 15 native plant species (19 recorded here in 900 square metres, at least three broad-leafed herbaceous native species excluding six disturbance resistant species (two recorded here in 900 square metres and one not far from quadrat - borderline B/C), at least two native grass species (six recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify as there is a good density of native grass and irongrass tussocks on the site and adjoining area.

Four of the six EPBC excluded disturbance resistant species - *Oxalis perennans*, *Convolvulus angustissimus*, *Euphorbia drummondii* and *Maireana enchylaenoides* are present on the site indicating the survival character of these species (having important underground roots which allow recovery after hard grazing). Given that the EPBC measure is taken over 2500 square metres parts of the paddock could be rated Class B but other parts would likely be Class C.

With a change in the current grazing management regime, an increase in diversity of native species would be expected given the higher diversity seen on the adjoining road reserve. Changing the grazing regime would be helpful in decreasing annual weed species, such as annual grass species and the broadleaf weeds observed. The timing of grazing would need to be closely observed to achieve the best outcomes for conservation. Combined with some broad leaf weed control, the frequency of native species would increase in cover abundance. Given the size of the paddock, and the interest of the landholder, future management changes to restore the condition of the irongrass grassland would be well worth pursuing.

Conservation rated species

The recording of *Austrostipa pilata* on the site (State Conservation Significance - Vulnerable species) is very interesting. This was the only site to record this species although there are records elsewhere in the region. *Lomandra micrantha ssp. micrantha* has a conservation rating (K) for Northern Lofty region.

Current Management Regime

The paddock is currently grazed as a part of a mixed farming business. With the increase in cropping over recent years it is likely that grazing pressure has increased somewhat on this paddock with less uncropped paddocks for stock over the winter/spring period. However, the paddock was maintaining a reasonable level of dry matter cover over summer and autumn. Weed control by the landholder was evident in terms of some target weeds.

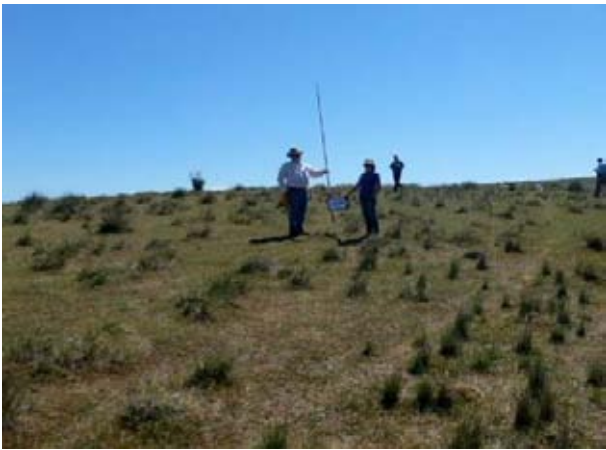


Photo 1: KAP-HOR-01, BS 836, 19/10/12
A well grazed Olive on the horizon.



Photo 2: KAP-HOR-01, A Summer view of the paddock showing good cover of soil with dry grass and litter.

Table 2a: Site flora records: KAP-HOR-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	1	F
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass				481	GL	T	I
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				6	GL	1	F, I
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				187	GL	T	I
<i>Austrostipa blackii</i>	Crested Spear-grass				482	GL	T	I
<i>Austrostipa eremophila</i>	Rusty Spear-grass				18	GT	T	F
<i>Austrostipa nodosa</i>	Tall Spear-grass				28	GT	1	B, I
<i>Austrostipa pilata</i>	Prickly Spear-grass		V		27	GT	1	B
<i>Convolvulus angustissimus ssp. angustissimus</i>	Pink Convolvulus				1	V	1	B
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	T	B
<i>Erodium cicutarium</i>	Cut-leaf Heron's-bill				12	J	1	F, I
<i>Euphorbia drummondii</i>	Caustic Spurge				70	J	N	V
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	2	N
<i>Lomandra micrantha ssp. micrantha</i>	Small-flower Mat-rush				26	VL	N	V
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25	VT	T	B, V
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	1	V
<i>Oxalis perennans</i>	Native Sorrel				21	J	T	F
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				15	J	T	F, B
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				483	J	T	M
<i>Vittadinia megacephala</i>	Giant New Holland Daisy				19	J	T	F
<i>Aira elegantissima</i>	Delicate Hair-grass			*	9	GL	T	F
<i>Avena barbata</i>	Bearded Oat			*	24	GT	1	I
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	1	F
<i>Bromus rubens</i>	Red Brome			*	33	GL	T	F, I
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F
<i>Galium murale</i>	Small Bedstraw			*	16	J	T	F
<i>Hypochaeris glabra</i>	Smooth Cat's Ear			*	22	J	1	F, M
<i>Marrubium vulgare</i>	Horehound			**	20	SD	T	V
<i>Medicago sp.</i>	Medic			*		J	2	F
<i>Moraea setifolia</i>	Thread Iris			*	8	J	1	V
<i>Neatostema apulum</i>	Hairy Sheepweed			*	17	J	T	V
<i>Olea europaea ssp. europaea</i>	Olive			**	31	SC	N	V

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Romulea rosea</i> var. <i>australis</i>	Common Onion-grass			*	2	J	1	I
<i>Salvia verbenaca</i> var. <i>verbenaca</i>	Wild Sage			*	14	J	T	B
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover			*	29	J	1	F,I
<i>Trifolium campestre</i>	Hop Clover			*	11	J	1	F
<i>Vulpia bromoides</i>	Squirrel-tail Fescue			*	32	GL	T	I,F

** - NRM declared species for the area requiring landholder control

Table 2b: Opportune flora records close to site (Spring 2013)

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria				37
<i>Chloris truncata</i>	Windmill Grass				80
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula				V

Fauna observations – combining both the Thiele Highway paddock site & road verge sites.

Birds observed on 19 October 2012 – observer Dragos Moise. Of particular conservation note – Peregrine Falcon recorded near creek to east of paddock.

Table 2c: Opportune bird records near site (also covers records on/near HOR 02)

Common Name	Genus	Species	A	SA	Int'd	Number
Australasian Pipit	<i>Anthus</i>	<i>novaeseelandiae</i>				1
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				6
Black-faced Cuckoo-shrike	<i>Coracina</i>	<i>novaehollandiae</i>				1
Brown Songlark	<i>Cincloramphus</i>	<i>cruralis</i>				1
Eurasian Skylark	<i>Alauda</i>	<i>arvensis</i>				2
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				2
Little Raven	<i>Corvus</i>	<i>mellori</i>				12
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				4
Peregrine Falcon	<i>Falco</i>	<i>peregrinus</i>		R		1
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>				2
Red Wattlebird	<i>Anthochaera</i>	<i>carunculata</i>				1
Singing Honeyeater	<i>Lichenostomus</i>	<i>virescens</i>				3
White-fronted Chat	<i>Epthianura</i>	<i>albifrons</i>				3
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	1
House Sparrow	<i>Passer</i>	<i>domesticus</i>			*	3
Rock Dove	<i>Columba</i>	<i>livia</i>			*	6

Reptiles and mammals observed on 19 October 2012 – observer Peter Matejic. Dwarf skink observed Adrian Shackley September 2013.

Table 2d: Opportune reptile records near site (also covers records on/near HOR 02)

Common Name	Genus	Species	A	SA	Int'd	Number
Adelaide Snake-eye Skink	<i>Morethia</i>	<i>adelaidensis</i>				1
Dwarf Skink	<i>Menetia</i>	<i>greyii</i>				1
Eastern Bearded Dragon	<i>Pogona</i>	<i>barbata</i>				1
Eastern Brown Snake	<i>Pseudonaja</i>	<i>textilis</i>				1

Table 2e: Opportune mammal records near site (also covers records on/near HOR 02)

Common Name	Genus	Species	A	SA	Int'd	Number
Rabbit	<i>Oryctolagus</i>	<i>cuniculus</i>			*	10
Sheep	<i>Ovis</i>	<i>aries</i>			*	150

6.2 Thiele Highway road reserve

Local Government Area: Light Regional Council		
Location: Eastern side of Thiele Highway, south-east of Falland Road intersection		
Site Identification: KAP HOR 02	Opportunistic Collection Site: Yes	
AMG Zone: 54	Easting: 311153	Northing: 6200673
Date of Survey: 19/10/12	Follow-up opportune collection: 16/11/12. Spring 2013	
Altitude: 290 metres	Estimated average rainfall: 500 mm	

Reserve Description

Like many native grassland sites, this grassland is inconspicuous. The roadside reserve survey site is 5 metres by 180 metres and is found where a cutting was made to facilitate road construction. The site contains many weeds, however native species are diverse. The cutting was constructed about 25 years ago when the Eudunda road was upgraded and bitumenised - prior to that, the site would have been in a similar position to other parts of the road reserve. Disturbance of the site area from road related activities has been much reduced over the last 25 years. The result is a much higher level of native flora diversity which is not evident on the road reserve away from this site. This is in part due to there being less damage to native species caused by road maintenance, spraying and the like, as the site (vegetation) is much higher than the road and less vulnerable to road maintenance activities. The soil on the top of the hill is also shallower which would favour natives over weeds to an extent.

General Description of Vegetation

The vegetation within the quadrat and surrounds contained *Lomandra spp.* and a mix of native tussock grass species, annual weed grasses and a range of herbaceous species. The surveyed site is found on the high side of the cutting, on the eastern side of the Thiele Highway. There is considerable disturbance to the site along the length of it, most due to weeds and historic roadside maintenance activities. Adjacent the surveyed site is a grazed paddock which contains a more degraded form of tussock grassland, with herbaceous and lily species less frequent.

Survey Site Specific Vegetation Description

The site was classified as **tussock grassland**. If the weed grasses were included in the vegetation description, it would be considered a **closed tussock grassland**. There are, however, several *Acacia pycnantha* as well as *Acacia paradoxa*. Like many areas which would have been grassland with little evidence of shrubs in pre-European times, native woody shrubs appear to be spreading. One factor is undoubtedly the lower incidence of fire with removal of Aboriginal burning practices. The spread of seeds of woody species along roadsides will have been increased with road maintenance grading.

The two *Acacia* species were low in cover abundance, but if they proliferate, they may change the vegetation classification in the future. Unless there is evidence that such woody species had a place in the original vegetation of the site then measures to limit and remove them can be justified to assist retention of the grassland. The road reserve adjacent the site also includes woody weeds; Pepper tree, Dog Rose and Almond. Removal of these woody weeds is a priority to ensure they do not spread further. In doing so, the likelihood of retaining the grassland diversity will be increased. See also historical information at page 135 indicating that *Acacia paradoxa* is an introduced species in the area.

The effect of road maintenance and related activities can be observed by a higher abundance of weed species closer to the road edge. A range of weed species was observed including woody species, grass species, annual and perennial broad leaf weed species.

Landform Pattern:	rises	Landform Element:	Hill slope
Outcrop Cover:	none apparent	Surface Strew Size:	none apparent
Surface Strew Cover:	nil	Soil Texture Class:	sandy clay loam
Bare Earth Estimate:	< 1%	Vegetation Condition:	disturbed natural



Photo 3: KAP-HOR-02, BS386, 19/10/12.
Grassland with *Acacia pycnantha* and *Acacia paradoxa* shrubs on road reserve. Olive shrubs in the paddock.



Photo 4: Spring 2012, Native grasses and grassy weeds, *Lomandra effusa*, *Ptilotus spathulatus*, *Stackhousia monogyna*, and grass tussocks.



Photo 5: February 2014, Kangaroo Grass tussocks just on paddock side of road fence – green and with seed heads after grazing ceased in December.



Photo 6: Spring 2012, *Stackhousia monogyna*, *Lomandra effusa* and grass tussocks being overgrown by *Acacia paradoxa*.

Summary of Conservation Values

There is a high cover abundance of grass weeds on this site. Despite this, a relatively high diversity of native grassland species was recorded. Plant species of conservation significance recorded included; Lemon Beauty-heads (*Calocephalus citreus*), rated as Uncommon for Northern Lofty; *Lomandra micrantha* rated K for Northern Lofty - likely to be Rare.

The site could also be assessed as a *Lomandra effusa/L. multiflora ssp. dura* (irongrass) native tussock grassland which is of very high conservation value - Commonwealth EPBC Act Critically Endangered plant association. Currently this site could be a borderline Class A site. A class A site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 30 native plant species (borderline - 31 recorded here in 900 square metres plus two nearby, 10 or more broad-leaved herbaceous native species excluding 6 disturbance resistant species (borderline - 10 recorded here in 900 square metres), at least five native grass species (eight recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not measured here but expect site to qualify as there is a good density of native grass and irongrass tussocks on the site and adjoining area).

A total of 31 native species and 19 weed species were recorded in the quadrat plus an opportune recording of *Salsola australis* near the site and *Walwhalleya proluta* a few hundred metres to the south on the road reserve. It would be expected that increased numbers of native species would be recorded over time if a higher level of regular weed control works (using appropriate bush regeneration methods) was in place.

Current Management Regime

Management of the road reserve is undertaken by the DPTI and by Light Regional Council. This appears to be limited to the control of weeds that are listed under the NRM Act.

Table 3a: Site flora records KAP-HOR-02

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Acacia paradoxa</i>	Kangaroo Thorn				100	SB	N	V
<i>Acacia pycnantha</i>	Golden Wattle				98	LB	T	I
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	1	B
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				215	J	T	F
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	T	F,I, B
<i>Atriplex semibaccata</i>	Berry Saltbush				56	P	N	V
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				103, 367, 368, 369, 370,372	GL	T	B, M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				373	GL	T	M
<i>Austrostipa blackii</i>	Crested Spear-grass				111	GT	T	I, M
<i>Austrostipa curticoma</i>	Short-crest Spear-grass				362,364	GT	T	M
<i>Austrostipa eremophila</i>	Rusty Spear-grass				361	GT	T	M
<i>Austrostipa nodosa</i>	Tall Spear-grass				99,363, 365,366, 371	GT	T	B M
<i>Bulbine bulbosa</i>	Bulbine-lily				53	J	1	I
<i>Calocephalus citreus</i>	Lemon Beauty-heads				110	SD	N	V
<i>Convolvulus angustissimus ssp. angustissimus</i>	Pink Convolvulus				1	V	N	F
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily				43	J	1	F
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	1	I,B
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	N	V
<i>Lomandra effusa</i>	Scented Mat-rush				3	VT	1	I

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Lomandra micrantha</i> ssp. <i>micrantha</i>	Small-flower Mat-rush				26	VT	N	I
<i>Lomandra multiflora</i> ssp. <i>dura</i>	Hard Mat-rush				25	VT	T	V
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	N	I
<i>Oxalis perennans</i>	Native Sorrel				21	J	N	V
<i>Ptilotus spathulatus</i> f. <i>spathulatus</i>	Pussy-tails				73	J	T	I,F
<i>Sida corrugata</i> var. <i>angustifolia</i>	Corrugated Sida				189	J	T	I
<i>Stackhousia monogyna</i>	Creamy Candles				108	J	T	F
<i>Themeda australis</i>	Kangaroo Grass				78	GT	1	V
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy				54	SD	T	F,I
<i>Vittadinia cervicularis</i> var. <i>cervicularis</i>	Waisted New Holland Daisy				104	SD	N	I,M
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				101	SD	T	I
<i>Vittadinia megacephala</i>	Giant New Holland Daisy				169	SD	N	I
<i>Aira elegantissima</i>	Delicate Hair-grass			*	9	GL	T	F
<i>Avena barbata</i>	Bearded Oat			*	24	GT	1	B,I, M
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	2	F,I
<i>Bromus hordeaceus</i> ssp. <i>hordeaceus</i>	Soft Brome			*	112	VL	T	I
<i>Bromus madritensis</i>	Compact Brome			*	109	GL	T	B
<i>Cynara cardunculus</i> ssp. <i>flavescens</i>	Artichoke Thistle			**	106	SD	N	V
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F
<i>Hypochaeris radicata</i>	Rough Cat's Ear			*	107	J	N	F
<i>Marrubium vulgare</i>	Horehound			**	20	J	T	V
<i>Moraea setifolia</i>	Thread Iris			*	66	J	T	I,F
<i>Olea europaea</i> ssp. <i>europaea</i>	Olive			**	31	SD	T	V
<i>Oxalis pes-caprae</i>	Soursob			*	61	J	T	
<i>Romulea rosea</i> var. <i>australis</i>	Common Onion-grass			*	2	J	1	I
<i>Salvia verbenaca</i> var. <i>verbenaca</i>	Wild Sage			*	14	J	T	B
<i>Scabiosa atropurpurea</i>	Pincushion			*	102	SD	2	V
<i>Solanum nigrum</i>	Black Nightshade			*	105	SD	N	I
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover			*	29	J	T	B
<i>Trifolium campestre</i>	Hop Clover			*	11	J	1	F,I
<i>Vulpia bromoides</i>	Squirrel-tail Fescue			*	32	GL	T	F

Table 3b: Opportune flora records close to site (2012 & spring 2013)

Scientific Name	Common Name	A	SA	Int'd	V
<i>Salsola australis</i>	Buckbush				77
<i>Walwhalleya proluta</i>	Rigid Panic				133
<i>Prunus dulcis</i>	Almond			*	-
<i>Rosa canina</i>	Dog Rose			*	V
<i>Schoenus molle</i>	Pepper-tree			*	173

** NRM declared species for the area requiring landholder control

6.3 Duff Road Crown Land Reserve, Kapunda

Local Government Area: Light Regional Council

Location: This small reserve is part of a little used road, which provides access to several farm paddocks and to the Light River. The Crown land reserve is formed as the road veers north-easterly (from its eastward direction), forming a small triangular section. The area of Crown land is about 0.7 hectares.

Site Identification: KAP DUF 01

Opportunistic Collection Site: Yes

AMG Zone: 54

Easting: 317976 Northing: 6202805

Date of Survey: 19/10/12

Follow-up opportune collection 16/11/12. Spring 2013.

Altitude: 330 metres

Estimated average rainfall: 475 mm

Site Description

This reserve contains a high diversity of native species, which is unusual considering both its size, the surrounding land use as well as its current use for moving stock and machinery from farm paddock to paddock. At the time of the survey, the road reserve, which this reserve forms part of, was being grazed by cattle moving to a paddock to the east.

The vegetation structure of the site is open with only a few planted trees to the south. Further west are several bushes and Peppermint Box trees (*Eucalyptus odorata*), but they are few and provide minor habitat.

General Description of Vegetation

The vegetation within the quadrat and surrounds contained *Lomandra spp.* and a mix of native tussock grass species and weed grasses and many herbaceous species. There are also several low native shrub species. Several species observed were not found on other sites, or found in different combinations of species.

Weed species were recorded but diversity was not high, and recorded to be of relatively small cover abundance in 2012. In spring 2013 weed cover abundance was higher, but after grazing by cattle in October, the weeds abundance appeared to be reduced relative to the native species which was interesting.

Survey Site Specific Vegetation Description

The dimensions of the surveyed site were 17 by 55 metres and contained vegetation that was classified as ***Lomandra spp.* grassland.**

The survey site contained a high number of native species, which is surprising given that the land use adjacent the site has been cropping, and the vegetation contains no “protection” (in the form of trees and shrubs) from herbicide drift. The site is also occasionally grazed by cattle and may well have been grazed more heavily in previous years because of its isolated/dead end road configuration.

In 2012 this was the only site in which *Caesia calliantha*, *Hypoxis sp.* and *Eucalyptus odorata* (the latter two adjacent the survey area) were recorded of the surveyed sites. In 2013 *Caesia calliantha*, and *Hypoxis* (identified as *H. vaginata var. vaginata*) were located on other sites. In 2013 *Halgania cyanea* and *Hyalosperma glutinosum ssp. glutinosum* were located on this site and *Pomaderris paniculosa ssp. paniculosa* on the road verge – all as new species for the survey and only at this site.

Of interest was the number of small shrub species, which were rarely found in other survey sites: including *Cryptandra campanulata* (State Rare species) *Maireana rohrlachii* (State Rare species) and *Acacia acinacea* – (Uncommon Northern Lofty species). These are shrub species which are mostly associated with grasslands in the region (and also for grasslands in the Mid North).

Many of the weed species are typically found in agricultural settings and appear to be found where disturbance is more noticeable.

Landform Pattern:	rises	Landform Element:	hill slope
Outcrop Cover:	< 10%	Outcrop Lithology:	quartzite
Surface Strew Size:	nil	Soil Texture Class:	sandy clay loam
Bare Earth Estimate:	2 %	Litter Estimate:	10 %
Vegetation Condition:	disturbed natural		

Summary of Conservation Values

Botanically this site is very significant. One wonders how this area looked before European settlement. The diversity of species is high despite the small size of the reserve. The diversity of *Lomandra spp.*, along with the low shrub layer created much discussion amongst survey participants. Also, a high diversity of herbaceous, lily and grass species was recorded. *Cryptandra campanulata* (State Rare species) *Maireana rohrlachii* (State Rare species) *Lomandra micrantha ssp. micrantha* (Rated K for Northern Lofty region) and *Acacia acinacea* and *Goodenia pinnafitida* – (Uncommon Northern Lofty species) were all species recorded on the site. It was expected that a number of additional species would be located with an early spring search and this was confirmed with six additional species in 2013.

A total of 36 native species and 19 weed species were recorded on the site in 2012. An additional four native species were collected opportunistically on the adjacent road reserve. The tally after spring 2013 is 42 on the quadrat and five opportune.

The site can be classified as a ***Lomandra effusa/L. multiflora ssp. dura* (irongrass) native tussock grassland**, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. This site is clearly a Class A EPBC site. A class A site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 30 native plant species (42 recorded here in 900 square metres plus two or three close by, 10 or more broad-leafed herbaceous native species excluding six disturbance resistant species (14 recorded here in 900 square metres), at least five native grass species (eight recorded here in 900 square metres) and have at least 50 native grass or *Lomandra* tussocks on a 50 metre transect (not checked here but expect site to qualify as there is a good density of native grass and irongrass tussocks on the site).

Unusual Crown land reserve on Duff Road serving no apparent purpose other than flora conservation – thanks to the surveyors of Hundred of Kapunda 150 years ago!

Current Management Regime

The site is currently occasionally grazed but relatively lightly and mostly occurring as stock meander from one paddock to another along the road. The heavier grazing of the shrub species in recent years was noticeable compared with Bateman²⁹ in 2004. Herbicide drift from adjacent paddocks may also be problematic, as there is little protection from any trees and higher shrubs.

At present, there appears to be little in the way of weeds management, which has not caused any major problem for the vegetation in terms of declared weeds but the level of grassy and herbaceous weeds is providing significant competition for native species.

Grazing on an intermittent basis may be the best way of ensuring that there is not a build-up of grass thatch which can result in small herbaceous species being shaded out (removing their ecological niche of filling the space between grass tussocks). The role of fire may also need to be explored to maintain diversity, although this is somewhat risky given the very small size of the reserve. Unless there are other better management options available, light grazing should be continued in the future – although this would be difficult to control without fencing.

²⁹ Bateman, Terri & Donovans Earthcare (2004) Survey findings – Community Land/Water reserves in Light Regional Council. Unpublished.



Photo 7: KAP-DUF-01, BS386, 19/10/12
Picture of site looking east. Planted eucalypts top corner.



Photo 8: Summer 2014 view – low thatch and good cover of ground. Cow pats introducing extra nutrients and supporting weeds.



Photo 9: September 2012, *Caesia calliantha* on site. Not seen in mid-October quadrat survey.



Photo 10: September 2012, *Hypoxis vaginata* var. *vaginata* - on road verge north of site, not seen in mid-October quadrat survey.



Photo 11: Spring 2013, Mallee Pomaderris (*Pomaderris paniculosa* ssp. *paniculosa*) on road verge – surviving after regular grazing.



Photo 12: Spring 2013, Golden Sunray (*Hyalosperma glutinosum* ssp. *glutinosum*) - only recorded at this site.

It is understood that Light Council, which manages the Crown land reserve, propose to fence the area but that this will be done in a way that will provide a wide gate at each end to allow stock to graze at selected times of the year and also allow preclusion of stock when required to advantage native species (especially late spring and early summer). It is noticeable that cattle manure pats are causing a nutrient/weed issue on the site. Given the small size of the patch it would be feasible to remove these when they are dry. This would advantage most of the native species relative to introduced plants and help avoid relocation of new weeds from elsewhere.

Should the site be fenced, it could be expected that the “low” shrubs may increase somewhat in height, thereby affecting somewhat the vegetation structure. The shrubs were significantly higher in March 2004 when a survey of Light Regional Council managed Crown land reserves was undertaken by Terri Bateman (information available from Terri Bateman and Adrian Shackley as well as Light Regional Council).

Future monitoring of the site should occur to ascertain if fencing has been positive or not regarding the diversity and representation of species on the site.

Table 4a: Site flora records KAP-DUF-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Acacia acinacea</i>	Wreath Wattle				38	SD	T	V
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	N	I
<i>Atriplex semibaccata</i>	Berry Saltbush				56	P	T	V
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				327	GT	1	M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				35, 57, 319, 321, 323, 329	GL	1	I, F, M
<i>Austrostipa blackii</i>	Crested Spear-grass				46, 52, 54, 317, 320, 326, 331	GT	2	F, I, M
<i>Austrostipa drummondii</i>	Cottony Spear-grass				60	GT	T	F
<i>Austrostipa elegantissima</i>	Feather Spear-grass				84	GL	N	I, M
<i>Austrostipa eremophila</i>	Rusty Spear-grass				64, 324, 330	GT	1	F, I, M
<i>Austrostipa nodosa</i>	Tall Spear-grass				62, 68, 318, 325, 328	GT	2	F, I, M
<i>Bulbine bulbosa</i>	Bulbine-lily				53	J	1	I, M
<i>Bursaria spinosa ssp. spinosa</i>	Sweet Bursaria				37	SD	N	V
<i>Caesia calliantha</i>	Blue Grass-lily				V	J	N	F
<i>Chrysocephalum apiculatum</i>	Yellow Buttons				47	J	T	F
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting				50	J	1	F
<i>Convolvulus angustissimus ssp. peninsularum</i>	Grassland Convolvulus				39, 322	V	1	V, F
<i>Cryptandra campanulata</i>	Long-flower Cryptandra		R		41	SD	T	M
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily				43	VT	V	F, I
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	T	F
<i>Euphorbia drummondii</i>	Caustic Spurge				70	J	N	V
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34	J	1	F

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Hyalosperma semisterile</i>	Orange Sunray				275	J	T	M
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge				40	VT	1	F,I
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	T	V
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	2	V
<i>Lomandra micrantha</i> var. <i>micrantha</i>	Small-flower Mat-rush				26	VL	T	V
<i>Lomandra multiflora</i> ssp. <i>dura</i>	Hard Mat-rush				25	VT	2	B
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	1	B
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush		R		36	SD	N	V
<i>Pimelea micrantha</i>	Curved Riceflower				48	SD	T	B
<i>Ptilotus spathulatus</i> f. <i>spathulatus</i>	Pussy-tails				73	J	T	B
<i>Sida corrugata</i> var. <i>angustifolia</i>	Corrugated Sida				189	J	N	V F
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy				54			
<i>Vittadinia cervicalis</i> var. <i>cervicularis</i>	Waisted New Holland Daisy				67	J	T	I
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				51	J	1	F,I, M
<i>Vittadinia megacephala</i>	Giant New Holland Daisy				19	J	T	F,I
<i>Arctotheca calendula</i>	Cape Weed			*	69	J	N	F,I
<i>Avena</i> sp.	Wild Oat			*		GT	1	M
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	1	I
<i>Bromus diandrus</i>	Great Brome			*	188	GL	N	M
<i>Bromus rubens</i>	Red Brome			*	33	GL	1	F
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F,I
<i>Hordeum glaucum</i>	Blue Barley-grass			*	44	GL	T	I,M
<i>Lepidium africanum</i>	Common Peppercross			*	55	J	1	V
<i>Lolium rigidum</i>	Wimmera Ryegrass			*	58	GT	T	B
<i>Medicago truncatula</i>	Barrel Medic			*	63	J	1	I
<i>Moraea setifolia</i>	Thread Iris			*	66	J	1	F,I
<i>Oxalis pes-caprae</i>	Soursob			*	61	J	T	V
<i>Poa bulbosa</i>	Bulbous Meadow-grass			*	45, 316	GL	T	M
<i>Reichardia tingitana</i>	False Sowthistle			*	49	J	T	B
<i>Romulea rosea</i> var. <i>australis</i>	Common Onion-grass			*	2	J	1	I M
<i>Salvia verbenaca</i> var. <i>verbenaca</i>	Wild Sage			*	14	J	1	B,F, M
<i>Trifolium fragiferum</i> var. <i>fragiferum</i>	Strawberry Clover			*	65	J	T	V
<i>Trifolium scabrum</i>	Rough Clover			*	254	J	N	M
<i>Vulpia</i> sp.	Fescue			*		GL	T	M

** - NRM declared species for the area requiring landholder control

Table 4b: Additional spring 2013 species on site

Scientific Name	Common Name	A	SA	Int'd	V	LF	CA	LS
<i>Asperula conferta</i>	Crowded Woodruff				137	J	T	F
<i>Crassula colorata</i> var. <i>acuminata</i>	Dense Crassula				208	J	T	F
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula				V	J	T	F
<i>Halgania cyanea</i>	Rough Blue-flower				V	SD	N	X
<i>Hypoxis vaginata</i> var. <i>vaginata</i>	Yellow Star				V	J	T	F
<i>Hyalosperma glutinosum</i> ssp. <i>glutinosum</i>	Golden Sunray				V	J	1	F,I

Table 4c: Opportune species close to site 2012 and 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Eucalyptus odorata</i>	Peppermint Box				V
<i>Maireana brevifolia</i>	Short-leaf Bluebush				221
<i>Pomaderris paniculosa</i> ssp. <i>paniculosa</i>	Mallee Pomaderris				V
<i>Themeda australis</i>	Kangaroo Grass				78
<i>Salsola australis</i>	Buckbush				80

Fauna observations – Duff Road site and locality

Table 4d: Opportune bird records near site 19 October 2012 – observer Dragos Moise

Common Name	Genus	Species	A	SA	Int'd	Number
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				1
Brown Goshawk	<i>Accipiter</i>	<i>fasciatus</i>				1
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				1
Little Raven	<i>Corvus</i>	<i>mellori</i>				1
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				2
Singing Honeyeater	<i>Lichenostomus</i>	<i>virescens</i>				1
Eurasian Skylark	<i>Alauda</i>	<i>arvensis</i>			*	1

Table 4e: Opportune reptile records near site 19 October 2012 – observer Peter Matejic. (Snake 2013)

Common Name	Genus	Species	A	SA	Int'd	Number
Brown Hare	<i>Lepus</i>	<i>europaeus</i>			*	1
Cattle	<i>Bos</i>	<i>taurus</i>			*	25
Eastern Bearded Dragon	<i>Pogona</i>	<i>barbata</i>				1
Eastern Brown Snake	<i>Pseudonaja</i>	<i>textilis</i>				1
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	1

6.4 Flagstaff Hill Road Quarry and Road Reserve, Kapunda Hills/Koonunga

Local Government Area: Light Regional Council

Location: Reserve at disused quarry, western side of bend

Site Identification: KAP FLA01

Opportunistic Collection Site: Yes

AMG Zone: 54

Easting: 318784

Northing: 6198246

Date of Survey: 19/10/12

Follow-up opportune collection: 16/11/12.

Altitude: 360 metres

Estimated average rainfall: 475 mm

Site Description

Flagstaff Quarry Reserve is located on the hills north-east of Kapunda adjacent Flagstaff Road. The site contains native grassland but part of the area has been used as a small quarry in the past. The site is not a separate Crown land reserve but is an extension of the road reserve. The additional land beyond the usual road reserve is about 1.8 hectares of which about 0.2 hectares is the quarry. The adjacent properties are used for grazing livestock. The road verge to the south west of the quarry also contains a significant remnant of native vegetation.

The site is open and windswept and is predominantly west facing. There is a range of broad leaf weeds, but also there are several relatively broadleaf weed free sections. Annual weed grass species are common across the site.

General Description of Vegetation

The vegetation within the reserve is a mix of mainly native tussock grasses, annual weed grasses and a range of herbaceous species. It is in variable condition. There are areas in the reserve that are quite degraded. Structurally however, the grassland does not appear to have been compromised significantly by the past quarrying.

The site has a number of sheep tracks along the road verges indicating that sheep are regularly moving along the road. Being a very isolated road it appears that regular grazing is occurring.

Several *Acacia pycnantha* and a few non-local eucalypts exist close to the quarry but not elsewhere on the road, probably introduced with quarry activities.

Survey Site Specific Vegetation Description

The surveyed site measured 15 by 60 metres and contained vegetation that was classified as **low open tussock grassland**.

This site contains several native species that have conservation significance, one of which was not found elsewhere in the survey.

The site contains a number of annual broad leaf weed species as well as annual weed grass species. No perennial exotic grass species were recorded; this is important in the management of the reserve.

Landform Pattern:	hills	Landform Element:	hill slope
Site Slope:	0%	Site aspect:	320 degrees
Outcrop Cover:	< 10 %	Outcrop Lithology:	schist
Surface Strew Size:	pebbles 5 – 50 mm	Surface Strew Cover:	< 10 %
Surface Strew Lithology:	Schist	Soil Texture Class:	clay loam
Bare Earth Estimate:	8 %	Litter Estimate:	15 %
Vegetation Condition:	degraded natural		

Summary of Conservation Values

This was one of only a few sites surveyed, which is in hilly country. It provides an important example of vegetation that occurred in the area before European settlement. The site has been classified as a grassland and it is significant in being in the middle of a very large area (originally in the order of 250 square kilometres or 25,000 hectares) of historic grassland. This area is an example of the land described by early explorers and settlers as grassy hills devoid or almost devoid of trees.

A total of 20 native species and 13 weed species were recorded on the site. An additional 15 native species and three weed species were collected opportunistically adjacent to the site and near the road reserve cutting to the west. *Maireana rohrlachii* (State Rare species) was recorded on the road reserve near the site.

This site is just out of the Northern Lofty Herbarium Region (in the Murray Region). Regional ratings can be a bit misleading with such an edge effect. The recording of Copper-wire Daisy (*Podolepis canescens*) is significant as this species is now infrequent in South Australia, and was not found elsewhere in the survey or known to exist elsewhere in the region of the survey. As well as being present on the site, there was a large patch of this species in the paddock to the east of the road cutting, comprising several thousand plants and providing a colourful spectacle in spring as well as a potential vital source of seed, not otherwise available in the region. Fine-hairy Spear Grass (*Austrostipa puberula*) is also a significant conservation find on this site.

The area can be assessed in relation to *Lomandra effusa*/*L. multiflora ssp. dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. While the site itself has limited *Lomandra* species present, the general area is typical of much of the *Lomandra spp.* grasslands in the region. This site could be a Class B EPBC site under the EPBC criteria. A class B site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 15 native plant species (20 recorded here in 900 square metres), three or more broad-leaved herbaceous native species excluding six disturbance resistant species (10 recorded here in 900 square metres), at least four native grass species (nine recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify as there is a good density of native grass and irongrass tussocks on the site).

Other survey work in locality

Considerable flora and fauna surveying has been occurring in this general area over recent years because of the discovery of significant populations of National and State Endangered Pygmy Blue-tongue Lizards. Of note also, there are significant populations of Southern Hairy-nose Wombats in the area. This recent flora survey work in the wider locality has recorded a further 20 native species (see Table 6c below) collected within 5 to 10km. from the site which were not found on any sites during our survey. This is very useful in providing a list of additional species which (apart from some wetland/creek species) would have been likely species in other nearby grassland areas.

Current Management Regime

As for most of the sites on this survey, there is little evidence of weed control on this site. It appears that the management is reduced to targeting of notifiable (under the NRM Act) weed species only.

The presence of several annual grass weed species (*Silvergrass/Vulpia spp.*, Wild Oats etc.), but no perennial grass weeds probably ensures the continued survival of the native species on the site. There was not a thick thatch of dead grass on the site, perhaps due to the low nutrient levels in the soil but also the result of sheep (and to a lesser extent perhaps kangaroos and rabbits) grazing the area. Ensuring that no perennial grass weed species invade the site will be important for its long term future.

Pincushion (*Scabiosa atropurpurea*) was found next to the site but not on it. Control of this weed should be a priority while it is in low numbers. Using broad leaf herbicides carefully amongst native grass areas (whilst avoiding broad leaf native plants), may also steadily decrease the level of these weeds, whilst ensuring native grass species are not reduced.

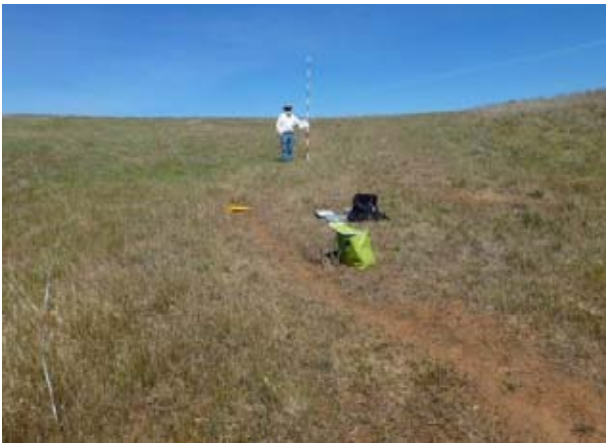


Photo 13: KAP-FLA-01, BS 386, 19/10/12. Regular sheep tracks in photo and well-grazed appearance.



Photo 14: Spring 2012, Adelaide Snake-Lizard (*Delma mollerii*) located in stones near site.



Photo 15: Rolling treeless hills characterise the area around Flagstaff Hill Road.



Photo 16: Spring 2013, *Podolepis canescens* (along with a bit of Capeweed) in grazed paddock near survey quadrat.



Photo 17: Spring 2013, Copper-wire Daisy (*Podolepis canescens*) growing in stony soil near site.

Table 5a: Site flora records KAP-FLA-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	2	F,I
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				215	J	N	F
<i>Atriplex semibaccata</i>	Berry Saltbush				56	P	N	V
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				76, 336	GL	1	F,I M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				335	GL	T	M
<i>Austrostipa blackii</i>	Crested Spear-grass				338	GT	1	M
<i>Austrostipa nodosa</i>	Tall Spear-grass				75, 334, 337	GL, GT	1	F,I M
<i>Austrostipa puberula</i>	Fine-hairy Spear-grass				333	GT	T	M
<i>Boerhavia dominii</i>	Tar-vine				339	J	N	V F
<i>Chloris truncata</i>	Windmill Grass				80	GL	N	V
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	T	V
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				342	J	T	I
<i>Podolepis canescens</i>	Button Podolepis, Copper-wire Daisy				74	J	1	F,I, M
<i>Ptilotus spathulatus f. spathulatus</i>	Pussy-tails				73	J	T	F,I
<i>Salsola australis</i>	Buckbush				77	SD	N	V
<i>Themeda australis</i>	Kangaroo Grass				78	GT	N	F,B
<i>Vittadinia australasica var. australasica</i>	Sticky New Holland Daisy				341	J	N	M
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy				53	J	T	I,M
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				72, 340	J	1	F,I M
<i>Vittadinia megacephala</i>	Giant New Holland Daisy				19	J	1	F,I
<i>Avena barbata</i>	Bearded Oat			*	24	GT	1	I,M
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	1	I,M
<i>Briza maxima</i>	Large Quaking-grass			*	79	GL	1	I,M
<i>Bromus rubens</i>	Red Brome			*	33	GL	T	I,M
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	1	F,I
<i>Lolium rigidum</i>	Wimmera Ryegrass			*	58	GL	T	B,F
<i>Moraea setifolia</i>	Thread Iris			*	8	J	T	F,I
<i>Romulea rosea var. australis</i>	Common Onion-grass			*	2	J	T	I,M
<i>Salvia verbenaca var. verbenaca</i>	Wild Sage			*	14	J	T	M,B
<i>Trifolium arvense var. arvense</i>	Hare's-foot Clover			*	29	J	T	I,M, F
<i>Trifolium campestre</i>	Hop Clover			*	11	J	1	F,I
<i>Vulpia bromoides</i>	Squirrel-tail Fescue			*	32	GL	1	I,M

** NRM declared species for the area requiring landholder control

Table 5b: Opportune flora records near site KAP-FLA-01

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				347
<i>Austrostipa eremophila</i>	Rusty Spear-grass				343, 357
<i>Austrostipa nodosa</i>	Spear-grass				352, 356
<i>Boerhavia dominii</i>	Tar-vine				355
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting				408
<i>Convolvulus angustissimus ssp. angustissimus</i>	Pink Convolvulus				351
<i>Cullen australasicum</i>	Tall Scurf-pea				406
<i>Hyalosperma semisterile</i>	Orange Sunray				410
<i>Maireana brevifolia</i>	Short-leaf Bluebush				409
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush		R		344
<i>Pimelea micrantha</i>	Silky Riceflower				350
<i>Sclerolaena diacantha</i>	Grey Bindyi				345, 354
<i>Sida corrugata var. corrugata</i>	Corrugated Sida				407
<i>Velleia arguta</i>	Toothed Velleia				346
<i>Vittadinia cuneata var. cuneata</i>	Fuzzy New Holland Daisy				212
<i>Galenia pubescens var. pubescens</i>	Coastal Galenia			*	405
<i>Marrubium vulgare</i>	Horehound			**	353
<i>Scabiosa atropurpurea</i>	Pincushion			*	102
<i>Solanum nigrum</i>	Black Nightshade			*	349

Table 5c: Additional species near site KAP-FLA-01 – recorded in recent years in grasslands within 5-10 km of site. Data obtained from DEWNR staff who have been undertaking research in the area in recent years (2010-2012). These are species which might be located on other grassland sites in the region.

Scientific Name	Common Name	A	SA	Int'd
<i>Aristida holathera var. holathera</i>	Tall Kerosene Grass			
<i>Atriplex stipitata</i>	Bitter Saltbush			
<i>Austrodanthonia carphoides</i>	Short Wallaby-grass			
<i>Austrostipa breviglumis</i>	Cane Spear-grass		R	
<i>Austrostipa scabra ssp. scabra</i>	Rough Spear-grass			
<i>Brachyscome sp.</i>	Native Daisy			
<i>Carex inversa var. inversa</i>	Knob Sedge			
<i>Chenopodium desertorum ssp. desertorum</i>	Frosted Goosefoot			
<i>Crassula colligata ssp. lamprosperma</i>	Crassula			
<i>Cynoglossum suaveolens</i>	Sweet Hound's-tongue			
<i>Drosera peltata</i>	Pale Sundew			
<i>Galium migrans ssp. migrans</i>	Loose Bedstraw			
<i>Geranium retrorsum*</i>	Grassland Geranium			
<i>Glycine rubiginosa*</i>	Twining Glycine			
<i>Goodenia pusilliflora*</i>	Small-flower Goodenia			
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort			

Scientific Name	Common Name	A	SA	Int'd
<i>Isoetopsis graminifolia</i> *	Grass Cushion			
<i>Juncus aridicola</i>	Inland Rush			
<i>Myoporum platycarpum</i> ssp.	False Sandalwood			
<i>Persicaria prostrata</i>	Creeping Knotplant			
<i>Plantago</i> sp. B (R. Bates 44765)	Little Plantain			
<i>Pleurosorus rutifolius</i> *	Blanket Fern			
<i>Podolepis tepperi</i>	Delicate Copper-wire Daisy			
<i>Solenogyne dominii</i>	Smooth Solenogyne			
<i>Spergularia marina</i>	Salt Sand-spurrey			
<i>Swainsona behriana</i> *	Behr's Swainson-pea		R	
<i>Wahlenbergia communis</i> *	Tufted Bluebell			
<i>Wahlenbergia stricta</i> ssp. <i>stricta</i>	Tall Bluebell			

* Located in spring 2013 on/near Lower North Survey sites.

Fauna observations – Flagstaff Hill Road site and locality.

Table 5d: Opportune bird records near site 19 October 2012 – observer Dragos Moise

Common Name	Genus	Species	A	SA	Int'd	Number
Brown Falcon	<i>Falco</i>	<i>berigora</i>				1
Brown Songlark	<i>Cincloramphus</i>	<i>cruralis</i>				1
Little Raven	<i>Corvus</i>	<i>mellori</i>				1
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				1
Little Raven	<i>Corvus</i>	<i>mellori</i>				1
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				1
Spring 2013 additional birds Adrian Shackley						
Wedge-tailed Eagle	<i>Aquila</i>	<i>audax</i>				2
White-fronted Chat	<i>Epthianura</i>	<i>albifrons</i>				12

Table 5e: Opportune reptile records near site 16 September 2012 – observer Peter Matejcic

Common Name	Genus	Species	A	SA	Int'd	Number
Adelaide Snake-lizard	<i>Delma</i>	<i>molleri</i>				1

6.5 Paddock adjacent River Road, Kapunda/Bagot Well

Local Government Area: Light Regional Council

Location: Section 320 Hundred of Kapunda. Western remnant in paddock

Site Identification: KAP MCK 01

Opportunistic Collection Site: Yes along adjoining road side and in other remnant areas in same paddock outside the site.

AMG Zone: 54 Easting: 314649 Northing: 6207274

Date of Survey: 19/10/12

Follow-up Opportune collection: 16/11/12. December 2012, August, September & October 2013, January and February 2015.

Altitude: 350 metres

Estimated average rainfall: 500 mm

Site Description

This site is located adjacent River Road, north of Kapunda. The adjacent paddock areas are used for agriculture, (cropping and livestock grazing). The soil type appears to be different from most of the other sites visited in this survey (although similar to the Duff Road site). In 2012, the adjacent land in the paddock was used for cropping; hence the survey site had not been grazed by livestock for several months leading up to the survey.

General Description of Vegetation

The vegetation type within this section consists of patches of Inland South Australian Blue Gum (*Eucalyptus leucoxyloides ssp. pruinosa*) grassy woodland, with adjacent areas including the survey site location being grassland. The site contains a very high number of species found in grassland vegetation, and is in exceptional condition. The cover abundance of weed species on the survey site was very low, but was higher elsewhere in the remnant areas. There was also a reasonable amount of fallen timber near the site (associated with the areas of adjacent grassy woodland).

Survey Site Specific Vegetation Description

The surveyed site measured 30 by 30 metres and contained vegetation that was classified as **tussock grassland**. Many of the species recorded were not found on other sites, and were not found in combinations on other sites as was the case at this site. This site and its surrounds had the highest diversity by far for the survey. Many herbaceous species were observed as well as a high diversity of grass, irongrass and lily species. Overall the vegetation is considered to be “disturbed natural”. The main weed of note on the site was False Brome (*Brachypodium distachyon*) but was considered not to be a major infestation on the site. Elsewhere in the remnant patches there is a wider diversity of weeds having significant impacts on the native species.

Landform Pattern:	rise	Landform Element:	hill slope
Site Slope:	6%	Site Aspect:	310 degrees
Outcrop Cover:	<10%	Outcrop Lithology:	not identified
Surface Strew Size:	5 – 50 mm	Surface strew cover:	< 10%
Soil Texture Class:	clay loam, sandy	Bare Earth Estimate:	10%
Litter Estimate:	5%	Vegetation Condition:	disturbed natural

Summary of Conservation Values

Botanically, this is a spectacular site. High native species diversity, low weed diversity and weed cover abundance that is very rare in grassy ecosystems. This special “gem” appears to be being managed well by the current landholders who indicated that they valued their native vegetation.

A total of 47 native species and 8 weed species were recorded on the quadrat site in 2012. There were 31 additional native species recorded in opportune collections near this site in 2012. A total of 78 native species on or near this site for 2012 recording was the standout result for the survey at that time.

Subsequently additional collections of species, particularly those flowering in late winter/early spring 2013 and summer 2014/15, has increased the number recorded on the survey quadrat to 64 and 116 for all three remnants in the paddock and roadside (and still likely to increase). Particularly significant was the recording of Behr’s Swainson Pea (*Swainsona behriana*) – a number of patches with over 200 plants observed in total. This is the largest known population of this species for a considerable distance.

There are three separate remnants in section 320 - about seven hectares on the western side (including the quadrat) which has some 101 identified native species including four State rated species, about six hectares in the central remnant (including the dam) which has some 85 identified native species including the same four State rated species, and the third small area of about 1.7 hectares further east from the dam (and in from River Road) which has some 50 identified native species including two State rated species - *Ptilotus erebescens* and *Cryptandra campanulata*. The central remnant is the second best patch inspected during the survey in terms of species diversity and the smaller eastern remnant is not far behind in about fifth place.

Also importantly, as Table 25 shows, some 35 of the species recorded in or near this site were not recorded on any other site in the survey (add 4 more in 2015). Further, comparing the list of plants recorded over recent years in the large area of grassland remnants in the vicinity of the Flagstaff Hill Road site – many species recorded on this area have also yet to be recorded in that survey work.

The recording of *Chthonocephalus pseudevax* (Ground heads) and *Wahlenbergia preissii* (Bluebell – no recognised common name) is a first recording of both of these species for Northern Lofty Herbarium region.

State conservation rated species recorded were *Ptilotus erebescens* (Rare) and *Swainsona behriana* (Rare) on site and *Cryptandra campanulata* (Rare) and *Maireana rohrlachii* (Rare) immediately adjacent the quadrat. Northern Lofty Region rated species on site were *Acacia acinacea*, *Amphipogon caricinus*, *Drosera glanduligera*, *Goodenia pinnafitida*, *Leptorhynchus tetrachaetus*, *Lomandra micrantha ssp. micrantha* and *Velleia paradoxa*. Northern Lofty Region rated species near the quadrat were *Austrostipa puberula*, *Distichlis distichophylla*, *Calocephalus citreus* and *Haloragis aspera* (to which could be added the first finds for Northern Lofty region species noted above).

The site can be assessed as *Lomandra effusa/L. multiflora ssp. dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. This site is clearly a Class A EPBC site. A class A site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 30 native plant species (64 recorded here in 900 square metres plus others close by), 10 or more broad-leafed herbaceous native species excluding 6 disturbance resistant species (42 recorded here in 900 square metres), at least five native grass species (15 recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify readily as there is a good density of grass, irongrass, and other “countable” tussocks on the site).

Another indication of the importance of this area is as a potential seed source. It is estimated (Adrian Shackley) that some 60 species recorded in this overall survey do not have any known occurrence within about 10 kms of the record in this survey. About half of these species are on the River Road property.

Current Management Regime

Currently the landholder grazes the site after the adjacent crop has been harvested. He indicated that grazing occurs mainly in the summer months.

This intermittent grazing regime is an interesting factor in the maintenance of the high species diversity. During the summer, any perennial species (most natives are perennials) will be favoured if they are grazed (although not too heavily) as the water transpired would be reduced, whilst the root system of each plant would remain intact, but able to take up and utilize rainfall. This is part of the explanation why grazed native grass tussocks maintain a green base over summer, and often into autumn if there is some rain. Opportunistic flowering and seed set can then occur at any time following a good rain event. Grazing of annual grass weeds and summer active herbaceous weeds during the summer months is also likely to reduce the seed set of these species to some extent.

The landholder indicated that they are interested in fencing off the remnant patches of vegetation. Fencing can assist with management of grazing provided that it is carefully planned. Fencing would allow grazing of the remnant grassland areas to be stopped somewhat earlier than the surrounding stubble areas, for example. It would also provide options to limit grazing in spring when seed set of natives is occurring in years where cropping does not occur and grazing may occur outside of the current summer grazing time. It would be important, however, to ensure that a light grazing regime continues while monitoring occurs to assess best options for future management.

The significance of this area for study of the species involved and for potential seed supply for propagation of these species for re-introduction to areas where they have become extinct is very high. Immediate steps should be taken to work with the landholder to plan a conservation regime which ensures the continued viability of this unique area. This has already occurred to an extent, with agreement about control of *Gazania*s which have unfortunately spread over recent years from a neighbouring property. Weed control has commenced in spring 2013 but will be an ongoing project for several years. It is estimated there may be up to 250,000 *Gazanias* growing in the western remnant.

History of farming on the site

Because of the unique diversity and quality of vegetation found on this site, additional effort has been made to understand the reasons. Interviews have been conducted by Adrian Shackley with current and previous farm managers. This produced general information going back some 120 years.

In more recent decades, since about 1940, the paddock has been an outlying paddock from the main farm homestead and centre of activities. This separation appears to be a factor in producing less intense impacts on the remnant areas.

No known clearance of trees has occurred in the paddock over the last 100 years. Given historical records it would seem likely that the coverage of trees in the paddock has essentially been unchanged at least for that time and probably since farming commenced around 1860. The trees occur on more stony ground and cultivation has not occurred in this area.

The paddock has a lack of water available for stock. The small dam in the paddock had been in place for many years and was been made larger in the last few years. Historically the small dam would only fill in a wet year and even then would then dry out by the end of summer unless there was a summer thunderstorm. Over the last 20 years or more with stubble retention cropping run off has reduced a lot. Over the whole history of stock grazing a lack of water has limited grazing to varying degrees over summer and autumn. Confirmation of this in 2013 – despite a fairly wet winter the dam only half filled and was dry by the end of October.

Sheep tended not to spend a lot of time in the western remnant patch because of a lack of feed there. This is consistent with current observations that there is a low bulk of herbage and a sparseness of the tussock vegetation providing a relatively low level of groundcover with little or no thatch – ideal for small herbaceous plants to thrive. This is not the case in other parts of the remnants where introduced

grasses such as False Brome have become well established. This is also consistent with much higher “sheep camping under trees” impacts observed in the central and eastern remnants compared with the western one.

Grazing pressure has been moderate. Prior to continuous cropping over recent years, cropping perhaps two years out of five for most of the time, there was potential for heavier grazing pressure to occur in non-cropping years. The paddock was a priority for use after shearing (August-September) due to the shelter provided by trees (the rest of the farm being mostly treeless except for plantings). However, the stocking rate has been at a low enough level to avoid major reduction in native species. The farm sheep flock was mostly a stable one – buying in rams and selling lambs and culling age ewes. The effect of that is to reduce weed introduction.

Sowing of clovers and fertilizing of pasture has occurred but this was only been in the cropped areas. This is unlike some other similar areas in the region where aerial spreading of clovers and phosphate fertilizers has occurred on remnant grassland areas – observations of some of these areas shows a dominance of clovers and introduced grasses and weeds and low diversity of native species, especially herbaceous ones.

Ploughing of firebreaks or other attempts to plough the remnant areas do not seem to have occurred during known history. The numbers of kangaroos (and emus) in the area are considered to have been very low over this same timeframe.

There is no direct evidence currently available about farming practices on the paddock for the first c.50 years of farming. We do know, however, that grazing activities in the area started in the late 1830s - Duttons establishing Anlaby by 1839 (this site was apparently in the original Dutton Crown licence/lease).

The South Australian Land Returns for 1843³⁰ show large grazing enterprises for the “Light” region e.g. recorded for Messers Dutton 6260 ewes, 300 rams, 1065 wethers, 3600 lambs, 8 cattle, 18 horses; Charles Bagot (Koonunga) 3500 ewes, 1500 wethers, 1500 lambs, 40 cattle, 9 horses; R & E Leake Belvidere (Hundred of Belvidere between Kapunda and Greenock) 6000 ewes, 3000 wethers, 8 cattle, 16 horses; EW Peters Emu Lodge (probably in Peters Hill area?) 7500 ewes, 3600 wethers, 16 cattle, 8 horses, Charles Tohill Light River 500 cattle, 6 horses. More information on F.H Dutton (Anlaby founder) and Charles Bagot (including 1845 picture of his farm buildings) is in “Pastoral Pioneers of South Australia.”³¹

Given that there were no fences (just shepherds) and only natural water supplies, grazing in those days often had major impacts on land around natural water points such as along the Light River. With the Light River having long stretches of permanent waterholes elsewhere, that may help explain why this paddock may not have been so heavily affected as places elsewhere. It is understood that the survey paddock was not part of Anlaby after 1851 when Anlaby was changed to a smaller, but still very large, freehold station with its boundary on the northern side of River Road.

Whatever the reasons, the native vegetation in the remnants on this paddock has led a charmed existence for about 175 years. While they may not be representative of the range of grassy ecosystems in the region, the remnants here are clearly the most valuable known grassy remnants for a long way. It is vital that they be managed carefully in future to maintain their significance. There is also a major opportunity for further study of the soils and other ecosystem components of grasslands for the region.

Documenting the reasons for the current good state of these remnants can greatly assist management planning for other grassland remnants in the region. Further study of the plants and soil ecosystems will produce very useful information. It is very pleasing that the current landowners are keen to preserve and continue the heritage which they have helped maintain.

30 Twining, Andrew & Sandra (1992) *South Australian Land Returns for 1843* – reprint of information compiled by James Allen
31 Cockburn, R. (1925-1927), *Pastoral Pioneers Of South Australia* Vol 1 page 34 F.H. Dutton, page 100 Charles Bagot

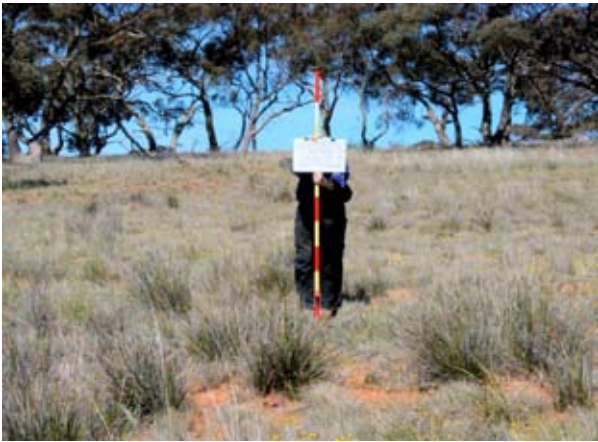


Photo 18: KAP-MCK-01, BS386, 19/10/12. Note the gaps between the tussock species and the small herbaceous species in these gaps notwithstanding a very dry spring in 2012. Background- Inland SA Blue Gums which occur in patches of each remnant.



Photo 19: February 2014, same scene as Photo 18 after a dry late spring and summer.



Photo 20: Spring 2013, Flowering *Austrodanthonia auriculata* and herbaceous plants.



Photo 21: February 2014, Lemon Beauty-heads (*Calocephalus citreus*) setting seed – the rest of the green in the picture is Gazanias – a bit less drought tolerance would help!



Photo 22: Spring 2013, Gazania invasion in full swing.



Photo 23: Spring 2013, Little Buttons (*Leptorhynchos tetrachaetus*) brightly flowering.



Photo 24: Spring 2013, *Arthropodium strictum* lilies and an interesting mix of moss, lichen and open ground.



Photo 25: Spring 2013, Hairy-tails (*Ptilotus erubescens*) flowering.



Photo 26: Spring 2013, Orange Sunray (*Hyalosperma semisterile*).



Photo 27: Spring 2013, Stiff Cup-flower (*Pogonolepis muelleriana*).



Photo 28: Spring 2013, Flannel Actinobole (*Actinobole uliginosum*)- Actual size about 2cm across for whole plant.



Photo 29: Spring 2013, Dryland Purslane (*Calandrinia eremaea*) – about actual size.



Photo 30: Spring 2013, Scarlet Sundew (*Drosera glanduligera*) with a captured bug about to be devoured.



Photo 31: Spring 2013, Scarlet Sundew showing colours.



Photo 32: Spring 2013, Grass Cushion (*Isoetopsis graminifolia*)- actual size about 3cm across.



Photo 33: Spring 2013, Small Yellow-heads (*Triptilodiscus pygmaeus*).



Photo 34: Spring 2013, Giant New Holland Daisy (*Vittadinia megacephala*) among *Maireana enchylaenoides* (left) and *Bulbine bulbosa*.



Photo 35: Spring 2013, Hairy Stylewort (*Levenhookia dubia*)- actual height about 2-3cm.



Photo 36: Spring 2013, Stiff Mat-rush (*Lomandra multiflora* ssp. *dura*) with immature fruit.



Photo 37: Spring 2013, Scaly Buttons (*Leptorhynchos squamatus* ssp. *squamatus*) and *Crassula*.



Photo 38: Spring 2013, Yellow Buttons (*Chrysocephalum apiculatum*).



Photo 39: Small-leaf Bush-pea (*Eutaxia microphylla*, prostrate form).



Photo 40: Spring 2013, Crowded Woodruff (*Asperula conferta*).



Photo 41: Early spring 2013, Early Nancy (*Wurmbea dioica* ssp. *dioica*).

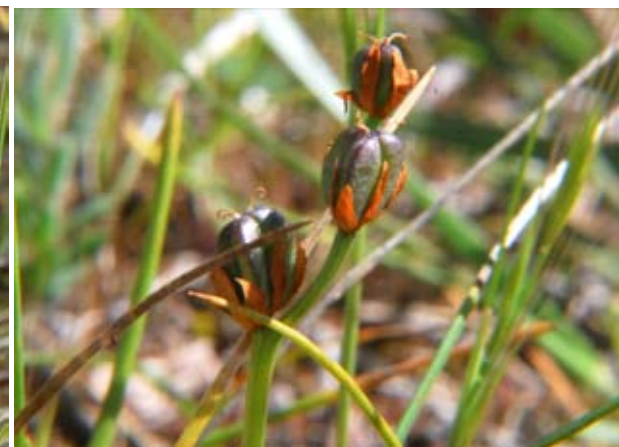


Photo 42: Early spring 2013, Early Nancy (*Wurmbea dioica* ssp. *dioica*) fruit.



Photo 43: Spring 2013, Smooth Daisy (*Rhodanthe laevis*)- actual height about 5cm.



Photo 44: Spring 2013, Eastern Bearded Dragon (*Pogona barbata*) getting some sun.



Photo 45: Spring 2013, Cockatiel surveying the scene.



Photo 46: Spring 2013, Dwarf Skink (*Menetia greyii*) among native lilies and moss.



Photo 47: Spring 2013: Behr's Swainson-pea (*Swainsona behriana*). State Rare plant.



Photo 48: Spring 2013, Long Grey-beard Grass (*Amphipogon caricinus* var. *caricinus*) flowering.

Table 6a: Site flora records KAP-MCK-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Acacia acinacea</i>	Wreath Wattle				38	SC	T	V
<i>Actinobole uliginosum</i>	Flannel Actinobole				289	J	T	M
<i>Amphipogon caricinus var. caricinus</i>	Long Grey-beard Grass				93, 281	GL	1	VI
<i>Aristida behriana</i>	Brush Wire-grass				4, 268	GL	I	BFI
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				267	GL	1	M
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	F	F,B,I
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass				83,277	GL	2	V,B, F
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				82	GT	1	B
<i>Austrodanthonia eriantha</i>	Hill Wallaby-grass				279	GL	T	M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				280	GL	T	M
<i>Austrostipa blackii</i>	Crested Spear-grass				46	GT	1	M
<i>Austrostipa elegantissima</i>	Feather Spear-grass				84	GT	N	B
<i>Austrostipa nodosa</i>	Tall Spear-grass				270, 272	GL	T	M
<i>Austrostipa scabra ssp. falcata</i>	Slender Spear-grass				282	GL	T	M
<i>Austrostipa setacea</i>	Corkscrew Spear-grass				278	GL	T	M
<i>Bulbine bulbosa</i>	Bulbine-lily				53	J	T	I
<i>Calostemma purpureum</i>	Pink Garland-lily				89	J	T	V
<i>Cheilanthes austrotenuifolia</i>	Annual Rock-fern				87	X	N	V
<i>Chrysocephalum apiculatum</i>	Yellow Buttons				47	SD	2	F
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting				50	SD	N	I
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily				43	VT	T	F
<i>Elymus scaber var. scaber</i>	Native Wheat-grass				92	GT	T	B
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	T	I
<i>Gonocarpus elatus</i>	Hill Raspwort				90	SD	1	B
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34	J	N	F
<i>Hyalosperma semisterile</i>	Orange Sunray				275	J	N	MX
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge				81	VL	1	M
<i>Leptorhynchus squamatus ssp. squamatus</i>	Scaly Buttons				94	J	T	F,I
<i>Leptorhynchus tetrachaetus</i>	Little Buttons				273	J	T	IM
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	N	V
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	T	V
<i>Lomandra micrantha ssp. micrantha</i>	Small-flower Mat-rush				2, 526	VL	T	V
<i>Lomandra multiflora ssp. dura</i>	Stiff Mat-rush					VL	T	V
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	T	V
<i>Neurachne alopecuroidea</i>	Fox-tail Mulga-grass				288	GL	T	FI
<i>Ptilotus erubescens</i>	Hairy-tails		R		85, 286	J	T	FIB
<i>Ptilotus spathulatus f. spathulatus</i>	Pussy-tails				73	J	N	M
<i>Rhodanthe pygmaea</i>	Pigmy Daisy				117			
<i>Sida corrugata var. angustifolia</i>	Grassland Sida				86, 284	J	N	V

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Stackhousia monogyna</i>	Creamy Candles				91, 285	J	T	B F I
<i>Themeda australis</i>	Kangaroo Grass				78	GT	1	X
<i>Triptilodiscus pygmaeus</i>	Small Yellow-heads				95,118	J	T(1)	F, I
<i>Velleia paradoxa</i>	Spur Velleia				96, 269	J	T	V, M
<i>Vittadinia cuneata</i> var. <i>cuneata</i>	Fuzzy New Holland Daisy				276, 283	J	T	M, X
<i>Wahlenbergia luteola</i>	Yellow-wash Bluebell				97	J	N	F
<i>Wurmbea dioica</i> ssp. <i>dioica</i>	Early Nancy				88, 287	J	T	I, X
<i>Aira elegantissima</i>	Delicate Hair-grass			*	9	GL	T	I
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	1	I
<i>Briza maxima</i>	Large Quaking-grass			*	79	GL	T	M
<i>Hypochaeris radicata</i>	Rough Cat's Ear			*	107	J	T	V
<i>Moraea setifolia</i>	Thread Iris			*	66	J	T	V
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover			*	29	J	N	B
<i>Vulpia</i> sp.	Fescue			*		GL	T	F

Table 6b: Site flora records. Additional species spring 2013 on site

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Asperula conferta</i>	Crowded Woodruff				137	J	T	F
<i>Calandrinia eremaea</i>	Dryland Purslane				315	J	1	F
<i>Cheilanthes seiberi</i>	Narrow Rock-fern				V	X	T	V
<i>Convolvulus angustissimus</i> ssp. <i>angustissimus</i>	Pink Convolvulus				297	J	T	
<i>Crassula colligata</i> ssp. <i>colligata</i>	Crassula				228,311	J	1	F
<i>Crassula colorata</i> var. <i>acuminata</i>	Dense Crassula				208	J	1	F
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula				V	J	1	F
<i>Drosera glanduligera</i>	Scarlet Sundew				V	J	1	F
<i>Drosera whittakeri</i>	Whittaker's Sundew				V	J	N	F
<i>Haloragis aspera</i>	Rough Raspwort				480	J	1	V,B
<i>Hyalosperma semisterile</i>	Orange Sunray				120	J	1	F
<i>Hypoxis vaginata</i> var. <i>vaginata</i>	Yellow Star				V	J	T	F
<i>Isoetopsis graminifolia</i>	Grass Cushion				V	J	T	F
<i>Leptorhynchos tetrachaetus</i>	Little Buttons				115,312	J	T	F
<i>Levenhookia dubia</i>	Hairy Stylewort				V	J	1	F
<i>Pogonolepis muelleriana</i>	Stiff Cup-flower				309	J	1	F
<i>Rhodanthe laevis</i>	Smooth Daisy				V	J	1	F
<i>Swainsona behriana</i>	Behr's Swainson-pea		R		V	J	T	F
<i>Vittadinia megacephala</i>	Giant New Holland Daisy				19	J	N	F
<i>Wahlenbergia communis</i>	Tufted Bluebell				V	J	1	F
<i>Gazania linearis</i>	Gazania			*	119	J	N	F
<i>Hedypnois rhagadioloides</i>	Cretan weed			*	V	J	T	F
<i>Pentaschistis airoides</i>	False Hairgrass			*	V		T	F

** NRM declared species for the area requiring landholder control

Table 6c: Opportune flora records nearby first day 2012 (additional species only)

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Acacia paradoxa</i>	Kangaroo Thorn				100
<i>Callitris gracilis</i> (single dead plant)	Southern Cypress Pine				490
<i>Calocephalus citreus</i>	Lemon Beauty-heads				110
<i>Chthonocephalus pseudevax</i>	Ground-heads				116
<i>Cryptandra campanulata</i>	Long-flower Cryptandra		R		113
<i>Eutaxia microphylla</i> (prostrate form)	Small-leaf Bush-pea				114
<i>Hyalosperma semisterile</i>	Orange Sunray				120
<i>Leptorhynchos tetrachaetus</i>	Little Buttons				115
<i>Rhodanthe pygmaea</i>	Pigmy Daisy				117

Table 6d: Opportune flora records nearby second day 2012 (additional species only)

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass				299
<i>Austrostipa nodosa</i>	Tall Spear-grass				306
<i>Austrostipa puberula</i>	Fine-hairy Spear-grass				301
<i>Austrostipa scabra</i> ssp. <i>falcata</i>	Slender Spear-grass				291, 292
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria				37
<i>Calandrinia eremaea</i>	Dryland Purslane				315
<i>Chenopodium desertorum</i> ssp. <i>microphyllum</i>	Small-leaf Goosefoot				296
<i>Convolvulus angustissimus</i> ssp. <i>angustissimus</i>	Pink Convolvulus				297
<i>Crassula colligata</i> ssp. <i>colligata</i>	Crassula				311
<i>Cryptandra campanulata</i>	Long-flower Cryptandra				295
<i>Einadia nutans</i> ssp. <i>nutans</i>	Climbing Saltbush				304
<i>Eucalyptus leucoxydon</i> ssp. <i>pruinosa</i>	Inland South Aust Blue Gum				293
<i>Eutaxia microphylla</i> (prostrate form)	Small-leaf Bush-pea				314
<i>Leptorhynchos tetrachaetus</i>	Little Buttons				312
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush		R		290
<i>Plantago hispida</i>	Hairy Plantain				310, 313
<i>Poa crassicaudex</i>	Thick-stem Tussock-grass				307
<i>Pogonolepis muelleriana</i>	Stiff Cup-flower				309
<i>Sida corrugata</i> var. <i>angustifolia</i>	Grassland Sida				298
<i>Teucrium racemosum</i>	Grey Germander				294
<i>Vittadinia cervicularis</i> var. <i>cervicularis</i>	Waisted New Holland Daisy				300 302 303
<i>Wahlenbergia gracilentia</i>	Annual Bluebell				305
<i>Wahlenbergia preissii</i>	Bluebell				388
<i>Carthamus lanatus</i>	Saffron Thistle			*	308

Table 6e: Opportune flora records near dam 2012

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Austrostipa nodosa</i>	Tall Spear-grass				399 400 401 402
<i>Convolvulus remotus</i>	Australian Convolvulus				397
<i>Distichlis distichophylla</i>	Emu-grass				393
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i> (<i>prostrate</i>)	Ruby Saltbush				404
<i>Haloragis aspera</i>	Rough Raspwort				394
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge				395
<i>Maireana brevifolia</i>	Short-leaf Bluebush				403
<i>Vittadinia cuneata</i> var. <i>cuneata</i>	Fuzzy New Holland Daisy				396
<i>Wahlenbergia luteola</i>	Yellow-wash Bluebell				398
<i>Walwhalleya prolata</i>	Rigid Panic				392

Table 6f: Opportune flora records all three remnants (spring 2013)

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Austrostipa flavescens</i>	Coast Spear-grass				V
<i>Caesia calliantha</i>	Blue Grass-lily				V
<i>Chloris truncata</i>	Windmill Grass				80
<i>Erodium crinitum</i>	Blue Heron's-bill				V
<i>Goodenia pusilliflora</i>	Small-flower Goodenia				V
<i>Haloragis acutangula</i>	Smooth Raspwort				V
<i>Juncus flavidus</i>	Broom rush				V
<i>Juncus subsecundus</i>	Finger Rush				V
<i>Lagenifera heugelii</i>	Coarse Bottle-daisy				V
<i>Lepidium papillosum</i>	Warty Peppercross				V
<i>Lythrum hyssopifolia</i>	Lesser Loosestrife				V
<i>Plantago gaudichaudiana</i>	Narrow-leaf Plantain				153
<i>Poa clelandii</i>	Matted Tussock-grass				V
<i>Swainsona behriana</i> (near dam)	Behr's Swainson-pea		R		V
<i>Thysanotus patersonii</i>	Twining Fringe-lily				V
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				51, 101
<i>Wurmbea dioica</i> ssp. <i>brevifolia</i>	Early Nancy				V
<i>Echium plantagineum</i>	Salvation Jane			**	13

Additional opportune native species recorded after summer rain January 2015 on the River Road property were *Persicaria prostrata**, *Dysphania melanocarpa**, *Polygonum plebeium**, *Centipeda cunninghamii**, *Dysphania pumilio* and *Panicum effusum* var. *effusum*. Additional opportune records just west of River Road property were *Helichrysum luteoalbum* and *Alternanthera denticulata** and as well as additional summer weeds. * = new Survey Vouchers.

Searching on the paddock north of River Road site. Table 6g records Spring 2013 species. In summer 2014/15 non-riparian species for area *Brachyscome ciliaris* var. *ciliaris**, *Austrostipa molliss**, *Eutaxia microphylla* var. *microphylla* (shrub form*), *Correa glabra* var. *turnbullii**, *Dodonaea viscosa* ssp. *spatulata*, *Boerhavia dominii*, *Hardenbergia violacea**, *Setaria constricta*, *Cheilanthes distans*, *Glycine rubiginosa* and *Poa labillardieri* var. *labillardieri* can be added.

Table 6g: Opportune flora records north of River Road (spring 2013)

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Allocasuarina verticillata</i>	Drooping Sheoak				
<i>Calandrinia volubilis</i>	Twining Purslane				V
<i>Callitris preissii</i>	Southern Cypress Pine				
<i>Cheilanthes austrotenuifolia</i>	Annual Rock-fern				
<i>Drosera auriculata</i>	Tall Sundew				V
<i>Drosera whittakeri</i>	Whittaker's Sundew				
<i>Gonocarpus elatus</i>	Hill Raspwort				
<i>Haloragis acutangula</i>	Smooth Raspwort				
<i>Hypoxis sp.</i>	Yellow Star				
<i>Pleurosus rutifolius</i>	Blanket Fern				
<i>Wurmbea dioica ssp. brevifolia</i>	Early Nancy				
<i>Wurmbea dioica ssp. dioica</i>	Early Nancy				
<i>Crassula natans</i>	Water Crassula			*	V

Some 15 different riparian/aquatic species were also observed on the above property in the River Light including Water Ribbons (*Triglochin procerum*). The landowners also confirmed the presence of Water Rats in the River Light in this area and a small number of Southern Hairy-nosed Wombats on the riverbank a few kilometres to the north-east. The existence of Southern Hairy-nosed Wombats in the locality was also confirmed in November 2013 when one was killed nearby on the Kapunda – Hamilton road near Allendale North (Terri Bateman pers. comm.).

Fauna observations – River Road site and locality

Table 6h: Opportune bird records near site 19 Oct 2012 – observer Dragos Moise & spring 2013 Adrian Shackley

Common name	Genus	Species	A	SA	Int'd	Number
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				2
Australian Reed-Warbler	<i>Acrocephalus</i>	<i>australis</i>				1
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>				9
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				7
Laughing Kookaburra	<i>Dacelo</i>	<i>novaequineae</i>				1
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>				2
Mistletoebird	<i>Dicaeum</i>	<i>hirundinaceum</i>				1
Noisy Miner	<i>Manorina</i>	<i>melanocephala</i>				5
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>				2
Red-rumped Parrot	<i>Psephotus</i>	<i>haematonotus</i>				5
Striated Pardalote	<i>Pardalotus</i>	<i>striatus</i>				6
Superb Fairy-wren	<i>Malurus</i>	<i>cyaneus</i>				2
White-plumed Honeyeater	<i>Lichenostomus</i>	<i>penicillatus</i>				8
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>				1
Common Blackbird	<i>Turdus</i>	<i>merula</i>			*	1
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	8
House Sparrow	<i>Passer</i>	<i>domesticus</i>			*	3

Table 6i: Opportune bird records near site spring 2013 observer Adrian Shackley

Common name	Genus	Species	A	SA	Int'd	Number
Australian Wood-duck	<i>Chenonetta</i>	<i>jubata</i>				2
Black-faced Cuckoo-shrike	<i>Coracina</i>	<i>novaeollandiae</i>				4
Cockatiel	<i>Nymphicus</i>	<i>hollandicus</i>				6
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				1
White-faced Heron	<i>Egretta</i>	<i>novaeollandiae</i>				2
White-winged Chough	<i>Corcorax</i>	<i>melanorhamphos</i>		R		14

Reptiles and mammal - Observed on 19 October 2012 – observer Peter Matejic. Except Eastern Bearded Dragon observed 26.10.2012 by Adrian Shackley and Sue Coldbeck and Sheep observed 5.1.2013 by Adrian Shackley. Sleepy Lizards observed by Adrian Shackley mid-August 2013 on a day with a maximum temperature of about 16 degrees - must have been breeding time.

Table 6j: Opportune reptile records near site

Common name	Genus	Species	A	SA	Int'd	Number
Adelaide Snake-eye Skink	<i>Morethia</i>	<i>adelaidensis</i>				1
Adelaide Snake-lizard	<i>Delma</i>	<i>molleri</i>				1
Bougainville's Skink	<i>Lerista</i>	<i>bougainvillii</i>				1
Dwarf Skink	<i>Menetia</i>	<i>greyii</i>				2
Eastern Bearded Dragon	<i>Pogona</i>	<i>barbata</i>				1
Sleepy Lizard	<i>Tiliqua</i>	<i>rugosa</i>				2
Three-toed Earless Skink	<i>Hemiergis</i>	<i>decrensiensis</i>				2

Table 6k: Opportune reptile records spring 2013 – observers Adrian Shackley and Belinda Copland

Common name	Genus	Species	A	SA	Int'd	Number
Dwarf Skink	<i>Menetia</i>	<i>greyii</i>				2
Eastern Bearded Dragon	<i>Pogona</i>	<i>barbata</i>				1
Eastern Bluetongue Lizard	<i>Tiliqua</i>	<i>scincoides</i>				2
Eastern Brown Snake	<i>Pseudonaja</i>	<i>textilis</i>				1
Sleepy Lizard	<i>Tiliqua</i>	<i>rugosa</i>				1

This River Road area recorded by far the most reptiles species of the sites visited although this was achieved to an extent by more visits made.

Table 6l: Opportune mammal records near site

Common name	Genus	Species	A	SA	Int'd	Number
Western Grey Kangaroo	<i>Macropus</i>	<i>fuliginosus</i>				7
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	1
Sheep	<i>Ovis</i>	<i>aries</i>			*	200

6.6 Disused Rail Reserve, North of Roseworthy (adjacent Main North Road)

Local Government Area: Light Regional Council
Location: North of Roseworthy just past Main North Road rail crossing on eastern side.
Site Identification: ROS MNR 01
Opportunistic Collection Site: Yes
AMG Zone: 54 Easting: 293783 Northing: 6178227
Date of Survey: 21/10/12
Follow-up Opportune collection: 19/11/12. Spring 2013
Altitude: 130 metres
Estimated average rainfall: 450 mm

Site Description

This site is located approximately 150 metres along the disused rail reserve, east of Main North Road (Horrocks Highway). It contains a native grassland, parts of which are low-lying and may occasionally become inundated during the wetter months of the year (particularly prior to the drain constructed adjacent the rail line to protect the rail formation). To the east the land is used for cropping, whilst to the west, is a small landholding including a house.

General Description of Vegetation

The vegetation type along most of the length of the rail reserve in this vicinity is native grassland, but also there are small sections of grassy woodland. Most sections are in fair condition but there are areas in the reserve that are quite degraded. A range of woody weeds, perennial grass weeds and annual weeds are present. The surveyed site itself contains a reasonably high diversity of both native and weed species.

Survey Site Specific Vegetation Description

The surveyed site measured 12 by 75 metres with vegetation classified as **tussock grassland**.

This site contains several native species that have conservation significance. The presence of four species of *Lomandra* as well as several native grass species gave this site the “tussock” appearance. The site also contains a good diversity of herbaceous species. However the presence of several woody weed species both on the site and nearby is affecting the site and may further damage the diversity of native species in the future.

Dichanthium sericeum ssp. sericeum (Southern Lofty Vulnerable species) was recorded, perhaps reflecting the heavy clay soil found on the site. No State conservation species were recorded but 10 other species with Southern Lofty conservation ratings occurred - *Lomandra effusa*, *Pimelea micrantha*, *Sida corrugata var. angustifolia* and *Vittadinia blackii* (all Southern Lofty Rare) and *Aristida behriana*, *Austrodanthonia fulva*, *Austrostipa curticomis*, *Austrostipa eremophila*, *Goodenia pinnafitida* and *Maireana enchylaeoides* (all Southern Lofty Uncommon).

The site contains a number of annual broad leaf weed species as well as perennial and annual weed grass species. Woody weeds are prolific nearby.

Landform Pattern:	plain	Site Slope:	0%
Site aspect:	0	Outcrop Cover:	none apparent
Surface Strew Cover:	nil	Soil Texture Class:	medium heavy clay
Bare Earth Estimate:	1 %	Litter Estimate:	10 %
Vegetation Condition:	Degraded natural		



Photo 49: ROS-MNR-01, 21/10/12 Looking north – the Pepper-tree in picture is on the site – the larger Pepper-tree is just to the south. Taller vegetation to the north – mainly Golden Wattle Olives and Bamboo. All spreading over recent years.



Photo 50: Two-leaf Cape Tulip (*Moraea miniata*), a dense patch in middle of site first seen in early spring 2013.



Photo 51: Spring 2012, Killing a feral Olive is good – wiping out nearby native *Lomandras*, daisies and grasses need not occur.



Photo 52: Spring 2013, Smooth Riceflower (*Pimelea glauca*) attracting native bees and insects.



Photo 53: Spring 2013, Black-anther Flaxy-lily (*Dianella revoluta* var. *revoluta*) flowering.



Photo 54: Wanderer Butterfly on *Pimelea glauca* flowers.

Summary of Conservation Values

Whilst this site was considered to be quite degraded it contains significant species diversity. Despite the lack of good weed management, native species have continued to exist. The low-lying area may be occasionally inundated during wetter times of the year, providing yet another example of the variety of native grasslands that may have been more widely distributed across the plains.

A total of 34 native species and 20 weed species were recorded on the site. There were six additional native species collected opportunistically near to the site.

The site can also be assessed as a *Lomandra effusa/L. multiflora ssp. dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. This site is reasonably seen as a Class A EPBC site. A class A site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 30 native plant species (34 recorded here in 900 square metres plus others close by, 10 or more broad-leafed herbaceous native species excluding six disturbance resistant species (13 recorded here in 900 square metres), at least five native grass species (9 recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify readily as there is a good density of grass and irongrass tussocks on the site).

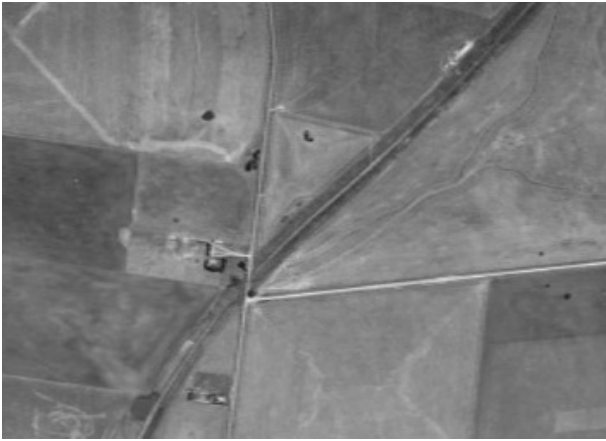
Current Management Regime

As for most of the sites on this survey, this site is managed in a haphazard manner. As opposed to most sites however, there were several examples of “glaringly” bad weed control work that has been done, with considerable off-target damage to native species. It would appear that this occurred when Artichoke Thistle and small Olives were targeted, but from some distance away from the target weed. This provides evidence of poor weed control training, or of poor attention by the person involved.

Whilst woody weeds have the potential to further impact negatively on this site, they would be reasonably easily controlled by contractors using the correct techniques. Using broad leaf herbicides carefully amongst native grass areas, whilst avoiding broad leaf native plants may also steadily decrease the level of these weeds, whilst ensuring native species are not reduced.

There is also a need to control some native shrub species which appear to have been introduced over the years as a result of activities associated with the railway. Patches of both Golden Wattle and Desert Senna are spreading along the line. Analysis of historical aerial photos back to 1935 indicate that these plants have only become significant in the area in the last 30 years or so – along with exotics such as Pepper-trees, Bamboo and Swamp Oak. Previously fire would have kept such species at low levels in a grassland situation. Now they can spread to the detriment of the high conservation value grassland species.

This site has a high potential to be actively managed to maintain and increase the conservation values. Weed control is the main need. The discovery of a significant infestation of Two-leaf Cape Tulip in 2013 has added to the challenge.



1949 Aerial thumbnail - no trees or shrubs of significance
Planted Sugar Gum at road T junction.



1962 Aerial thumbnail - current large pepper tree appears.



1979 Aerial thumbnail - adjacent house & some shrubs.



2011 Aerial picture - site position in red rectangle – shrubs now showing up, spreading rapidly along rail line.

All the above Maps courtesy of thumbnails available for aerial photos 1949 – 1979 items plus the 2011 map produced on DEWNR Nature Maps web site. The survey site is the red rectangle in the 2011 map.

Table 7a: Site flora records ROS-MNR-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Acacia pycnantha</i>	Golden Wattle				98	LB	T	I,B
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	1	B
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				215	J	T	F
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	N	F,I
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				76	GT	T	M
<i>Austrodanthonia fulva</i>	Leafy Wallaby-grass				439, 479	GT	T	M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				440	GT	T	M
<i>Austrostipa blackii</i>	Crested Spear-grass				46	GT	1	F
<i>Austrostipa curticola</i>	Short-crest Spear-grass				430, 431, 437	GT	T	M
<i>Austrostipa eremophila</i>	Rusty Spear-grass				434, 436	GT	T	M
<i>Austrostipa nodosa</i>	Tall Spear-grass				432, 433, 435	GT	T	M
<i>Calostemma purpureum</i>	Pink Garland-lily				89	J	1	V
<i>Chrysocephalum apiculatum</i>	Yellow Buttons				47	SD	T	F

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting				50	SD	1	F
<i>Convolvulus angustissimus ssp. angustissimus</i>	Pink Convolvulus				1, 438	J	T	F I
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily				43	J	1	F
<i>Dichanthium sericeum ssp. sericeum</i>	Silky Blue-grass				178	GL	T	B
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34	J	1	F,I
<i>Haloragis aspera</i>	Rough Raspwort				144, 480	J	1	F I B
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge				174	VT	N	X
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	N	V
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	N	V
<i>Lomandra micrantha ssp. micrantha</i>	Small-flower Mat-rush				26	VL	N	V
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25	VL	1	I
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	N	B
<i>Oxalis perennans</i>	Native Sorrel				61	J	T	F
<i>Pimelea glauca</i>	Smooth Riceflower				123	SD	T	F,I
<i>Pimelea micrantha</i>	Silky Riceflower				177	SD	T	B
<i>Scaevola albida</i>	Pale Fanflower				127	SD	N	V
<i>Sida corrugata var. angustifolia</i>	Corrugated Sida				189	J	T	F
<i>Stackhousia monogyna</i>	Creamy Candles				176	SD	T	F,I
<i>Themeda australis</i>	Kangaroo Grass				78	GT	2	F,I
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy				54	J	N	M
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				156	SD	N	B
<i>Arundo donax</i>	Giant Reed			*	442	GT	N	V
<i>Asphodelus fistulosus</i>	Onion Weed			*	166	J	T	F,B, I
<i>Asteriscus spinosus</i>	Golden Pallensis			*	158	J	N	F,B
<i>Avena barbata</i>	Bearded Oat			*	24	GT	1	I,F
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	2	I
<i>Bromus diandrus</i>	Great Brome			*	188	GT	T	I
<i>Casuarina glauca</i>	Grey Bul oak			*	441	S	N	V
<i>Cynara cardunculus ssp. flavesces</i>	Artichoke Thistle			**	106	J	N	V
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F
<i>Hypochaeris radicata</i>	Rough Cat's Ear			*	107	J	N	B
<i>Moraea setifolia</i>	Thread Iris			*	8	J	T	I
<i>Olea europaea ssp. europaea</i>	Olive			**	31	SD	N	V
<i>Oxalis pes-caprae</i>	Soursob			*	21	J	T	V
<i>Piptatherum millaceum</i>	Rice Millet			*	179	GT	N	B
<i>Plantago lanceolata var. lanceolata</i>	Ribwort			*	175	J	T	B
<i>Romulea sp.</i>	Onion-grass			*		J	T	M

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Scabiosa atropurpurea</i>	Pincushion			*	102	J	T	F
<i>Schinus molle</i>	Pepper-tree			*	173	LA	N	I
<i>Sonchus oleraceus</i>	Common Sow-thistle			*	139	J	N	I
<i>Vicia sativa</i>	Common Vetch			*	V	J	T	I
Species on site August 2013 declared weed								
<i>Moraea miniata</i>	Two-leaf Cape Tulip			**	V	J	1	F

Table 7b: Opportune flora records close to site

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Bursaria spinosa ssp. spinosa</i>	Sweet Bursaria				37
<i>Enteropogon acicularis</i>	Umbrella Grass				183
<i>Euphorbia drummondii</i>	Caustic Spurge				70
<i>Opercularia scabrida</i>	Stalked Opercularia				V
<i>Senna artemisioides ssp. coriacea</i>	Broad-leaf Desert Senna				198
<i>Vittadinia megacephala</i>	Giant New Holland Daisy				19
<i>Oenothera stricta ssp. stricta</i>	Evening Primrose			*	180

** - NRM declared species for the area requiring landholder control

Fauna observations – Site ROS – MNR - 01 and locality

Table 7c: Opportune bird records near site 15 April 2013 – observer Chris Steeles

Common name	Genus	Species	A	SA	Int'd	Number
Australasian Pipit	<i>Anthus</i>	<i>novaeseelandiae</i>				1
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				2
Brown Falcon	<i>Falco</i>	<i>berigora</i>				1
Crested Pigeon	<i>Ocyphaps</i>	<i>lophotes</i>				7
Red Wattlebird	<i>Anthochaera</i>	<i>carunculata</i>				3
Singing Honeyeater	<i>Lichenostomus</i>	<i>virescens</i>				1
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	2
Spotted Dove	<i>Stigmatopelia</i>	<i>chinensis</i>			*	2

No Reptiles and mammals observed 2 March 2013– observer Peter Matejcic.

6.7 Fords Road and Rail Reserve – South of Kapunda

Local Government Area: Light Regional Council
Location: Eastern side of Fords Rd, and adjacent disused railway line.
Site Identification: KAP FOR 01
Opportunistic Collection Site: Yes
AMG Zone: 54 Easting: 305622 Northing: 6194261
Date of Survey: 21/10/12 **Follow-up Opportune collection:** 16/11/12. Spring 2013
Altitude: 200 meters
Estimated average rainfall: 475 mm

Site Description

This survey site is situated on and adjacent to the disused railway, which is the eastern part of the survey site. To the west is a grazed paddock, which forms part of a Council reserve. The survey site is on the top of a low hill, with a small gully to the south. The grazed paddock to the west faces west north-west.

The vegetation in this area is affected by ridges of quartz stone running approximately east/west which have created a series of stony outcrops. Drooping Sheoak (*Allocasuarina verticillata*) is growing on all of these outcrops providing a distinctive variation in vegetation compared to other sites.

General Description of Vegetation

The vegetation type within this locality is variable, with the grazed paddock to the west of the survey site being a tussock grassland, whilst in the rail reserve, the vegetation included one *Allocasuarina verticillata* and some Sticky Hop-bush (*Dodonaea viscosa ssp. spatulata*) shrubs. The site contains species commonly found in grassland vegetation, and is in relatively good condition. The cover abundance of weed species was moderate with several species of broad leaf weeds.

Of note also, there are several areas of land adjoining the rail reserve in the locality which have moderate levels of remnant native grass and *Lomandra* species (mainly *Lomandra effusa*) still present, along with some grazing resistant herbaceous species.

Survey Site Specific Vegetation Description

The surveyed site measured 60 by 15 metres and contained vegetation that was classified as **tussock grassland**. Many of the species recorded were found on other sites, however, this site had a relatively high cover abundance of Pink Garland-lily (*Calostemma purpureum*), which was not found in such high numbers on other sites. This site had a relatively high diversity of both native and weed species. Overall the vegetation was considered to be “disturbed natural”. Weed species included a diversity of annual broad leaf and grass species.

Landform Pattern:	hills	Landform Element:	hill slope
Site Slope:	23%	Site Aspect:	200 degrees
Outcrop Cover:	<10%	Outcrop Lithology:	quartzite
Surface Strew Size:	50 - 250 mm	Surface strew cover:	< 10%
Soil Texture Class: loam	Bare Earth Estimate: 1%		
Litter Estimate: 10%	Vegetation Condition: disturbed natural		

Summary of Conservation Values

The high diversity of native species on this site two similar rocky hills a few hundred metres to the north along the rail line provides a valuable reference point for surrounding areas.

Species of State conservation significance included state rated Rare species Pale flax-lily (*Dianella longifolia* var. *grandis*) and Wiry Dock (*Rumex dumosus*). Weeds which impact greatly on the site and which may prevent germination and thriving of native species included *Romulea* sp., *Moraea setifolia*, *Brachypodium distachyon* and several clovers.

A total of 28 native and 20 weed species were recorded on the site. An additional 16 native species were collected opportunistically near the site in 2012. Species on the site of conservation significance for the Northern Lofty region included *Haloragis aspera* and *Drosera glanduligera*. Adjacent the site were *Aristida contorta* (Northern Lofty Rare) and *Goodenia albiflora* (Northern Lofty Uncommon).

Searching the rocky outcrops and rail cuttings to the north in spring 2013 resulted in a surprising 27 additional native species being identified. *Glycine rubiginosa*, *Lomandra collina*, *Opercularia turpis*, *Lotus australis* and *Geranium retrorsum* were in this locality and were not found elsewhere in the survey - they are all rare in the local region. Plus *Digitaria brownii* which, although found at two other sites in the survey, is extremely rare in this area with total known numbers of about 100 plants. And *Erodium crinitum* found here and only on only one other site.

Overall, the site and surrounding area are of high conservation significance. Notably, after the River Road and Shanahan Road rail area, this Fords area contained the highest number of native species not located elsewhere during the survey (10 species).

The locality can also be assessed as a *Lomandra effusa*/L. *multiflora* ssp. *dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. This site might be a Class A EPBC site if that can occur with a low level of *Lomandra* spp. coverage. Only *Lomandra densiflora* on site but the two key species are present nearby. A class A site requires the following in an area of 2500 square metres (0.25 hectares) - more than 30 native plant species (28 recorded here in 900 square metres plus at least 12 close by, 10 or more broad-leafed herbaceous native species excluding six disturbance resistant species (11 recorded here in 900 square metres plus eight nearby), at least five native grass species (11 recorded here in 900 square metres and a couple nearby) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify as there is a good density of grass and irongrass tussocks on the site).

Current and Future Management Regime

Whilst the site has a high diversity of weeds, most can be controlled with suitably skilled bush regenerators using broad leaf herbicides. Currently however, there appears to be no management of the site on railway land, whilst the adjacent paddock (which is part of the reserve) is grazed. The difference in the grazed paddock and the railway land is noticeable, with herbaceous species rare in the grazed paddock.

Clearly in the past the Council grazed reserve/paddock has been heavily grazed as evidenced by low numbers of herbaceous species present. Currently grazing appears to have been reduced and a good tussock grass cover is present. If conservatively grazed, its condition can be expected to improve from its current state with the potential for herbs and forbs from the rail corridor to re-establish themselves. Light Regional Council needs to have some discussion with the landholders who are undertaking the grazing to sort out a regime which will achieve conservation goals.

The railway land, where the survey site is located may eventually become a grassy shrubland with a shrub layer possibly out-competing many of the grass species on the site – however the use of fire as a management tool may prevent this.

The two cuttings on the rail line to the north of the site both contain very significant remnant vegetation but also serious olive infestations. Removal of the olives and a modest level of other weed control will greatly assist in allowing the remnants to remain viable.



Photo 55: KAP-FOR-01, BS 386, 21/10/12. In the foreground is the grazed road reserve with the rail corridor and stony outcrop in the background.



Photo 56: Spring 2013, Looking west from south of site - Sheoaks dot the hillside but Pepper-tree and Olive are a weed problem.



Photo 57: Spring 2013, *Glycine rubiginosa* in a stony rail cutting just north of survey quadrat.



Photo 58: September 2013, *Drosera whittakeri* on survey quadrat – damp south facing slope.



Photo 59: Sand Mat-rush (*Lomandra collina*) on edge of rocky cutting north of site.



Photo 60: Australian Trefoil / Native Clover (*Lotus australis*) growing near rail line.



Photo 61: Spring 2013, Blue Heron's-bill (*Erodium cicutarium*).



Photo 62: Spring 2013, Creamy Candles (*Stackhousia monogyna*) – a mini forest on part of site.



Photo 63: Spring 2013, Two-leaf Cape Tulip (*Moraea miniata*) In grazed paddock adjacent site - not seen in 2012.



Photo 64: Spring 2013, Blue Grass-lily (*Caesia calliantha*).

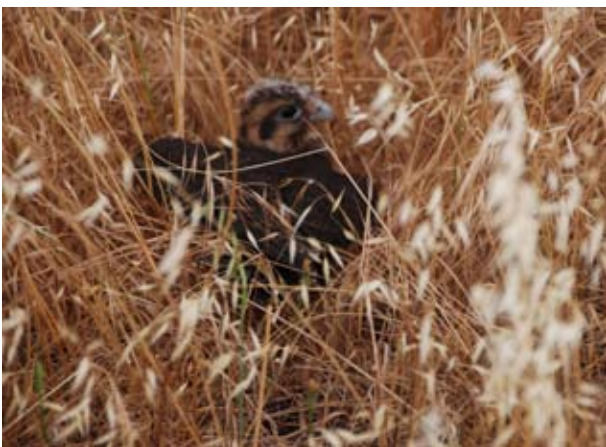


Photo 65: Spring 2013, Fledgling Brown Falcon out of nest but unable to fly, hiding in the grass near the rail line – second one also nearby.



Photo 66: Concerned parent wings overhead.

Table 8a: Site flora records KAP-FOR-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Allocasuarina verticillata</i>	Drooping Sheoak				157	LB	N	I,M
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	2	F,I
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass				170	GL	T	B,I,M
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				376, 377	GT	T	M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				35	GT	T	M
<i>Austrodanthonia sp.</i>	Wallaby grass					GL	1	B
<i>Austrostipa blackii</i>	Crested Spear-grass				46	GT	1	B
<i>Austrostipa eremophila</i>	Rusty Spear-grass				171	GT	T	B
<i>Austrostipa nodosa</i>	Tall Spear-grass				169, 374	GT	T	M B
<i>Austrostipa setacea</i>	Corkscrew Spear-grass				278	GT	T	B
<i>Bulbine bulbosa</i>	Bulbine-lily				53	J	T	I
<i>Calostemma purpureum</i>	Pink Garland-lily				89	J	1	V
<i>Convolvulus angustissimus var angustissimus</i>	Pink Convolvulus				168	V	N	F,I
<i>Dianella longifolia var. grandis</i>	Pale Flax-lily		R		155	VT	N	B
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily				43	VT	N	F,I
<i>Dodonaea viscosa ssp. spatulata</i>	Sticky Hop-bush				165	S	N	I
<i>Drosera whittakeri</i>	Whittaker's Sundew				XX	J	T	F/X
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	1	I
<i>Gonocarpus elatus</i>	Hill Raspwort				162	SD	1	B
<i>Haloragis aspera</i>	Rough Raspwort				144	J	N	F,B
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	T	I
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	T	I
<i>Oxalis perennans</i>	Native Sorrel				21	J	T	V
<i>Rumex dumosus</i>	Wiry Dock		R		164	J	N	I
<i>Setaria constricta</i>	Knotty-butt Setaria				160, 375	GL	1	M I
<i>Stackhousia monogyna</i>	Creamy Candles				161	SD	T	F,I
<i>Themeda australis</i>	Kangaroo Grass				78	GT	2	V
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				156	J	N	F,I
<i>Aira elegantissima</i>	Delicate Hair-grass			*	9	J	1	B
<i>Asphodelus fistulosus</i>	Onion Weed			*	166	J	T	B,F,I
<i>Asteriscus spinosus</i>	Golden Pallensis			*	158	J	N	B
<i>Avena barbata</i>	Bearded Oat			*	24	GT	1	M,X,I
<i>Brachypodium distachyon</i>	False Brome			*	10	GT	T	I
<i>Briza maxima</i>	Large Quaking-grass			*	79	GL	T	I,M
<i>Bromus hordeaceus ssp. hordeaceus</i>	Soft Brome			*	112	GT	T	I
<i>Cynara cardunculus ssp. flavescens</i>	Artichoke Thistle			**	106	J	N	V
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F
<i>Erodium botrys</i>	Long Heron's-bill			*	172			

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Marrubium vulgare</i>	Horehound			**	20	SD	N	F,I
<i>Moraea setifolia</i>	Thread Iris			*	66	J	T	F,I
<i>Nicotiana glauca</i>	Tree Tobacco			*	167	SA	N	B,F
<i>Rapistrum rugosum ssp. rugosum</i>	Turnip Weed			*	128	J	N	I,F
<i>Romulea rosea var australis</i>	Common Onion-grass			*	2	J	T	M,X
<i>Sonchus oleraceus</i>	Common Sow-thistle			*	139	J	T	B
<i>Trifolium angustifolium</i>	Narrow-leaf Clover			*	159	J	1	B
<i>Trifolium arvense var. arvense</i>	Hare's-foot Clover			*	29	J	T	B
<i>Trifolium campestre</i>	Hop Clover			*	11	J	1	F
<i>Vulpia myuros f. myuros</i>	Rats-tail Fescue			*	163	J	N	I
Additional flora species on site spring 2013								
<i>Drosera glanduligera</i>	Scarlet Sundew				V	J	T	F

** NRM declared species for the area requiring landholder control

Table 8b: Opportune flora records close to site 2012

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Acacia pycnantha</i>	Golden Wattle				98
<i>Aristida contorta</i>	Curly Wire-grass				382
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				215
<i>Atriplex semibaccata</i>	Berry Saltbush				56
<i>Austrostipa drummondii</i>	Cottony Spear-grass				60
<i>Boerhavia dominii</i>	Tar-vine				339
<i>Euphorbia drummondii</i>	Caustic Spurge				463
<i>Convolvulus angustissimus ssp. peninsularum</i>	Grassland Convolvulus				379
<i>Digitaria brownii</i>	Cotton Panic-grass				378
<i>Goodenia albiflora</i>	White Goodenia				380
<i>Haloragis aspera</i>	Rough Raspwort				381
<i>Lomandra effusa</i>	Scented Mat-rush				3
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy				54
<i>Vittadinia cervicalis var. cervicalis</i>	Waisted New Holland Daisy				104
<i>Wahlenbergia luteola</i>	Yellow-wash Bluebell				97

Table 8c: Opportune flora records close to site **spring 2013**

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71
<i>Asperula conferta</i>	Crowded Woodruff				137
<i>Austrostipa</i> sp. – <i>additional species</i>	Spear grass				V
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria				37
<i>Caesia calliantha</i>	Blue Grass-lily				V
<i>Cheilanthes austrotenuifolia</i>	Annual Rock-fern				V
<i>Crassula colorata</i> ssp. <i>acuminata</i>	Dense Crassula				208
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula				V
<i>Cymbopogon ambiguus</i>	Lemon-grass				220
<i>Distichlis distichophylla</i>	Emu-grass				393
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush				192
<i>Eremophila longifolia</i>	Weeping Emubush				204
<i>Erodium crinitum</i>	Blue Heron's-bill				V
<i>Geranium retrorsum</i>	Grassland Geranium				V
<i>Glycine rubiginosa</i>	Twining Glycine				V
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34
<i>Lomandra collina</i>	Sand Mat-rush				V
<i>Lotus australis</i>	Australian Trefoil				V
<i>Maireana brevifolia</i>	Short-leaf Bluebush				403
<i>Melaleuca brevifolia</i>	Short-leaf Honey-myrtle				V
<i>Opercularia turpis</i>	Twiggy Opercularia				V
<i>Pimelea glauca</i>	Smooth Riceflower				123
<i>Pimelea micrantha</i>	Silky Riceflower				48
<i>Pittosporum angustifolium</i>	Native Apricot				193
<i>Poa crassicaudex</i>	Thick-stem Tussock-grass				257
<i>Poa labillardieri</i> var. <i>labillardieri</i>	Tussock-grass				473
<i>Ptilotus spathulatus</i> f. <i>spathulatus</i>	Pussy-tails				73
<i>Scaevola albida</i>	Pale Fan-flower				127
<i>Asparagus asparagoides</i> f. <i>asparagoides</i>	Bridal Creeper			*	216
<i>Moraea miniata</i>	Two-leaf Cape Tulip			**	V

Most of the above species were added as a result of searching two rail line cuttings (through similar rocky outcrops as at the site) about 250 and 500 metres to the north of the site.

Table 8d: Opportune bird records near site Fords KAP – FOR – 01

Birds observed on survey site visits – observer Adrian Shackley. Reed-warblers in River Light reeds. Fairy Martins Kate Graham and Adrian Shackley September 2013.

Common name	Genus	Species	A	SA	Int'd	Number
Australasian Pipit	<i>Anthus</i>	<i>novaeseelandiae</i>				1
Australasian Pipit	<i>Anthus</i>	<i>novaeseelandiae</i>				2
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				10
Australian Reed-warbler	<i>Acrocephalus</i>	<i>australis</i>				2
Brown Falcon	<i>Falco</i>	<i>berigora</i>				2
Brown Goshawk	<i>Accipiter</i>	<i>fasciatus</i>				1
Crested Pigeon	<i>Ocyphaps</i>	<i>lophotes</i>				2
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>				6
Fairy Martin	<i>Petrochelidon</i>	<i>ariel</i>				25
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				10
Little Raven	<i>Corvus</i>	<i>mellori</i>				4
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>				1
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				4
Noisy Miner	<i>Manorina</i>	<i>melanocephala</i>				2
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>				3
Red-rumped Parrot	<i>Psephotus</i>	<i>haematonotus</i>				10
Welcome Swallow	<i>Hirundo</i>	<i>neoxena</i>				4
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>				2
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	12

Table 8e: Opportune reptile records near site observed 2 March 2013 – observer Peter Matejcic

Common name	Genus	Species	A	SA	Int'd	Number
Large striped ctenotus	<i>Ctenotus</i>	sp.				2
Sleepy Lizard	<i>Tiliqua</i>	<i>rugosa</i>				2
Small dark fast skinks (AS)						5

Table 8f: Opportune mammal records near site - observer Peter Matejcic & Adrian Shackley

Common name	Genus	Species	A	SA	Int'd	Number
Western Grey Kangaroo	<i>Macropus</i>	<i>fuliginosus</i>				1
White-tailed Water Rat	<i>Hydromys</i>	<i>chrysogaster</i>				1
Cat	<i>Felis</i>	<i>catus</i>			*	1
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	1

In addition a record of European Carp (*Cyprinus carpio*) was made in the nearby Light River.

6.8 North of Shanahan Road, Rail Reserve – Southern Site

Local Government Area: Light Regional Council

Location: Rail Reserve north of Shanahan Road, Roseworthy – Freeling rail line

Site Identification: FRE SHA 01

Opportunistic Collection Site: Yes

AMG Zone: 54 Easting: 296591 Northing: 6181915

Date of Survey: 21/10/12 **Follow-up collection:** 19/11/12. Spring 2013

Altitude: 185 metres

Estimated average rainfall: 525 mm

Site Description

This site is located north of Shanahan Road, part of a disused rail line reserve which is approximately 60 metres wide. The grassland remnant is on the east side only of the rail reserve. The adjacent area is used for agriculture (cropping and livestock grazing). Parts of the grassland vegetation are very weedy, however there are sections of the site, which contain diverse grassland and are also relatively weed-free. The site is not grazed; hence a range of palatable species is still present.

The site has survived because of the dumping of soil on much of the eastern side of the rail reserve for about 700 metres from a rail cutting constructed in 1859/60 when the Gawler to Kapunda rail line was built. It is considered unlikely that the area had been cultivated at that time as Crown land was only released in the area in the late 1850s. Except where there were obstacles such as this dumped spoil, the remainder of the rail corridor in this area has been cropped for many years resulting in the destruction of almost all of the original vegetation.

General Description of Vegetation

There are areas within the rail reserve remnant that appear to be degraded. Closer inspection often reveals a high diversity of native species including a range of both native grasses and herbs. No shrub species higher than 0.5 metres were observed. The only trees for some distance around have been planted. This site has the appearance of a “classic” tussock grassland remnant.

Survey Site Specific Vegetation Description

The surveyed site measured 15 by 60 metres and contained vegetation that was classified as **open tussock grassland**. It contains several native species that have conservation significance that were not found elsewhere in the survey. The site included an embankment, which was formed during the construction of the railway. This is a relatively weed-free part of the survey site and contained a diverse range of species.

Weed species found included some perennial weed species and in places a thick sward of False Brome *Brachypodium distachyon* was recorded. Whilst several other weed species appear to be causing a threat to the biodiversity assets of the site, the False Brome especially may preclude the establishment of smaller native species, once it (the False Brome) has established. The recording of Crow Garlic weed (*Allium viminale*) near this site is a first recording of this weed species in the Northern Lofty Herbarium region although it has been recorded previously close by near Roseworthy (Southern Lofty region).

Landform Pattern:	plain	Landform Element:	plain
Site Slope:	0%	Outcrop Cover:	none apparent
Outcrop Lithology:	not identified	Surface Strew Size:	none apparent
Soil Texture Class:	clay loam	Bare Earth Estimate:	1%
Litter Estimate:	10%	Vegetation Condition:	disturbed natural

Summary of Conservation Values

As for several other sites along the railroad corridor, the high diversity of native species provides a valuable example of the grassland vegetation – in this case for heavier soils of the Adelaide Plains.

A total of 29 native species and 12 weed species were recorded on the site in 2012. Opportunistic collection was done near this site in November 2012 with four additional species recorded. Four additional native species were recorded in spring 2013 – three were early flowering *Wurmbea* and *Hypoxis* species.

The presence of some perennial weed species, as well as annual grass weed species is a threat to the on-going existence of the site as a quality grassland remnant.

The recording of *Calocephalus citreus*, *Minuria leptophylla*, *Pimelea curviflora* ssp. *sericea*, Showy Copper-wire Daisy (*Podolepis jaceoides* - State Rare species) and four species of *Lomandra* (irongrass) at the site is of significance given the heavy clearance that has occurred on the Adelaide Plains. The finding of Orange Swainson-pea (*Swainsona stipularis*) near the site was a highlight (see later comment in Discussion section). The *Leiocarpa* plants on site were determined as *Leiocarpa websteri* but there is some variability in the plants present which initially was thought to be two different species. Further checking would be warranted.

The site can be also be assessed as *Lomandra effusa*/*L. multiflora* ssp. *dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. This site is marked as a likely Class A EPBC site. A class A site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 30 native plant species (33 recorded here in 900 square metres plus several close by, 10 or more broad-leafed herbaceous native species excluding 6 disturbance resistant species (15 recorded here in 900 square metres), at least five native grass species (9 recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify as there is a good density of grass and irongrass tussocks on the site.

Current and Future Management Regime

The railroad reserve is managed in a haphazard manner. We observed several instances of poor weed control methods; generally however there has been no weed control at all. It appears that the management is limited to targeting of notifiable weed species only.

The site appears to be used as occasional access for four-wheel drive vehicles. Whilst this is currently a minor issue, the growth of four-wheel driving as a pastime, combined with a scarcity of sites for this activity, as well as the close proximity to urban areas; this reserve may be subject to increasing recreational activities that are not compatible with nature conservation.

Under the existing management regime, it is our opinion that a downward trend in native species diversity and cover abundance, and an increase in weed species cover abundance can be expected.

The use of fire in the future management of this reserve may be of assistance in altering this outlook.

While the rail corridor is leased to Genesee Wyoming, the State Government remains the owner of the corridor. Genesee Wyoming is only responsible for weed management in relation to rail use. There is a role for Government agencies and community organisations to assist with conservation of the biodiversity values that remain on the corridor.



Photo 67: FRE-SHA-01, BS836, 21/10/12. Photo looking north. Rail cutting on left side.



Photo 68: Curved Riceflower (*Pimelea curviflora* var. *sericea*) - also present on Ben Lomond station near Eudunda in large numbers.



Photo 69: Narrow Plover-daisy (*Leiocarpa websteri*).



Photo 70: Smooth Riceflower (*Pimelea glauca*) with a butterfly resting in the sunshine.



Photo 71: Minnie Daisy (*Minuria leptophylla*) growing between two spiky Scented Mat-rush (*Lomandra effusa*).



Photo 72: Western Grey Kangaroo near site – occasionally seen moving along the rail corridor.

Table 9a: Site flora records FRE-SHA-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				215	J	T	F
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	T	I
<i>Asperula conferta</i>	Crowded Woodruff				137	J	N	F
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				411, 412	GT	T	M
<i>Austrodanthonia fulva</i>	Leafy Wallaby-grass				134, 486	GT	1	B, M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				413, 414	GT	T	M
<i>Austrodanthonia sp.</i>						GL	2	B
<i>Austrostipa blackii</i>	Crested Spear-grass				46	GT	2	B,F
<i>Austrostipa eremophila</i>	Rusty Spear-grass				129, 416	GT	T	B M
<i>Austrostipa nodosa</i>	Tall Spear-grass				417, 418	GT	T	M
<i>Austrostipa sp.</i>						GT	1	B
<i>Calocephalus citreus</i>	Lemon Beauty-heads				110, 125	SD	N	B
<i>Convolvulus angustissimus ssp. peninsularum</i>	Grassland Convolvulus				485	J	T	F
<i>Convolvulus angustissimus ssp. angustissimus</i>	Pink Convolvulus				124	V	1	F,I
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax lily				43	VT	T	F,B
<i>Elymus scaber var. scaber</i>	Native Wheat-grass				92	GL	T	B
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34	J	T	F
<i>Haloragis aspera</i>	Rough Raspwort				144, 419	J	T	B,F
<i>Linum strictum ssp. strictum</i>	Upright Yellow Flax				121	J	1	F
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	T	I
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	T	F
<i>Lomandra micrantha ssp. micrantha</i>	Small-flower Mat-rush				26	VL	N	V
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25	VL	1	V
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	T	I
<i>Minuria leptophylla</i>	Minnie Daisy				135	J	N	I
<i>Pimelea curviflora var. sericea</i>	Curved Riceflower				122	SD	1	B
<i>Pimelea glauca</i>	Smooth Riceflower				123	SD	1	B
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy	R			16, 126	J	T	F
<i>Scaevola albida</i>	Pale Fanflower				127	P	N	F
<i>Teucrium racemosum</i>	Grey Germander				484	J	T	F
<i>Themeda australis</i>	Kangaroo Grass				78	GT	2	B
<i>Walwhalleya proluta</i>	Rigid Panic				133	GL	N	B
<i>Anagallis arvensis</i>	Pimpernel			*	130	J	T	F
<i>Avena fatua</i>	Wild Oat			*	138	GT	T	F,I
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	3	I
<i>Bromus rubens</i>	Red Brome			*	33, 136	GL	1	B I
<i>Centaurea melitensis</i>	Malta Thistle			*	132, 415	J	T	B

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Centaurium tenuifolium</i>	Common Centaury			*	131	J	T	F
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F,I
<i>Oxalis pes-caprae</i>	Soursob			*	61	J	T	V
<i>Rapistrum rugosum ssp. rugosum</i>	Turnip Weed			*	128	J	1	F,I
<i>Salvia verbenaca</i>	Wild Sage			*	14	J	1	I
<i>Sonchus oleraceus</i>	Common Sow-thistle			*	139	J	T	F

** NRM declared species for the area requiring landholder control

Table 9b: Additional species on site spring 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Haloragis acutangula</i>	Smooth Raspwort				V	J	T	V
<i>Hypoxis vaginata var. vaginata</i>	Yellow Star				V	J	T	F
<i>Wurmbea dioica ssp. brevifolia</i>	Early Nancy				V	J	N	F
<i>Wurmbea dioica ssp. dioica</i>	Early Nancy				V	J	1	F
<i>Vicia sativa</i>	Common Vetch			*	V	J	1	F

Table 9c: Opportune flora records close to site 2012

Scientific Name	Common Name	SA	Aus	Int'd	Voucher
<i>Bursaria spinosa ssp. spinosa</i>	Sweet Bursaria				37
<i>Euphorbia drummondii</i>	Caustic Spurge				70
<i>Leiocarpa websteri</i>	Narrow Plover-daisy				141
<i>Stackhousia monogyna</i>	Creamy Candles				145
<i>Swainsona stipularis</i>	Orange Swainson-Pea				146
<i>Allium vineale</i>	Crow Garlic			**	454
<i>Pennisetum villosum</i>	Feather-top			*	474

Fauna observations for Sites FRE - SHA – 01 and 02 combined

Table 9d: Opportune bird records near site December 2011 – observer Adrian Shackley

Common name	Genus	Species	A	SA	Int'd	Number
Australasian Pipit	<i>Anthus</i>	<i>novaeseelandiae</i>				1
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				4
Brown Goshawk	<i>Accipiter</i>	<i>fasciatus</i>				1
Brown Songlark	<i>Cincloramphus</i>	<i>cruralis</i>				1
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				12
Little Raven	<i>Corvus</i>	<i>mellori</i>				5
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				2
Red-rumped Parrot	<i>Psephotus</i>	<i>haematonotus</i>				5
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>				20
Stubble Quail	<i>Coturnix</i>	<i>pectoralis</i>				20
Wedge-tailed Eagle	<i>Aquila</i>	<i>audax</i>				1
Eurasian Skylark	<i>Alauda</i>	<i>arvensis</i>			*	2

Table 9e: Opportune bird records near site 21 October 2012 – observer Adrian Shackley

Common name	Genus	Species	A	SA	Int'd	Number
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				3
Brown Falcon	<i>Falco</i>	<i>berigora</i>				1
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				6
Spotted Harrier	<i>Circus</i>	<i>assimilis</i>				1
Stubble Quail	<i>Coturnix</i>	<i>pectoralis</i>				4
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>				1
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	15

Table 9f: Opportune bird records near site 15 April 2013 – observer Chris Steeles.

Common name	Genus	Species	A	SA	Int'd	Number
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				5
Brown Falcon	<i>Falco</i>	<i>berigora</i>				3
Brown Songlark	<i>Cincloramphus</i>	<i>cruralis</i>				1
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				2
Red-rumped Parrot	<i>Psephotus</i>	<i>haematotus</i>				2
Eurasian Skylark	<i>Alauda</i>	<i>arvensis</i>			*	1
House Sparrow	<i>Passer</i>	<i>domesticus</i>			*	6

Table 9g: Opportune reptile records – March 2013 and May 2013 – observer Peter Matejic

Common name	Genus	Species	A	SA	Int'd	Number
Adelaide Snake-lizard	<i>Delma</i>	<i>molleri</i>				1
Eastern Bluetongue Lizard	<i>Tiliqua</i>	<i>scincoides</i>				1
Large striped ctenotus	<i>Ctenotus</i>	sp.				1
Eastern Bluetongue Lizard	<i>Tiliqua</i>	<i>scincoides</i>				3
Worm-lizard	<i>Aprasia</i>	sp.				1

Table 9h: Opportune mammal records – March 2013 and May 2013 – observer Peter Matejic

Common name	Genus	Species	A	SA	Int'd	Number
Western Grey Kangaroo	<i>Macropus</i>	<i>fuliginosus</i>				1
Cat	<i>Felis</i>	<i>catus</i>			*	1
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	1
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	1

6.9 North of Shanahan Road, Rail Reserve – Northern Site

Local Government Area: Light Regional Council
Location: Rail Reserve north of Shanahan Road, Roseworthy – Freeling rail line
Site Identification: FRE SHA 02
Opportunistic Collection Site: Yes
AMG Zone: 54 Easting: 296718 Northing: 6182067
Date of Survey: 21/10/12
Follow-up collection: 19/11/12. Spring 2013
Altitude: 185 metres
Estimated average rainfall: 525 mm

Site Description

This site is located some 150 metres north of survey site FRE SHA 01, which is itself north of Shanahan Road. The site is similar to FRE SHA 01 as part of a disused rail line reserve. The adjacent area is used for agriculture (cropping and livestock grazing). Like other sites along the disused railroad reserve, parts of the vegetation are very weedy, however there are sections of the site, which contain diverse grassland and are also relatively weed-free. The site is not grazed and hence has a range of palatable species is still present.

General Description of Vegetation

There are areas within the reserve that appear to be degraded. As for the other site nearby, a closer inspection reveals a high diversity of native species – both grasses and herbaceous. No shrub species were observed on this site.

Survey Site Specific Vegetation Description

The surveyed site measured 15 by 60 metres and contained vegetation that was classified as **tussock grassland**. The site had a slightly higher cover abundance of the four species of *Lomandra* (irongrass) as well as a slight increase in inter-tussock spaces between irongrass plants and native grasses compared to nearby site FRE SHA 01.

Similarly this site also contains several native species that have conservation significance which were not found elsewhere in the survey. The site also included an embankment, which was formed during the construction of the railway and which is somewhat more weed-free than the survey site.

Weed species found included some perennial weed species and in places a thick sward of *Brachypodium distachyon* was recorded. Whilst several other weed species appear to be causing a threat to the biodiversity assets of the site, the False Brome particularly fills spaces between the perennial native tussocks and will limit the establishment of smaller native species, once it (the False Brome) has established. These smaller species need open areas between the tussocks (which let in light at ground level) to thrive.

Landform Pattern:	plain	Landform Element:	plain
Site Slope:	0%	Outcrop Cover:	none apparent
Outcrop Lithology:	not identified	Surface Strew Size:	none apparent
Soil Texture Class:	clay loam	Bare Earth Estimate:	1%
Litter Estimate:	5 - 10%	Vegetation Condition:	disturbed natural



Photo 73: FRE-SHA-02, BS386, 21/10/12 Note planted Sugar Gums and roadside planted Eucalypts in the background.



Photo 74: Spring 2013, Early Nancy (*Wurmbea dioica* ssp. *brevifolia*) – much pinker flowers than *W. dioica* ssp. *dioica*.



Photo 75: Spring 2012, Showy Copper-wire Daisy (*Podolepis jaceoides*) and survey term group.



Photo 76: Spring 2013, Notched Onion-orchard (*Microtis arenaria*)- none observed flowering to date.



Photo 77: Spring 2012, Orange Swainson-pea (*Swainsona stipularis*) – strong weed (and some natives) competition reducing seed set.



Photo 78: Late spring 2012, Drumsticks (*Pycnosorus globosus*) – suffering from dry spring but still setting seed.

Summary of Conservation Values

As for several other sites along the railroad corridor, the high diversity of native species on this site provides an example of the grassland vegetation – in this case heavier soils of the Adelaide Plains. The area of about 1.5 hectares is the only good remnant known for deep grey cracking clay soils of this general Freeling locality. Previously some roadsides in the locality had reasonable remnant vegetation but most of this has been lost over the years caused by cultivation, weed spraying and other impacts.

Presence of some perennial weed species, as well as annual grass weed species is a threat to on-going diversity of the site as found in the survey. A total of 39 native species and 16 weed species were recorded on site. Six additional native species was collected opportunistically adjacent to the site.

The recording of *Leiocarpa websteri*, Native Flax (*Linum marginale*), *Swainsona stipularis*, *Pycnosorus globosus* - State rated Vulnerable species, *Podolepis jaceoides* - State rated Rare species, Swollen Spear-grass (*Austrostipa gibbosa* - State rated Rare species), Notched Onion Orchid (*Microtis arenaria*) – observed a patch of 20-30 plants when the site was checked in September (not seen on the October survey date but relocated in August 2013 – probably more than 300 observed. This was the only orchid species recorded during the survey). Together with the four species of *Lomandra* (irongrass) this site is of major significance given the heavy clearance that has occurred on the Adelaide Plains and the Freeling district. Previously near this site in 2009 a single Blue Squill (*Chamaescilla corymbosa*) plant was recorded (Adrian Shackley observation). Whilst not seen for this survey, this is another species not otherwise recorded or known for a considerable distance.

The finding during the survey of seven small patches, with a total of more than 50 plants, of *Swainsona stipularis* was a real surprise. The only other known live population in the wider region is a handful of plants in a clay scour creek bank at Reeves Plains. These Reeves Plains plants have been monitored for about 10 years but have failed to produce any seed in that time. There are historical records of this species at Gawler (Ferdinand von Mueller in 1848) and at Freeling and Wasleys from the 1880s. The nearest other live population recorded in the last 30 years would/may be at Arthurton on Yorke Peninsula and Redcliffs near Burra³². This Freeling population has the potential to provide seed to allow the re-establishment of this species in the area from provenance seed.

The site can also be assessed as *Lomandra effusa*/*L. multiflora ssp. dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. This site is assessed as a likely Class A EPBC site. A class A site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 30 native plant species (39 recorded here in 900 square metres plus two or three close by, 10 or more broad-leafed herbaceous native species excluding six disturbance resistant species (21 recorded here in 900 square metres), at least 5 native grass species (11 recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify as there is a good density of grass and irongrass tussocks).

Different flora attributes on Shanahan Road sites

The soil on these sites SHA 01 and SHA 02 is a dark cracking clay typical of the soils in the Freeling locality. It is interesting that these sites had a number of obvious differences in flora – no chenopods were recorded here. *Enneapogon nigricans* and *Aristida behriana* – two of the most common grasses on other sites were entirely absent. Similarly *Oxalis perennans* and *Crassula spp.* were absent. In 2012 with the dry spring no mosses were observed on these sites. With the wet winter in 2013 some small areas of moss have been observed but much less than the other sites which all have widespread moss cover. Soil factors appear to be the most important in creating the differences in these two sites. There may also be some farm spraying impacts given the close proximity of crops.

Of interest also the northern site had no shrub species – somewhat unusual even for a grassland ecosystem. The Flagstaff Hill Road, Gordon Road and Stebonheath Road sites also had this result.

³² Data available from Atlas of Living Australia website.

Current and Future Management Regime

As for the nearby site FRE SHA 01 (south of this site) the railroad reserve is managed in a haphazard manner. We observed several instances of poor weed control methods, but there is predominantly no weed control at all. It appears that the management is targeting notifiable weed species only, and then somewhat sporadically. The site may also be being used as occasional access for four-wheel drive vehicles. See notes for FRE-SHA-01 site.

Under the existing management regime, it is our opinion that a downward trend in native species diversity and cover abundance, with an increase in weed species cover abundance can be expected. The use of fire in the future management of this reserve may assist in altering this outlook. Similar comment as for southern site FRE SHA 01 applies for other future management issues.

Table 10a: Site flora records FRE-SHA-02

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				420	J	T	F V
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	1	F,I
<i>Asperula conferta</i>	Crowded Woodruff				137	J	2	I
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				76	GT	T	M
<i>Austrodanthonia fulva</i>	Leafy Wallaby-grass				475, 476	GT	T	M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				428	GT	T	M
<i>Austrostipa blackii</i>	Crested Spear-grass				423, 425	GT	T	M
<i>Austrostipa curticoma</i>	Short-crest Spear-grass				424	GT	T	M
<i>Austrostipa eremophila</i>	Rusty Spear-grass				426	GT	T	M
<i>Austrostipa gibbosa</i>	Swollen Spear-grass		R		427	GT	T	M
<i>Austrostipa nodosa</i>	Tall Spear-grass				151 421, 422, 477, 478	GT	T	M B
<i>Calocephalus citreus</i>	Lemon Beauty-heads				110	J	N	V
<i>Convolvulus angustissimus ssp. angustissimus</i>	Pink Convolvulus				1, 429	J	1	F
<i>Daucus glochidiatus</i>	Native Carrot				149	J	N	I
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily				43	VL	1	F,I
<i>Elymus scaber var. scaber</i>	Native Wheat-grass				92	GL	T	B
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34	J	1	F
<i>Haloragis aspera</i>	Rough Raspwort				144	J	1	F
<i>Leiocarpa websteri</i>	Narrow Plover-daisy				142	SD	T	F
<i>Linum marginale</i>	Native Flax				140	J	N	F,I
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VT	T	V
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	1	V
<i>Lomandra micrantha ssp. micrantha</i>	Small-flower Mat-rush				26	VL	T	B
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25	VL	1	B
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	T	I
<i>Microtis arenaria</i>	Notched Onion Orchid				V	J	T	X
<i>Plantago gaudichaudii</i>	Narrow-leaf Plantain				153	J	1	T
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy		R		126	J	1	F,I
<i>Pycnosorus globosus</i>	Drumsticks		V		143	J	T	F

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Stackhousia monogyna</i>	Creamy Candles				145	SD	T	I,F
<i>Swainsona stipularis</i>	Orange Swainson-pea				146	J	T	I
<i>Teucrium racemosum</i>	Grey Germander				152	SD	T	V
<i>Themeda australis</i>	Kangaroo Grass				78	GT	T	B
<i>Walwhalleya proluta</i>	Rigid Panic				133	GL	T	I
<i>Avena fatua</i>	Wild Oat			*	138	GT	2	I
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	1	I
<i>Bromus diandrus</i>	Great Brome			*	249	GL	T	M
<i>Centaurea melitensis</i>	Malta Thistle			*	132	J	2	V
<i>Cynara cardunculus ssp. flavescens</i>	Artichoke Thistle			**	106	J	N	D
<i>Linum strictum ssp. strictum</i>	Upright Yellow Flax			*	121	J	1	F
<i>Medicago truncatula</i>	Barrel Medic			*	154	J	T	I
<i>Moraea setifolia</i>	Thread Iris			*	8	J	T	I
<i>Oxalis pes-caprae</i>	Soursob			*	61	J	T	V
<i>Plantago scabra</i>	Rough Plantain			*	148	J	T	I
<i>Rapistrum rugosum ssp. rugosum</i>	Turnip Weed			*	128	J	2	F,I
<i>Salvia verbenaca var. verbenaca</i>	Wild Sage			*	14	J	T	I
<i>Scorzonera laciniata</i>	Scorzonera			*	150	J	N	I
<i>Sonchus oleraceus</i>	Common Sow-thistle			*	139	J	T	F
<i>Vicia monantha</i>	Spurred Vetch			*	147	J	1	I,M

Table 10b: Additional species on site spring 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Hypoxis vaginata var. vaginata</i>	Yellow Star				V	J	1	F
<i>Wurmbea dioica ssp. brevifolia</i>	Early Nancy				V	J	T	F
<i>Wurmbea dioica ssp. dioica</i>	Early Nancy				V	J	1	F

Table 10c: Opportune flora records close to site 2012

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting				50

Table 10d: Opportune flora records close to site spring 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Bulbine bulbosa</i>	Bulbine-lily				53
<i>Haloragis acutangula</i>	Smooth Raspwort				V
<i>Lomandra collina</i>	Sand Mat-rush				V
<i>Plantago hispida</i>	Hairy Plantain				V
<i>Plantago varia</i>	Variable Plantain				V
<i>Vicia sativa</i>	Common Vetch			*	V

Fauna records – refer to site report for FRE SHA 01.

6.10 Roseworthy town Rail Reserve

Local Government Area: Light Regional Council

Location: Rail reserve south of Roseworthy township. Just west of effluent ponds.

Site Identification: ROS RAI 01

Opportunistic Collection Site: Yes

AMG Zone: 54 Easting: 292880 Northing: 6175408

Date of Survey: 24/10/12 **Follow-up Opportune collection:** 16/11/12. Spring 2013

Altitude: 100 metres

Estimated average rainfall: 450 mm

Site Description

This site is located on a mostly disused rail line reserve approximately 60 metres wide but only the east side contains significant understorey native vegetation. To the east of the survey site are the town effluent ponds, which are part of the urban development of Roseworthy. Residential areas are to the north and west. The area to the south is mainly used for agriculture. Whilst this site is not a grassland site, it nevertheless represents vegetation that contain many of components of a grassland. Large parts of the rail reserve are degraded. The area around the survey site provides a good example of vegetation now largely removed.

General Description of Vegetation

There is a range of shrubs, herbaceous species, irongrass and grass species as well as taller trees. A range of weeds exist on the site, including annual and perennial grass weed species and woody weeds.

Survey Site Specific Vegetation Description

The surveyed site was classified as a ***Eucalyptus largiflorens* open grassy woodland**. The site also contains a single tree identified as Inland SA Blue Gum (*Eucalyptus leucoxylon ssp. pruinosa*) which may have been a hybrid with another eucalypt species. All of the other approximately 100 trees in the general vicinity appear to be *Eucalyptus largiflorens* although there is some variability towards *Eucalyptus porosa*. Martin O'Leary at the State Herbarium inspected the eucalypt vouchers from the site and hopefully follow-up clarification will occur.

A total of 30 native species and 16 weed species were recorded on the quadrat with an additional nine opportune native species near the quadrat. Whilst the site contains a good diversity of native species, there is also a significant number of high threat weed species. This may be as a result of the narrow configuration of the railway reserve, nearby urban area and the soil type (calcareous loam).

Weed species of concern include Pepper-tree, Olive, Bridal Creeper, Rice Millet, Squirting Cucumber, Silver-leaf Nightshade, Couch, Artichoke Thistle and Western Coastal Wattle as well as a high diversity of annual weed grass species, which may prevent germination and survival of native herbaceous species. There are also a significant number of additional weeds not recorded for the survey associated with the sewerage ponds and the overflow creek which is running alongside the rail corridor. Light Regional Council need to look at management of these sewerage ponds and overflow to avoid causing major damage to the rail corridor vegetation.

Landform Pattern:	plain	Landform Element:	plain
Outcrop Cover:	none apparent	Outcrop Lithology:	not identified
Surface Strew Size:	none apparent	Soil Texture Class:	medium clay
Bare Earth Estimate:	1%	Litter Estimate:	10%
Vegetation Condition:	disturbed natural		



Photo 79: ROS-RAI-01, BS836, 24/10/12 site looking north.



Photo 80: February 2014, Rohrlach's Bluebush (*Maireana rohrlachii*) flowering and fruiting. State Rare species.



Photo 81: Summer 2014, Sticky Sword-sedge (*Lepidosperma viscidum*) and Soft Tussock Mat-rush (*Lomandra densiflora*) on the southern end of the remnant patch.



Photo 82: Spring 2012, Silver Goodenia (*Goodenia willisiana*).



Photo 83: Spring 2013, Cottony Spear-grass (*Austrostipa drummondii*) competing with Onion Weed.



Photo 84: River Box (*Eucalyptus largiflorens*) – typical concentration of flowers near the ends of branches.

Summary of Conservation Values

Eucalyptus largiflorens woodlands are reasonably well conserved elsewhere in South Australia, such as near the River Murray. While there are quite a few remnant stands of this species found between Gawler and the Gawler River northwards to Balaklava, very little understorey vegetation remains in these remnants making this site of particular interest. The presence of *Eucalyptus largiflorens* indicates that in the past, occasional flooding of the area occurred. With climate change occurring, *Eucalyptus largiflorens* woodlands are likely to be an association that will be at risk in this region.

Eucalyptus largiflorens is a Southern Lofty Vulnerable species. Nine other species with Southern Lofty conservation ratings occurred - *Lomandra effusa*, *Sida corrugate* var *angustifolia* and *Pittosporum angustifolium* (all Rare) and *Aristida behriana*, *Acacia notabilis*, *Austrostipa curticaoma*, *Austrostipa eremophila*, *Goodenia pinnafitida* and *Maireana enchylaeoides* (all Uncommon).

The presence of several perennial weed species is a threat to the on-going existence of the site as found in the survey. Woody weeds (e.g. Olive, Pepper-tree and *Acacia Cyclops* – native species relocated from Yorke Peninsula or father west) may eventually shade out many grassland species if they continue to expand across the site.

Current and Future Management Regime

As for other surveyed sites along this same railroad corridor, the reserve is managed in a haphazard manner. For this site, there was little evidence of any weed control work being carried out apart from Artichokes Thistle control (which has not been very effective).

Under the existing management regime, we predict a downward trend in native species diversity and cover abundance, whilst an increase in weed species cover abundance can be expected. The continued expansion of residential development will increase dumping of hard rubbish and garden waste, contributing to a further spread of weeds. Further pressure will be exerted on the site, by casual recreational use (illegal and legal). A number of large tree branches have recently been chopped off, apparently associated with cubbyhouse making. Given the closeness of the site to an urban population, the site may be suitable for management by a volunteer group (e.g. Bush For Life).

Table 11a: Site flora records ROS-RAI-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	T	F,I
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				215	J	N	V
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	N	F,I
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				448, 449	GT	T	F
<i>Austrodanthonia fulva</i>	Leafy Wallaby-grass				439,479	GT	T	F
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				187, 440	GL	1	I,M
<i>Austrostipa curticaoma</i>	Short-crest Spear-grass				430,431, 445	GT	T	F
<i>Austrostipa drummondii</i>	Cottony Spear-grass				60	GT	1	F
<i>Austrostipa eremophila</i>	Rusty Spear-grass				182, 434, 447	GT	T	F,I
<i>Austrostipa nodosa</i>	Tall Spear-grass				184, 191, 432,433, 435,443	GT	T	I
<i>Chloris truncata</i>	Windmill Grass				80	GL	N	F
<i>Convolvulus angustissimus</i> ssp. <i>angustissimus</i>	Pink Convolvulus				438	J	N	

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily				43	VL	1	F, I
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush				192	SD	T	V
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	1	B,F,I
<i>Enteropogon acicularis</i>	Umbrella Grass				183	GL	1	F,I
<i>Eucalyptus largiflorens</i>	River Box				186	LA	2	B,F,I, M
<i>Eucalyptus leucoxylon</i> ssp. <i>pruinosa</i>	Inland South Australian Blue Gum				487	LA, T	N	F
<i>Euphorbia drummondii</i>	Caustic Spurge				70	J	N	V
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	1	I
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	1	V
<i>Lomandra multiflora</i> ssp. <i>dura</i>	Hard Mat-rush				25	VL	T	V
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	T	I
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush		R		36	SD	T	V
<i>Oxalis perennans</i>	Native Sorrel				21	J	T	V
<i>Pimelea micrantha</i>	Silky Riceflower				177			
<i>Pittosporum angustifolium</i>	Native Apricot				193	S	N	F
<i>Rhagodia parabolica</i>	Mealy Saltbush				194	SC	N	B
<i>Salsola australis</i>	Buckbush				77	SD	N	V
<i>Sida corrugata</i> var. <i>angustifolia</i>	Corrugated Sida				189	P	T	V
<i>Stackhousia monogyna</i>	Creamy Candles				108, 176			
<i>Themeda australis</i>	Kangaroo Grass				78	VT	2	F
<i>Asphodelus fistulosus</i>	Onion Weed			**	166	J	1	I
<i>Avena barbata</i>	Bearded Oat			*	24	GT	1	I,M,X
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	2	F,I
<i>Bromus diandrus</i>	Great Brome			*	188	GL	1	I,M
<i>Bromus madritensis</i>	Compact Brome			*	185	GT	1	I,M
<i>Cynara cardunculus</i> ssp. <i>flavescens</i>	Artichoke Thistle			**	106	J	T	V
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F,I
<i>Olea europaea</i> ssp. <i>europaea</i>	Olive			**	31	S	1	F,I
<i>Piptatherum millicaceum</i>	Rice Millet			*	179, 190	GT	T	B
<i>Plantago lanceolata</i> var. <i>lanceolata</i>	Ribwort			*	175	J	T	F,I
<i>Reichardia tingitana</i>	False Sowthistle			*	49	J	T	F
<i>Schinus molle</i>	Pepper-tree			*	173	LB	N	V
<i>Solanum nigrum</i>	Black Nightshade			*	105	SD	N	V
<i>Trifolium angustifolium</i>	Narrow-leaf Clover			*	159	J	T	F,I
<i>Vicia sativa</i>	Common Vetch			*	V	V	1	I

Table 11b: Opportune flora records close to site

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Acacia notabilis</i>	Notable Wattle				222
<i>Atriplex suberecta</i>	Lagoon saltbush				491
<i>Austrostipa exilis</i>	Heath Spear-grass				196
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush				503
<i>Epilobium hirtigerum</i>	Hairy Willow-herb				V
<i>Eucalyptus largiflorens</i>	River Box				501, 502
<i>Goodenia willisiana</i>	Silver Goodenia				488
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge				174
<i>Lomandra micrantha</i> ssp. <i>micrantha</i>	Small-flower Mat-rush				195
<i>Maireana brevifolia</i>	Short-leaf Bluebush				221
<i>Senna artemisioides</i> ssp. <i>coriacea</i>	Broad-leaf Desert Senna				198
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				51
<i>Acacia cyclops</i> ³³	Western Coastal Wattle			*	451
<i>Asparagus asparagoides</i> f. <i>asparagoides</i>	Bridal Creeper			*	216
<i>Asteriscus spinosus</i>	Golden Pallensis			*	453
<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch			*	452
<i>Ecballium elaterium</i>	Squirting Cucumber			*	200
<i>Gomphocarpus cancellatus</i>	Broad-leaf Cotton-bush			*	199
<i>Medicago scutellata</i>	Snail Medic			*	197
<i>Solanum elaeagnifolium</i>	Silver-leaf Nightshade			**	450

** NRM declared species for the area requiring landholder control

Fauna observations – Roseworthy rail corridor Site ROS – RAI – 01 and locality

Table 11c: Opportune bird records near site 24 October 2012 – observer Dragos Moise. The results here are significantly affected by the waterbirds using the adjacent Roseworthy waste ponds.

Common name	Genus	Species	A	SA	Int'd	Number
Australasian Grebe	<i>Tachybaptus</i>	<i>novaehollandiae</i>				2
Australasian Pipit	<i>Anthus</i>	<i>novaeeseelandiae</i>				1
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				3
Australian Reed-Warbler	<i>Acrocephalus</i>	<i>australis</i>				4
Black-faced Cuckoo-shrike	<i>Coracina</i>	<i>novaehollandiae</i>				2
Black-tailed Native-hen	<i>Tribonyx</i>	<i>ventralis</i>				4
Brown Quail	<i>Coturnix</i>	<i>ypsilophora</i>		V		1
Corella	<i>Cacatua</i>	<i>sp.</i>				1
Crested Pigeon	<i>Ocyphaps</i>	<i>lophotes</i>				3
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>				7
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				1
Grey Teal	<i>Anas</i>	<i>gracilis</i>				12

³³ *Acacia Cyclops* is found on Yorke Peninsula and further west but regarded as introduced on the Adelaide Plains (where it has been planted in quite a few places).

Common name	Genus	Species	A	SA	Int'd	Number
Hardhead	<i>Aythya</i>	<i>australis</i>				1
Little Grassbird	<i>Megalurus</i>	<i>gramineus</i>				1
Little Raven	<i>Corvus</i>	<i>mellori</i>				2
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>				2
Masked Lapwing	<i>Vanellus</i>	<i>miles</i>				2
Musk Lorikeet	<i>Glossopsitta</i>	<i>concinna</i>				6
New Holland Honeyeater	<i>Phylidonyris</i>	<i>novaehollandiae</i>				4
Noisy Miner	<i>Manorina</i>	<i>melanocephala</i>				5
Pacific Black Duck	<i>Anas</i>	<i>supercilliosa</i>				8
Purple Swamphen	<i>Porphyrio</i>	<i>porphyrio</i>				1
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>				2
Rainbow Lorikeet	<i>Trichoglossus</i>	<i>haematodus</i>				2
Red Wattlebird	<i>Anthochaera</i>	<i>carunculata</i>				3
Singing Honeyeater	<i>Lichenostomus</i>	<i>virescens</i>				1
Stubble Quail	<i>Coturnix</i>	<i>pectoralis</i>				1
Welcome Swallow	<i>Hirundo</i>	<i>neoxena</i>				2
White-faced Heron	<i>Egretta</i>	<i>novaehollandiae</i>				1
White-plumed Honeyeater	<i>Lichenostomus</i>	<i>penicillatus</i>				8
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>				1
Common Blackbird	<i>Turdus</i>	<i>merula</i>			*	1
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	8
House Sparrow	<i>Passer</i>	<i>domesticus</i>			*	5
Rock Dove	<i>Columba</i>	<i>livia</i>			*	3
Spotted Dove	<i>Stigmatopelia</i>	<i>chinensis</i>			*	1

Table 11d: Opportune reptile records near site 2 March and 10 May 2013 – observer Peter Matejcic and Adrian Shackley

Common Name	Genus	Species	A	SA	Int'd	Number
Small brown skink	<i>Morethia</i>	<i>Sp.</i>				1

Table 11e: Opportune mammal records near site 2 March and 10 May 2013 – observer Peter Matejcic and Adrian Shackley. One fox observation on each day.

Common Name	Genus	Species	A	SA	Int'd	Number
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	1
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	1
Rabbit	<i>Oryctolagus</i>	<i>cuniculus</i>			*	2

6.11 Dead Man's Pass Reserve – Gawler

Local Government Area: Town of Gawler

Location: Beside rough walking track, south of river, on top of steep river bank near Gawler Terrace.

Site Identification: GAW DMP 01

Opportunistic Collection Site: Yes

AMG Zone: 54 Easting: 293864 Northing: 6167855

Date of Survey: 24/10/12 **Follow-up Opportune collection:** 23/11/2012. Spring 2013

Altitude: 65 metres **Estimated average rainfall:** 480 mm

Site Description

Dead Man's Pass Reserve contains valuable native grassland vegetation in several sections of the reserve. The location of the survey site is adjacent rough walking path along the southern bank of the South Para river. The path begins near the top of the adjacent road (Gawler Terrace), but below some 1980s plantings of mainly Western Australian eucalypts. The steep site has a northerly aspect to the sun. North of the site is the South Para river, whilst south of the site is urban residential development. It is likely that the vegetation continues to exist mainly due to the steepness of the terrain – while grazing occurred from about 1840 to 1976 (when it became a Council reserve after over 100 years ownership by the Riggs family), cultivation has not occurred because of stony soil (in patches) and slope.

General Description of Vegetation

The vegetation contains considerable diversity, due to the variability in terrain. The steep north facing slopes contain vegetation that has developed on poorer nutrient soils. The condition of the vegetation is highly variable, with some areas containing few weeds, whilst other areas are highly disturbed and contain a large diversity of weed species, with few natives. Better native vegetation appears to be confined to steep or stony areas where soil nutrients are less.

Survey Site Specific Vegetation Description

Due to the steepness of the terrain, the site surveyed measured 180 by 5 metres. It contained vegetation that was classified as **tussock grassland**. Many of the species recorded were found on other survey sites, however, this site has a relatively high diversity of grass and herbaceous species. Overall the vegetation was considered to be “disturbed natural”. Most weed species recorded were annual broad leaf species or annual and perennial grass species.

Landform Pattern:	escarpment	Landform Element:	scarp
Site Aspect:	230 degrees	Outcrop Cover:	none apparent
Surface Strew Size:	none apparent	Surface strew cover:	nil
Soil Texture Class:	clay loam	Bare Earth Estimate:	5%
Litter Estimate:	5%	Vegetation Condition:	disturbed natural

Summary of Conservation Values

The high diversity of native species on this site provides a valuable reference point for surrounding areas, especially on steep sites which have a northerly aspect to the sun.

A total of 49 native species and 32 weed species were recorded on the site as well as six planted species (which have been disregarded for site species counts and survey summaries). An additional 20 native species and seven weed species were collected opportunistically adjacent to the site and along the grassy river banks to the east of the site.

Species of conservation significance included Woolly Plover-daisy (*Leiocarpa tomentosa*), which was not recorded in other sites during the survey. This is a first recording of this species in the Southern

Lofty Herbarium region. One species of State significance was collected just east of the site - Rohrlach's Bluebush (*Maireana rohrlachii*) - State Rare species.

Species recorded on site or general locality but not elsewhere on the survey included *Lomandra nana* – this record could well be the western-most record of this species moving out of the hills towards the drier Adelaide Plains, *Cheilanthes lasiophylla* (Southern Lofty Endangered rating), *Eremophila longifolia* (Southern Lofty Vulnerable rating), *Digitaria brownii* and *Panicum effusum* (both Southern Lofty K rating), *Zygophyllum glaucum* (Southern Lofty T rating) and *Ptilotus nobilis ssp. angustifolius* (Southern Lofty no rating but undoubtable deserving a significant conservation rating, at least Vulnerable).

Eighteen other species with Southern Lofty conservation ratings occurred on site of in the locality - *Austrostipa puberula* (Southern Lofty K rating), *Cheilanthes distans*, *Lomandra effusa*, *Pimelea micrantha*, *Ptilotus spathulatus*, *Setaria constricta*, *Sida corrugate var angustifolia* and *Pittosporum angustifolium*, *Velleia arguta*, *Vittadinia blackii*, *Vittadinia megacephala* and *Walwhalleya proluta* (all Southern Lofty Rare) and *Cymbopogon ambiguous* and *Dichanthium sericeum ssp. sericeum* (both Southern Lofty Vulnerable rating), *Aristida behriana*, *Austrostipa eremophila*, *Goodenia pinnafitida* and *Maireana enchylaeoides* (all Southern Lofty Uncommon).

Overall about 40% of the species recorded on site or nearby have conservation significance at a Southern Lofty regional level. An even higher percentage of species would have significance for the more local Adelaide Plains and foothills. This area is of very high conservation rating as the best grassland remnant known to survive near Gawler and on the Adelaide Plains to the west.

A large range of weed species inhabits the site. Despite their presence, this site had a high diversity of native species, with the long and narrow configuration of the survey site increasing the diversity recorded, as it includes a larger range of micro-habitats.

The site can also potentially be classified as *Lomandra effusa/L. multiflora ssp. dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. It contains both the key *Lomandra* species although in low numbers. This site looks like a Class A EPBC site if low *Lomandra* coverage is allowed. A class A site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 30 native plant species (49 recorded here in 900 square metres plus others close by), 10 or more broad-leaved herbaceous native species excluding six disturbance resistant species (20 recorded here in 900 square metres), at least five native grass species (14 recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify as there is a good density of grass tussocks on the site).

Current and Future Management Regime

While the site has a high diversity of weeds, most can be controlled with suitably skilled bush regenerators using broad leaf herbicides. Fortunately, the Town of Gawler has a small trained Biodiversity Team, which could undertake the management of valuable reserves such as this along with community environmental organisations and volunteers. Two Council team members accompanied the survey team for the Dead Man's Pass site survey which was a valuable exercise for both parties.

Removing biomass of annual grass weeds by brush cutting or the like (whilst avoiding other native species) in early spring would assist in reducing weed abundance over time.

Clearing an area of planted eucalypts (mostly West Australian) to the south of this important grassland remnant would allow expansion and assist in its long term viability. It would also provide opportunities to plant grassland species unlikely to regenerate in the short term (such as *Lomandra spp.*) or which have been lost in the area e.g. *Hyalosperma*, *Millotia* and *Chrysocephalum* daisies and legumes such as *Lotus* and *Swainsona* species and many other species which were recorded near Gawler by Ferdinand Mueller and Hermann Behr in 1845-1851 but are no longer in the locality.



Photo 85: GAW-DMP-01, BS836, 24/10/12. West end of site looking east. Planted woodland eucalypts and pines to the south (right side). South Para river – River Red Gum dominated strip along the riparian corridor to the north (left).



Photo 86: Spring 2012, Overstory of *Austrostipa blackii*, *Enneapogon nigricans* & *Aristida behriana* with weedy grass



Photo 87: Spring 2013, Kangaroo Grass (*Themeda australis*) and Small Mat-rush (*Lomandra nana*).



Photo 88: Spring 2012, Bristly Cloak-fern (*Cheilanthes distans*) unusually growing in open area rather than on rocky ledge.



Photo 89: Autumn 2013, Pink Garland-lily (*Calostemma Purpureum*) emerging after autumn rain.



Photo 90: Spring 2013, Cotton Panic Grass (*Digitaria brownii*) - seeds have a small cotton like surround.



Photo 91: Late Spring 2013, Knotty-butt Setaria (*Setaria constricta*) setting seed.



Photo 92: Woolly Plover-daisy (*Leiocarpa tomentosa*) flowering- not dense plant on left side. Also *Lomandra nana* (top right corner).



Photo 93: December 2013, Yellow-tails (*Ptilopus nobilis* ssp. *angustifolius*) north facing slope to the east.



Photo 94: Spring 2013, Toothed Velleia (*Velleia arguta*).



Photo 95: Spring 2013, Rainbow Bee-eaters enjoying the view.



Photo 96: Spring 2013, Brown Goshawk looking out for lunch.

Table 12a: Site flora records GAW-DMP-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	1	F,I
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				215	J	1	F
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	1	I
<i>Atriplex semibaccata</i>	Berry Saltbush				56	P	N	V
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				76	GT	1	I,M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				35	GT	T	M
<i>Austrostipa blackii</i>	Crested Spear-grass				46	GT	1	I,F
<i>Austrostipa drummondii</i>	Cottony Spear-grass				60	GT	1	F,I
<i>Austrostipa eremophila</i>	Rusty Spear-grass				18	GT	T	M
<i>Austrostipa nodosa</i>	Tall Spear-grass				464	GT	1	F, I, M
<i>Austrostipa puberula</i>	Fine-hairy Spear-grass				465	GT	T	M
<i>Boerhavia dominii</i>	Tar-vine				339	J	T	F
<i>Calostemma purpureum</i>	Pink Garland-lily				89	J	1	V
<i>Cheilanthes lasiophylla</i>	Woolly Cloak-fern				219	X	T	V
<i>Crassula colorata</i> var. <i>acuminata</i>	Crassula Stonecrop				208	J	T	M
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax Lily				43	VT	1	F,I
<i>Digitaria brownii</i>	Cotton Panic Grass				202	GL	T	V
<i>Elymus scaber</i> var. <i>scaber</i>	Native Wheat-grass				92	GT	1	B
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush				192	SD	T	M
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	T	I
<i>Eremophila longifolia</i>	Weeping Emubush				204	S	T	F
<i>Euphorbia drummondii</i>	Caustic Spurge				70	J	T	F
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34	J	T	F,I
<i>Leiocarpa tomentosa</i>	Woolly Plover-daisy				209	SD	1	F,I
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	N	I
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	T	V
<i>Lomandra multiflora</i> ssp. <i>dura</i>	Hard Mat-rush				25	VT	1	I
<i>Lomandra nana</i>	Small Mat-rush				201	VL	N	I
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	T	I
<i>Oxalis perennans</i>	Native Sorrel				21	J	1	V
<i>Panicum effusum</i> var. <i>effusum</i>	Hairy Panic				202, 203	VL	1	B,F
<i>Pittosporum angustifolium</i>	Native Apricot				193	S	N	F
<i>Ptilotus spathulatus</i> f. <i>spathulatus</i>	Pussy-tails				73	J	1	I
<i>Salsola australis</i>	Buckbush				77	SD	N	V
<i>Setaria constricta</i>	Knotty-butt Setaria				160	GL	1	I
<i>Sida corrugata</i> var. <i>angustifolia</i>	Grassland Sida				284	P	T	I/M
<i>Sida corrugata</i> var. <i>corrugata</i>	Corrugated Sida				214	P	T	F,I
<i>Themeda australis</i>	Kangaroo Grass				78	GT	2	F,I
<i>Velleia arguta</i>	Toothed Velleia				217	J	1	F,I
<i>Vittadinia cuneata</i> f. <i>cuneata</i>	Fuzzy New Holland Daisy				211, 212	J	1	F,I
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				51	J	T	F,I

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Vittadinia megacephala</i>	Giant New Holland Daisy				19	J	T	B,F
<i>Aira sp.</i>	Hair-grass			*		GL	T	M
<i>Anagallis arvensis</i>	Pimpernel			*	130	J	T	F
<i>Arctotheca calendula</i>	Cape Weed			*	69	J	N	F
<i>Asparagus asparagoides f. asparagoides</i>	Bridal Creeper			**	216		T	V
<i>Asphodelus fistulosus</i>	Onion Weed			*	166	J	1	I,M
<i>Avena barbata</i>	Bearded Oat			*	4	GT	1	I,M
<i>Brachypodium distachyon</i>	False Brome			*	10	VL	1	I,M
<i>Brassica tournefortii</i>	African Mustard			*	213	J	T	F,I
<i>Briza maxima</i>	Large Quaking-grass			*	79	GL	T	M
<i>Bromus diandrus</i>	Great Brome			*	188	GL	T	I,M
<i>Carthamus lanatus</i>	Saffron Thistle			*	218	J	T	V
<i>Cynara cardunculus ssp. flavescens</i>	Artichoke Thistle			**	106	J	T	V
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F,I
<i>Ehrharta longiflora</i>	Annual Veldt Grass			*	210	GL	T	I,M
<i>Euphorbia sp.</i>	Spurge			*	-	J	T	I
<i>Euphorbia terracina</i>	False Caper			**	V	J	N	V
<i>Galenia pubescens var. pubescens</i>	Coastal Galenia			*	207	P	N	B
<i>Hypochaeris sp.</i>	Cat's Ear			*		J	N	F
<i>Lepidium sp.</i>	Peppercress			*		J	N	I,M
<i>Lolium rigidum</i>	Ryegrass			*	58	GL	T	I
<i>Moraea setifolia</i>	Thread Iris			*	8	J	T	I,M
<i>Olea europaea ssp. europaea</i>	Olive			*	31	SC	N	V
<i>Oxalis pes-caprae</i>	Soursob			*	61	J	1	V
<i>Parentucellia latifolia</i>	Red Bartsia			*	205	J	N	X
<i>Piptatherum miliaceum</i>	Rice Millet			*	179		T	B
<i>Prunus dulcis</i>	Almond			*	-	S	1	I
<i>Romulea rosea var. australis</i>	Common Onion-grass			*	2	J	T	M
<i>Salvia verbenaca var. verbenaca</i>	Wild Sage			*	14	J	T	M
<i>Scabiosa atropurpurea</i>	Pincushion			*	102	J	N	F,B
<i>Sonchus oleraceus</i>	Common Sow-thistle			*	139	J	T	V
<i>Trifolium angustifolium</i>	Narrow-leaf Clover			*	159	J	1	F,I
<i>Trifolium arvense var. arvense</i>	Hare's-foot Clover			*	29	J	1	F
<i>Trifolium campestre</i>	Hop Clover			*	11	J	1	I,M
<i>Vulpia myuros forma myuros</i>	Rats tail Fescue			*	206	GL	T	M
<i>Acacia argyrophylla</i>	Silver Mulga-bush			Planted		SB	T	M
<i>Acacia iteaphylla</i>	Flinders Ranges Wattle		R	Planted		SB	N	I
<i>Acacia pendula</i>	Weeping Myall		V	Planted		SB	N	I
<i>Callitris gracilis</i>	Southern Cypress Pine			Planted		S	N	F
<i>Eucalyptus camaldulensis ssp.</i>	River Red Gum			Planted		LA	N	V
<i>Rhagodia parabolica</i>	Mealy Saltbush			Planted	194	SC	N	F,I

Table 12b: Additional flora species records on site spring 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Cheilanthes distans</i>	Bristly Cloak-fern				253	X	T	V
<i>Crassula colligata</i> ssp. <i>colligata</i>	Crassula				228	J	T	F
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula				V	J	T	F
<i>Drosera glanduligera</i>	Scarlet Sundew				V	J	T	F
<i>Gonocarpus elatus</i>	Hill Raspwort				162	J	N	V
<i>Pleurosus rutifolius</i>	Blanket Fern				V	X	N	V

Table 12c: Opportune species close to site 2012

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Austrostipa eremophila</i>	Rusty Spear-grass				466
<i>Convolvulus angustissimus</i> ssp. <i>peninsularum</i>	Grassland Convolvulus				469
<i>Convolvulus remotus</i>	Australian Convolvulus				467
<i>Cymbopogon ambiguus</i>	Lemon-grass				220
<i>Dichanthium sericeum</i> ssp. <i>sericeum</i>	Silky Blue-grass				178
<i>Dodonaea viscosa</i> ssp. <i>spathulata</i>	Sticky Hop-bush				165
<i>Enteropogon acicularis</i>	Umbrella Grass				183
<i>Lomandra nana</i>	Small Mat-rush				472
<i>Maireana brevifolia</i>	Short-leaf Bluebush				221
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush		R		36
<i>Poa labillardieri</i> var. <i>labillardieri</i>	Tussock-grass				473
<i>Ptilotus nobilis</i> ssp. <i>angustifolius</i>	Yellow-tails				470
<i>Setaria jubiflora</i>	Warrego Summer-grass				471
<i>Zygophyllum glaucum</i>	Pale Twinleaf				468
<i>Pennisetum villosum</i>	Feather-top			*	474

Table 12d: Additional opportune flora species close to site/river banks spring 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Atriplex suberecta</i>	Lagoon Saltbush				491
<i>Carex bichenoviana</i>	Notched Sedge				V
<i>Distichlis distichophylla</i>	Emu-grass				393
<i>Pimelea micrantha</i>	Silky Riceflower				48
<i>Stackhousia monogyna</i>	Creamy Candles				108
<i>Walwhalleya prolata</i>	Rigid Panic				392
<i>Euphorbia peplus</i>	Petty Spurge			*	V
<i>Pennisetum setaceum</i>	Fountain grass			*	V
<i>Withania somnifera</i>	Winter Cherry			*	V

** - NRM declared species for the area requiring landholder control

Fauna observations – Dead Man’s Pass Site and locality

Table 12e: Opportune bird records near site 24 October 2012 – observer Dragos Moise

Common name	Genus	Species	A	SA	Int'd	Number
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				3
Australian Reed-Warbler	<i>Acrocephalus</i>	<i>australis</i>				2
Black-faced Cuckoo-shrike	<i>Coracina</i>	<i>novaehollandiae</i>				1
Brown Goshawk	<i>Accipiter</i>	<i>fasciatus</i>				1
Crested Pigeon	<i>Ocyphaps</i>	<i>lophotes</i>				3
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>				8
Dusky Moorhen	<i>Gallinula</i>	<i>tenebrosa</i>				2
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				2
Grey Shrike-thrush	<i>Colluricincla</i>	<i>harmonica</i>				1
Laughing Kookaburra	<i>Dacelo</i>	<i>novaeguineae</i>				2
Little Grassbird	<i>Megalurus</i>	<i>gramineus</i>				1
Little Pied Cormorant	<i>Microcarbo</i>	<i>melanoleucos</i>				1
Little Raven	<i>Corvus</i>	<i>mellori</i>				1
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>				5
Musk Lorikeet	<i>Glossopsitta</i>	<i>concinna</i>				10
Noisy Miner	<i>Manorina</i>	<i>melanocephala</i>				5
Pacific Black Duck	<i>Anas</i>	<i>supercilliosa</i>				3
Peaceful Dove	<i>Geopelia</i>	<i>placida</i>				1
Purple Swampphen	<i>Porphyrio</i>	<i>porphyrio</i>				1
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>				2
Rainbow Lorikeet	<i>Trichoglossus</i>	<i>haematodus</i>				10
Red Wattlebird	<i>Anthochaera</i>	<i>carunculata</i>				5
Red-rumped Parrot	<i>Psephotus</i>	<i>haematotus</i>				2
Silvereye	<i>Zosterops</i>	<i>lateralis</i>				2
Welcome Swallow	<i>Hirundo</i>	<i>neoxena</i>				5
White-fronted Chat	<i>Epthianura</i>	<i>albifrons</i>				1
White-plumed Honeyeater	<i>Lichenostomus</i>	<i>penicillatus</i>				10
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>				1
Common Blackbird	<i>Turdus</i>	<i>merula</i>			*	2
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	14
House Sparrow	<i>Passer</i>	<i>domesticus</i>			*	6
Rock Dove	<i>Columba</i>	<i>livia</i>			*	5
Spotted Dove	<i>Stigmatopelia</i>	<i>chinensis</i>			*	2

Table 12f: Opportune reptile records near site 2 March 2013 – observer Peter Matejčić and Adrian Shackley (except the last 3 which were records by Adrian Shackley during 2012)

Common name	Genus	Species	A	SA	Int'd	Number
Dwarf Skink	<i>Menetia</i>	<i>greyii</i>				2
Eastern Striped Skink	<i>Ctenotus</i>	<i>robustus</i>				1
Grass Skink	<i>Lampropholis</i>	<i>guichenoti</i>				1
Sleepy Lizard, Shingleback	<i>Tiliqua</i>	<i>rugosa</i>				1
Eastern Brown Snake	<i>Pseudonaja</i>	<i>textilis</i>				1
Red-bellied Black Snake	<i>Pseudechis</i>	<i>porphyriacus</i>				1

Table 12g: Opportune mammal records near site - observer Adrian Shackley 2012

Common name	Genus	Species	A	SA	Int'd	Number
Short-beaked Echidna	<i>Tachyglossus</i>	<i>aculeatus</i>				1
Brush-tail Possum	<i>Trichosurus</i>	<i>vulpecula</i>		R		2

Table 12h: Opportune frog records near site 24 October 2012 - observer Dragos Moise

Common name	Genus	Species	A	SA	Int'd	Number
Eastern Banjo Frog	<i>Limnodynastes</i>	<i>dumerillii</i>				3
Clicking Froglet	<i>Crinia</i>	<i>signifera</i>				10

Table 12i: Opportune mammal records near site early (wet) spring 2013 - observer Adrian Shackley

Common name	Genus	Species	A	SA	Int'd	Number
Clicking Froglet	<i>Crinia</i>	<i>signifera</i>				20
Eastern Banjo Frog	<i>Limnodynastes</i>	<i>dumerillii</i>				10
Spotted Grass Frog	<i>Limnodynastes</i>	<i>tasmaniensis</i>				20

6.12 Gordon Road Reserve – Gawler/Evanston South

Local Government Area: Town of Gawler
Location: Road reserve, west of Main North Road, west of small bridge over creek, which runs under Main North Road
Site Identification: GAW GOR 01
Opportunistic Collection Site: Yes
AMG Zone: 54 Easting: 291348 Northing: 6164641
Date of Survey: 24/10/12
Follow-up Opportune collection: 23/11/2012
Altitude: 60 metres
Estimated average rainfall: 480 mm

Site Description

This site appears to be part of a paddock, but is actually an unmade road reserve, which is proposed to be developed as a road, as part of urban expansion in the surrounding area. The road reserve follows a small shallow ephemeral creek which is well grassed thereby preventing erosion.

Land on both sides of the road reserve has been used for cropping and grazing. This land has been leased or sharefarmed over many years. Sheep have been the only stock grazing the paddocks for many years but have come from a number of places with the associated likelihood of introducing new weeds.

General Description of Vegetation

The vegetation type within the road reserve was classified as tussock grassland. The native species appear to be reasonably evenly interspersed with a range of weeds. The sides of the creek slope gently down, and contain the greatest diversity of native species – especially of *Lomandra* species.

Despite the appearance of the site being within a paddock, the vegetation is reasonably diverse. It contains a diversity range of native grasses, irongrass and several herbaceous species. At the same time there is also a high diversity of weed species, reflecting the adjacent land use and the continued disturbance to the site.

Survey Site Specific Vegetation Description

The surveyed site measured 10 by 90 metres and contained vegetation that was classified as **tussock grassland**.

The survey site contained a considerably number of native species, which is surprising given that the land-use adjacent the site has been used for cropping, whilst the vegetation contains no “protection” (in the form of trees and shrubs) from herbicide drift.

Many of the weed species are typically found in agricultural settings.

Landform Pattern:	plain	Landform Element:	plain
Site Slope:	0%	Outcrop Cover:	none apparent
Outcrop Lithology:	not identified	Surface Strew Size:	none apparent
Soil Texture Class:	loam	Bare Earth Estimate:	1 %
Litter Estimate:	15 %	Vegetation Condition:	degraded natural

Summary of Conservation Values

It is unusual to find such a diversity of species so close to urban areas. Whilst the site has been used for agricultural activities until recently, it has been reasonably well preserved. Three species of *Lomandra* (Irongrass) and a diversity of native grass species as well as the number of species of conservation significance would not normally be expected in such a location. The *Lomandra densiflora* plants on this site constitute the best remnant of this species known for the Adelaide Plains (about 200 large tussocks in a concentrated area). *Rumex dumosus* recorded on site is a State rated Rare species.

Part of the purpose of recording this site was to have a permanent record of the area as remnant grassland, given the confusion which has existed about historic vegetation in the area.

The presence of several annual weed species (Fescue/Silver grass, Wild Oats etc.) is related to agricultural activities, whilst perennial weed species have become established adjacent the small creek line, and may have been aided by high nutrient run-off from the nearby Main North Road and land to the east.

The site might also be assessed as *Lomandra effusa*/*L. multiflora ssp. dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act; Critically Endangered. It contains both key species but only in small numbers (and outnumbered by *Lomandra densiflora*). This site appears to fit criteria for a Class B EPBC site except for small *Lomandra effusa* and *L. multiflora ssp. dura* numbers. A class B site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 15 native plant species (22 recorded here in 900 square metres plus others close by, three or more broad-leaved herbaceous native species excluding six disturbance resistant species (seven recorded here in 900 square metres), at least four native grass species (six recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify as there is a good density of grass tussocks on the site).

Current Management Regime

As for most of the sites on this survey, this site is managed in a haphazard manner. There appeared to be no weed control at all. At best management has been targeting declared weed species only.

The continued existence of the site is doubtful due to the surrounding proposed urban development, which requires that the road reserve be developed into a road which services the urban development. Grassland sites such as these are rare, but as the site is earmarked for development, plant rescue of (in particular) *Lomandra spp.* may be the only way of preserving the genetic attributes of native species. Seed collection of as much and from as many native species is equally important.

Update. As of winter 2013 the site has been replaced with urban road development. It is understood that some rescue of plant species from the site was organised by the Department of Planning Transport and Infrastructure which is managing the road construction and traffic lights. However, it seems apparent that unfortunately most of the *Lomandra densiflora* plants on the creek line have been lost in the construction process.



Photo 97: GAW-GOR-01, BS836, 24/10/12, Road reserve looking west. Shallow creek on south side of reserve.



Photo 98: Same scene as Photo 97 – Winter 2013. Move over grassland.

Table 13: Site flora records GAW-GOR-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	1	F,I
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				460	GL	1	M,I
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				459	GL	1	I,M
<i>Austrostipa blackii</i>	Crested Spear-grass				46	GT	2	M,I
<i>Austrostipa nodosa</i>	Tall Spear-grass				28	GT	1	I,M
<i>Boerhavia dominii</i>	Tar-vine				NV	V	N	V
<i>Calostemma purpureum</i>	Pink Garland-lily				89	J	T	V
<i>Chloris truncata</i>	Windmill Grass				80	GL	1	M,I
<i>Crassula colligata ssp. colligata</i>	Crassula				228	J	N	I,M
<i>Cyperus gymnocaulos</i>	Spiny Flat-sedge				223	VT	1	I,M ,S
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax lily				43	VT	N	F,I
<i>Elymus scaber var. scaber</i>	Native Wheat-grass				461	GT	1	I
<i>Euphorbia drummondii</i>	Caustic Spurge				463	J	T	I

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34	J	1	S
<i>Helichrysum luteoalbum</i>	Jersey Everlasting				227	J	N	I,M
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush				59	VL	1	I
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	T	I
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25	VT	T	I
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	T	I
<i>Oxalis perennans</i>	Native Sorrel				21	J	N	F
<i>Rumex dumosus</i>	Wiry Dock		R		164	J	N	M, S
<i>Sida corrugata var. angustifolia</i>	Corrugated Sida				86	J	T	F,I
<i>Avena barbata</i>	Bearded Oat			*	24	GT	2	S
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	1	S, M
<i>Bromus diandrus</i>	Great Brome			*	188	GL	1	M,I
<i>Cynara cardunculus ssp. flavescens</i>	Artichoke Thistle			**	106	J	N	F
<i>Cynodon dactylon var. dactylon</i>	Couch			*	224	GL	1	V
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	S, M
<i>Ehrharta longiflora</i>	Annual Veldt Grass			*	210	GT	1	X
<i>Lolium sp.</i>	Ryegrass			*	-	GL	T	M
<i>Medicago polymorpha</i>	Burr-medic			*	NV	J	T	S
<i>Oxalis pes-caprae</i>	Soursob			*	61	J	T	V
<i>Pennisetum clandestinum</i>	Kikuyu			*	225	GL	T	V
<i>Piptatherum miliaceum</i>	Rice Millet			*	179	GT	N	M,I
<i>Romulea rosea var. australis</i>	Common Onion-grass			*	2	J	1	S
<i>Trifolium angustifolium</i>	Narrow-leaf Clover			*	159	J	T	S,I, M
<i>Vicia sativa</i>	Common Vetch			*	V	J	T	I,M
<i>Vulpia myuros forma myuros</i>	Rats-tail Fescue			*	226	GL	1	S, M

** NRM declared species for the area requiring landholder control

No additional flora recorded – site turned into a road in 2013.

No fauna recordings.

6.13 Stebonheath Roadside Reserve

Local Government Area: City of Playford

Location: Narrow road side reserve, eastern side of road

Site Identification: PLA STE 01

Opportunistic Collection Site: Yes

AMG Zone: 54 Easting: 288148 Northing: 6164138

Date of Survey: 24/10/12 **Follow-up Opportune collection:** 23/11/2012. Spring 2013.

Altitude: 40 metres

Estimated average rainfall: 475 mm

Site Description

Stebonheath Road has a narrow roadside reserve containing a relatively diverse range of native species. Whilst the site contains native grassland, there is currently one remnant tree on it. Historical aerial photos dating back to 1935 consistently show this single tree in the area. Areas of *Eucalyptus porosa* woodland occurred not far to the west of this site according to early records (the Peachey Belt woodland) and this single tree is an outlier from that woodland area. The adjacent properties are used for horticulture with urban development of the area likely to occur in the near future.

Like most roadsides, parts of the vegetation are very weedy, however there are sections of the site, which contain diverse grassland and are also relatively weed-free. Maintenance of roads tends to have negative impacts on vegetation, especially narrow roadside reserves. This site, however, contains a surprising diversity of native species.

General Description of Vegetation

The vegetation type within the roadside reserve contains a high number of native grass species, two irongrass species, a low number of native herbs and a range of common weed species. There are areas along the roadside that are quite degraded. This tends to occur closer to houses, where private gardens can “export” garden plants into roadsides. There are areas of the road reserve further to the south of the survey site which contain native shrub species as well as trees. There are also introduced trees and shrubs, which may have been planted (as opposed to spreading there).

Survey Site Specific Vegetation Description

The surveyed site measured 5 by 180 metres and contained vegetation classified as **tussock grassland**.

Like most of the sites surveyed, this site also contains some native species that have conservation significance which were not found elsewhere in the survey. This is surprising given that the site is very narrow.

Run-off from the bituminized road has increased the level of perennial weed infestation. Couch as well as Galenia are two weed species that are thus advantaged and may increase in the future. False Brome, Wild Oats and Silver grass (*Vulpia sp.*) were recorded and appear to be the most frequent species on the site. Whilst several other weed species appear to be causing a threat to the biodiversity assets of the site, these aforementioned weeds may preclude the establishment of native species.

Landform Pattern:	plain	Landform Element:	clay plain
Site Slope:	0%	Outcrop Cover:	none apparent
Outcrop Lithology:	not identified	Surface Strew Size:	none apparent
Soil Texture Class:	clay loam	Bare Earth Estimate:	10 %
Litter Estimate:	5 %	Vegetation Condition:	degraded natural

Summary of Conservation Values

It is unusual to find such a diversity of species on a narrow strip adjacent a road. The diversity of grass species as well as the number of species of conservation significance would not normally be expected in such a narrow strip of vegetation.

The presence of several annual weed species (Silver grass, Wild Oats etc.), as well as a number of perennial species which are favoured by run-off from the adjacent road further add to the unlikelihood of such a site existing.

The recording of Cotton Panic Grass (*Digitaria brownii*), Red-leg Grass (*Bothriochloa macra*) – State rated Rare species, and Wire Grass (*Aristida australis*) – State rated Rare species, at the site is of significance given the heavy clearance that has occurred on the Adelaide Plains. The site also contains an important remnant of Kangaroo Grass (*Themeda australis*) – historically the dominant species of the grasslands of the Adelaide Plains. Other isolated Kangaroo Grass remnants occur in the region such as near the Womma train station and in patches at Reeves Plains and towards Mallala but such remnants are now very rare.

The site might also be assessed as *Lomandra effusa/L. multiflora ssp. dura* (irongrass) native tussock grassland, which is of very high conservation value - Commonwealth EPBC Act Critically Endangered. It contains both key *Lomandra* species although in small numbers. This site appears to fit a Class B or Class C EPBC site. A class B site requires the following attributes in an area of 2500 square metres (0.25 hectares) - more than 15 native plant species (20 recorded here in 900 square metres plus two others close by, three or more broad-leaved herbaceous native species excluding six disturbance resistant species (three recorded here in 900 square metres and two nearby), at least four native grass species (13 recorded here in 900 square metres) and have at least 50 native tussock on a 50 metre transect (not checked here but expect site to qualify as there is a good density of grass tussocks on the site.

Current and Future Management Regime

As for most of the sites on this survey, this site is managed in a haphazard manner. It appears likely that the area has been significantly affected by roadside weed spraying as the level of herbaceous native species has been reduced to low number which would not be expected to occur without cultivation or herbicides. Three *Crassula* species and a *Sida* species were found on the site. *Boerhavia dominii* and *Helichrysum luteoalbum* were noted on the road reserve nearby – two herbaceous natives which seem to be able to survive some herbicide spraying. This was the only site that did not record *Maireana enchylaenoides* which is a survivor under most conditions in the region apart from herbicide spraying.

The narrow configuration of the site is a disadvantage to its on-going survival. Such narrow areas of native vegetation are more likely to be affected by adjacent land use. Road maintenance activities affect the site, with untargeted weed spraying likely to occur. Neighbouring properties undertake activities, which may also affect the site, such as weed spraying for horticultural purposes.

Under the existing management regime, it is our opinion a downward trend in native species diversity and cover abundance will continue, whilst increase in weed species cover abundance can be expected.

The surrounding area is zoned for future housing development. Given the need for open space in new urban areas, the opportunity exists for Playford Council to develop native grassland areas. Such areas can be maintained with a regular program of slashing which is consistent with maintenance of a wide range of native grass species and many low profile herbaceous species such as *Sida sp.*, *Convolvulus sp.*, *Atriplex semibaccata*, *Atriplex suberecta*, *Ptilotus sp.*, smaller daisy species and the like. Hopefully this survey will provide some impetus for grassland restoration to match nearby Playford council work restoring areas of grassy woodland in the open space buffer along Dalkeith Road.



Photo 99: PLA-STE-01, BS386, 24/10/12. Road verge (looking south) is regularly mown. Horticultural use to the east and the isolated *Eucalyptus porosa* in the distance.



Photo 100: Spring 2013, weed spraying at SA Water marker - decades old Scented Irongrass (*Lomandra effusa*) near fence is hard to kill but someone managed it.



Photo 101: Spring 2013, A carpet of *Crassulas* appeared in 2013 on a number of patches of the site.

Table 14a: Site flora records PLA-STE-01

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Aristida australis</i>	Wire grass		R		229	GT	T	I
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	2	I,M
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				460	GL	1	M,I
<i>Austrostipa blackii</i>	Crested Spear-grass				46	GT	T	I,M
<i>Austrostipa drummondii</i>	Cottony Spear-grass				60	GT	T	I,M
<i>Austrostipa eremophila</i>	Rusty Spear-grass				171	GT	1	I,M
<i>Austrostipa nodosa</i>	Tall Spear-grass				191, 455, 456	GT	1	I,M
<i>Bothriochloa macra</i>	Red-leg Grass		R		230	GT	T	M
<i>Chloris truncata</i>	Windmill Grass				80	GL	T	I
<i>Crassula colligata</i> ssp. <i>colligata</i>	Crassula				457	J	T	M
<i>Crassula colorata</i> var. <i>acuminata</i>	Dense Crassula				208	J	T	I
<i>Digitaria brownii</i>	Cotton Panic-grass				202	GL	T	I

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	1	I
<i>Enteropogon acicularis</i>	Umbrella Grass				183	GL	1	I,M
<i>Eucalyptus porosa (single tree)</i>	Mallee Box				500	T	N	F
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	T	V
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25	VT	T	I
<i>Sida corrugata var. angustifolia</i>	Grassland Sida				189	GT	T	I
<i>Themeda australis</i>	Kangaroo Grass				78	GT	2	F,I
<i>Avena barbata</i>	Bearded Oat			*	24	GL	T	I
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	1	I
<i>Bromus diandrus</i>	Great Brome			*	188	GL	1	I,M
<i>Conyza bonariensis</i>	Flax-leaf Fleabane			*	-	J	N	I,M
<i>Cynodon dactylon var. dactylon</i>	Couch			*	224	GL	T	V
<i>Ehrharta longiflora</i>	Annual Veldt Grass			*	210	GL	T	M, X
<i>Galenia pubescens var. pubescens</i>	Coastal Galenia			*	207	P	T	F,I
<i>Galium murale</i>	Small Bedstraw			*	458	J	T	M
<i>Lolium rigidum</i>	Wimmera Ryegrass			*	58	GL	T	I
<i>Olea europaea ssp. europaea</i>	Olive			**	31	SD	N	V
<i>Rostraria cristata</i>	Annual Cat's-tail			*	231	GL	T	F,I
<i>Sonchus oleraceus</i>	Common Sow-thistle			*	139	J	N	F,I
<i>Trifolium angustifolium</i>	Narrow-leaf Clover			*	159	J	T	I
<i>Trifolium arvense var. arvense</i>	Hare's-foot Clover			*	29	J	1	I
<i>Vulpia bromoides</i>	Squirrel-tail Fescue			*	32	GL	1	M

Table 14b: Additional species on site spring 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Crassula decumbens var. decumbens</i>	Spreading Crassula				V	J	T	F

Table 14c: Opportune flora records close to site 2012

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Boerhavia dominii</i>	Tar-vine				339
<i>Helichrysum luteoalbum</i>	Jersey Everlasting				227

** NRM declared species for the area requiring landholder control

6.14 Spring Gully Gawler East EPBC Irongrass grassland site

Local Government Area: Town of Gawler
Location: Partly fenced area south of Spring Gully creek line
Site Identification: Not an official Survey site. Opportune records only.
Opportunistic Collection Site: Yes
AMG Zone: 54 Easting: 299975 Northing: 6167977
Date of “Survey”: November 2011, January 2013
Follow-up Opportune collection: August 2013, January 2014.
Altitude: 80 metres
Estimated average rainfall: 480 mm

Site Description

The Spring Gully site comprises an area of about 1.5 hectares, which was assessed as *Lomandra effusa/L. multiflora ssp. dura* (irongrass) native tussock grassland for an EPBC referral in 2011³⁴. The referral also related to likely habitat for Flinders Ranges Worm-lizard – an EPBC Vulnerable species. Iron-grass Natural Temperate Grassland of South Australia was listed as a Critically Endangered plant association under the EPBC Act in 2007. At that time Gawler was not included in the EPBC map showing likely occurrence of the association. As a result of the referral of this site in 2011 and other information supplied to the Commonwealth, the EPBC map now shows Gawler and surrounds as an area of possible occurrence.

The site contains a few small *Eucalyptus porosa* trees and a few shrubs but is otherwise mainly native and introduced grasses herbs and forbs. The vegetation is quite weedy. For this survey almost 30 introduced species have been identified. Across the whole farm of (some 200 hectares), the EPBC Referral report identified around 100 introduced species – a rather high number.

This bad weed situation has arisen from a combination of a sand quarry on the property which operated for about 40 years from the 1950s and a history of agistment of sheep plus having a significant horse population (with imported hay). This irongrass site clearly has never been cultivated and contains a surprising diversity of native species.

General Description of Vegetation

The vegetation within the area contains a range of native grasses and herbaceous species and some shrubs as well as a wide range of weeds – mainly grasses, herbs and shrubs. The adjacent creek line contains a thick sedge cover, resulting from a permanent spring feeding the creek a few hundred metres to the east. The site assessment excluded the wetland plants growing in the creek line but covered some grassland species growing on the creek bank.

Survey Site Specific Vegetation Description

The site from which data is presented is the whole 1.5 hectares and contained vegetation that was classified as ***Lomandra effusa/L. multiflora ssp. dura* (irongrass) native tussock grassland**. The cover abundance figures presented in the following table have been adjusted where appropriate to reflect the relative number of plant which would occur on a 900 square metre site.

³⁴ www.environment.gov.au/cgi-bin/epbc/epbc_ap.pl?name=current_referral_detail&proposal_id=5826 has details of the EPBC referral and decision.

Like most of the sites surveyed, this site contains some native species that have conservation significance and which were not found elsewhere in the survey.

Landform Pattern:	north facing slope	Landform Element:	red-brown earth
Site Slope:	not measured, steep in parts	Outcrop Cover:	Less than 5%
Outcrop Lithology:	local bluestone in creek	Surface Strew Size:	not measured
Soil Texture Class:	clay loam	Bare Earth Estimate:	5 %
Litter Estimate:	5 %	Vegetation Condition:	degraded natural

Summary of Conservation Values

KBR consultants recorded the site as an EPBC Class B irongrass tussock grassland. The EPBC assessment of the site by KBR consultants³⁵ only recorded about half the number of native species compared to that recorded by Gawler Environment & Heritage Association members in two survey visits.³⁶

Based on assessment by GEHA leading to the preparation of this report, the site could be regarded as borderline between an A and B class site. It is of very high conservation significance. The outcomes of the EPBC referral were requirements for removal of stock grazing, an ongoing weed control program and an intention that when the nearby area is developed for housing that about three hectares of land will become a reserve in perpetuity for protection and expansion of the irongrass community.

The recording of Rohrlach's Bluebush (*Maireana rohrlachii*) – State rated Rare species at the site is of significance. Small populations of this species also occur in nearby Town of Gawler Dead Man's Pass and Clonlea reserves. The recording of Silky Umbrella-grass (*Digitaria ammophila*) was also a surprise as this species has not been recording anywhere in the Gawler region before. The site also contains an important remnant of *Themeda australis* – historically the dominant species of the grasslands of the Adelaide Plains and these parts of the foothills.

Current and Future Management Regime

The site is currently being managed in part for the owner by a weed contractor who has been removing Artichoke Thistles, Olives, African Boxthorns and other major woody weeds. In order to produce better conditions for the native species on the site, reduction of the weed competition from introduced grasses and forbs is also a priority.

With the surrounding area proposed to be developed for residential housing, there will be ongoing issues with weeds and management of human impacts which will need to be addressed. If the remnant is well conserved this will be an important feature of the area for future residents to understand, appreciate and assist in protecting.

³⁵ Kellogg Brown & Root Pty Ltd 20 August 2010 *Gawler East Development Plan Amendment. Gawler East Ecological Survey* Prepared for Delfin Lend Lease

³⁶ Gawler Environment & Heritage Association (2011) submission February 2011 on the Gawler East EPBC Referral available on www.geha.org.au and Gawler Environment & Heritage Association (2009) Submission on Gawler East Development Plan Amendment (conservation related extracts – See Appendix 4 of submission)



Photo 102: Spring 2013, Mobile phone photo of Flinders Ranges Worm-lizard in creek locality.



Photo 103: Spring Gully resident noseying around.



Photo 104: Summer 2012/13 *Digitaria ammophila* growing on rocky ledge with extra moisture.



Photo 105: Summer 2012/13 Silky Blue-grass (*Dichanthium sericeum* ssp. *sericeum*) growing on rocky ledge.



Photo 106: Summer 2012/13 Moss and colourful lichens finding a home on a rocky outcrop.



Photo 107: Summer 2012/13 *Aristida behriana* maintaining a green presence with Artichokes and a Pepper-tree also doing much too well. Typical steep creek bank for the site.

Table 15a: "Site" flora records Spring Gully Gawler East

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Acacia pycnantha</i>	Golden Wattle				98	SA	N	M
<i>Aristida behriana</i>	Brush Wire-grass				4	GL	1	M
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				215	J	N	F
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71	J	N	M
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				76	GT	T	M
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				35	GT	T	M
<i>Austrostipa blackii</i>	Crested Spear-grass				46	GT	1	M
<i>Austrostipa drummondii</i>	Cotony Spear-grass				60			
<i>Austrostipa eremophila</i>	Rusty Spear-grass				18	GT	T	M
<i>Austrostipa nodosa</i>	Tall Spear-grass				62	GT	T	M
<i>Boerhavia dominii</i>	Tar-vine				339	J	T	F
<i>Calostemma purpureum</i>	Pink Garland-lily				89	J	N	V
<i>Cheilanthes distans</i>	Bristly Cloak-fern				253	X	N	I
<i>Chloris truncata</i>	Windmill Grass				80	GL	N	M
<i>Convolvulus angustissimus var angustissimus</i>	Pink Convolvulus				1	J	N	F
<i>Convolvulus remotus</i>	Australian Convolvulus				258	J	N	F
<i>Crassula colligata ssp. colligata</i>	Crassula				228	J	N	F
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily				43	VL	N	M
<i>Dichanthium sericeum ssp. sericeum</i>	Silky Blue Grass				178	GL	T	F
<i>Digitaria ammophila</i>	Silky Umbrella-grass				505	GL	N	F M
<i>Dysphania pumilio</i>	Clammy Goosefoot				-	J	N	F
<i>Enchylaena tomentosa var. tomentosa</i>	Ruby Saltbush				192	SD	N	I
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	1	M
<i>Enteropogon acicularis</i>	Umbrella Grass				183	GL	N	M
<i>Eucalyptus porosa</i>	Mallee Box				500	LB	N	I
<i>Euphorbia drummondii</i>	Caustic Spurge				70	J	T	F
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia				34	J	N	F
<i>Lomandra densiflora</i>	Scented Mat-rush				59	VL	N	V
<i>Lomandra effusa</i>	Scented Mat-rush				3	VL	1	V
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25	VL	T	V
<i>Maireana brevifolia</i>	Short-leaf Bluebush				221	SD	N	F
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant				5	J	T	FI
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush	R			36	SD	N	V
<i>Oxalis perennans</i>	Native Sorrel				21	J	T	FI
<i>Pimelea micrantha</i>	Silky Riceflower				48	J	N	I
<i>Ptilotus spathulatus forma spathulatus</i>	Pussy-tails				73	J	N	I

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Sida corrugata</i> var. <i>angustifolia</i>	Grassland Sida				189	J	N	F I
<i>Teucrium racemosum</i>	Grey Germander				152	J	N	V
<i>Themeda australis</i>	Kangaroo Grass				78	GT	1	M
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy				54	J	T	M
<i>Vittadinia cuneata</i> var. <i>cuneata</i>	Fuzzy New Holland Daisy				211	J	T	M
<i>Walwhalleya prolata</i>	Rigid Panic				392	GL	N	I
<i>Aira</i> sp	Hair Grass			*		J	N	M
<i>Anagallis arvensis</i>	Pimpernel			*	130	J	N	M
<i>Asphodelus fistulosus</i>	Onion Weed			*	166	J	1	M
<i>Asteriscus spinosus</i>	Golden Pallensis			*	158	J	N	M
<i>Avena</i> sp	Wild Oat			*		GT	1	M
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	2	F M
<i>Briza maxima</i>	Large Quaking-grass			*	79	J	N	X
<i>Bromus diandrus</i>	Great Brome			*	188	J	1	M
<i>Bromus hordeaceus</i>	Soft Brome			*	112	J	N	M
<i>Carthamus lanatus</i>	Saffron Thistle			*	218	J	N	M
<i>Cynara cardunculus</i> ssp. <i>flavescens</i>	Artichoke Thistle			**	106	J	N	F
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	1	M
<i>Helminthotheca echiodes</i>	Ox-tongue			*	-	J	N	F
<i>Hordeum murinum</i>	Barley-grass			*	-	GL	T	M
<i>Lolium rigidum</i>	Wimmera Ryegrass			*	58	GL	T	M
<i>Marrubium vulgare</i>	Horehound			**	20	SD	T	M
<i>Olea europaea</i> ssp. <i>europaea</i>	Olive			**	31	SC	T	V
<i>Rapistrum rugosum</i> ssp. <i>rugosum</i>	Turnip Weed			*	128	J	N	M
<i>Romulea rosea</i> var. <i>australis</i>	Common Onion-grass			*	2	J	N	M
<i>Rumex crispus</i>	Curly Dock			*		J	N	M
<i>Salvia verbenaca</i> var. <i>verbena</i>	Wild Sage			*	14	J	T	M
<i>Schinus molle</i>	Pepper-tree			*	173	LB	N	V
<i>Sonchus oleraceus</i>	Common Sow-thistle			*	139	J	N	X
<i>Trifolium angustifolium</i>	Narrow-leaf Clover			*	159	J	T	M
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover			*	29	J	1	M
<i>Trifolium campestre</i>	Hop Clover			*	11	J	T	M
<i>Vulpia</i> sp.	Fescue			*		GL	T	M
<i>Withania somnifera</i>	Winter Cherry			*	V	SD	N	I

** NRM declared species for the area requiring landholder control

Table 15b: Extra flora species on "site" spring 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula				V	J	1	F
<i>Pleurosus rutifolius</i>	Blanket Fern				V	X	1	V
<i>Stackhousia monogyna</i>	Creamy Candles				91	J	N	F

Table 15c: Opportune flora records close to site 2012, 2013

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Acacia acinacea</i>	Wreath Wattle				108
<i>Carex bichenoviana</i>	Notched Sedge				V
<i>Poa labillardieri</i> var. <i>labillardieri</i>	Tussock-grass				473
<i>Vittadinia cervicalis</i> var. <i>circularis</i>	Waisted New Holland Daisy				67
<i>Vittadinia megacephala</i>	Giant New Holland Daisy				19
<i>Aster subulatus</i>	Aster weed			*	-

Fauna observations – Spring Gully locality

Table 15d: Opportune bird records near site 2 March 2013 – observer Dragos Moise. Several species were recorded in South Para corridor near Spring Gully including state Rare Crested Shrike-tit two adults and juvenile.

Common name	Genus	Species	A	SA	Int'd	Number
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				3
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				3
Brown Goshawk	<i>Accipiter</i>	<i>fasciatus</i>				1
Brown Goshawk	<i>Accipiter</i>	<i>fasciatus</i>				1
Crested Pigeon	<i>Ocyphaps</i>	<i>lophotes</i>				3
Crested Shrike-tit	<i>Falcunculus</i>	<i>frontatus</i>		R		3
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>				6
Little Pied Cormorant	<i>Microcarbo</i>	<i>melanoleucos</i>				1
Little Raven	<i>Corvus</i>	<i>mellori</i>				1
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>				2
New Holland Honeyeater	<i>Phylidonyris</i>	<i>novaehollandiae</i>				6
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>				2
Rufous Whistler	<i>Pachycephala</i>	<i>rufiventris</i>				1
Superb Fairy-wren	<i>Malurus</i>	<i>cyaneus</i>				2
Tawny Frogmouth	<i>Podargus</i>	<i>strigoides</i>				1
Weebill	<i>Smicrornis</i>	<i>brevirostris</i>				5
White-plumed Honeyeater	<i>Lichenostomus</i>	<i>penicillatus</i>				6
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>				2
Yellow-rumped Thornbill	<i>Acanthiza</i>	<i>chrysorrhoa</i>				8
Common Blackbird	<i>Turdus</i>	<i>merula</i>			*	1
House Sparrow	<i>Passer</i>	<i>domesticus</i>			*	5
Rock Dove	<i>Columba</i>	<i>livia</i>			*	2

Table 15e: Additional opportune bird records near site other birds recorded near the irongrass grassland site by GEHA 2011, 2012

Common Name	Genus	Species	A	SA	Int'd	Number
Diamond Firetail	<i>Stagonopleura</i>	<i>guttata</i>		V		2
Peregrine Falcon	<i>Falco</i>	<i>peregrinus</i>		R		2
White-winged Chough	<i>Corcorax</i>	<i>melanorhamphos</i>		R		6

Table 15f: Opportune reptile records near site 2013 – observer Peter Matejcic and Adrian Shackley

Common name	Genus	Species	A	SA	Int'd	Number
Eastern Striped Skink	<i>Ctenotus</i>	<i>robustus</i>				1
Speckled Wall Skink	<i>Cryptoblepharus</i>	<i>pannosus</i>				1
Flinders Ranges Worm-lizard	<i>Aprasia</i>	<i>pseudopulchella</i>	EPBC V			1

The KBR reports for Delfin Lend Lease recorded some 12 reptile species, most of which would be potential users of the irongrass grassland site, including the EPBC Vulnerable species Flinders Ranges Worm-lizard. Flinders Ranges Worm-lizard is usually only seen in winter and early spring when moist soils attract them to the surface. In the dry months they burrow down in the soil and hence are unlikely to be found in usual reptile searching in late spring and summer when most other reptiles are active.

Table 15g: Opportune mammal records near site 2012, 2013

Common name	Genus	Species	A	SA	Int'd	Number
Euro	<i>Macropus</i>	<i>robustus</i>				2
Short-beaked Echidna	<i>Tachyglossus</i>	<i>aculeatus</i>				1
Western Grey Kangaroo	<i>Macropus</i>	<i>fuliginosus</i>				2
Black/Common Rat	<i>Rattus</i>	<i>rattus</i>			*	2
Cat	<i>Felis</i>	<i>catus</i>			*	3
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	1
House Mouse	<i>Mus</i>	<i>musculus</i>			*	20
Rabbit	<i>Oryctolagus</i>	<i>cuniculus</i>			*	2

Table 15h: Opportune frog records near site 2013

Name	Genus	Species	NPWSA	Int'd	Number
Clicking Froglet	<i>Crinia</i>	<i>signifera</i>			20
Eastern Banjo Frog	<i>Limnodynastes</i>	<i>dumerilli</i>			2
Spotted Grass Frog	<i>Limnodynastes</i>	<i>tasmaniensis</i>			20

Amphibians

In 2011 and 2012 no amphibians were recorded in the Spring Gully creek. These visits were late spring and summer when breeding may have ceased or the water may have been too saline for frogs to stay. However, in early spring 2013 after a wet winter, three species were recorded, two in significant numbers.

Additional records

In addition to the GEHA records, we have contacted Mr Steve Kerrison, contractor working on weed control along the creek line and in and near the irongrass site during the last two years. Mr Kerrison has spent quite a few weeks in total working on the locality. Reptile species recorded by Mr. Kerrison include more than a dozen Eastern Brown Snakes and a Flinders Ranges Worm-lizard found in early spring of 2013 on the northern creek bank (picture page 105).

Mr. Kerrison reported a large range of raptors in the area, including a pair of Wedge-tail Eagles regularly seen. Other birds of interest include Rainbow Bee-eaters as regular spring and summer visitors, including nesting in the sand mine area to the north of the site.

Additional mammal species seen on site by Mr. Kerrison are House Mouse, Common Rat, Rabbit and Domestic Cat – not surprising given the close proximity to residential areas.

Mycorrhiza and fungi

Mr. Kerrison is also a keen observer of mycorrhiza and fungi and is compiling a list of observations on site. One of species seen to date is shown below. Among fungi identified to date (mostly only to genus because of the difficulty in keying to species) are Stalked Puffballs (*Battarrea stevenii*) which can grow to about 25 centimeters high, four *Mycena* species, two *Agericus* species, *Sterum illudnes*, one *Gynopolis* species (Big Jim), one *Fuligo* species, one *Amanita* species, one *Bovista* species and one *Clitocybe* species (species with grassland as preferred habitat).



Photo 108: Fungus at Spring Gully.

6.15 Para Woodland southern site BAR – KER - 01

Two additional sites were surveyed because they have recently been purchased by Nature Foundation SA to add to the Para Woodland conservation and restoration project. The land was purchased at about the time the survey was conducted. The survey sites at the time of survey were grassland sites but the original native vegetation in the area might well have been mixed grassland and grassy woodland judging by the surrounding area. This area has higher rainfall and different soil types compared with the other survey sites. The data from these two sites has not been included in the summary of the other 14 sites which is presented elsewhere in this report.

Local Government Area: The Barossa Council

Location: Section 710 Hundred of Barossa

Site Identification: BAR – KER - 01

Opportunistic Collection Site: Yes

AMG Zone: 54 Easting: 298852 Northing: 6163564

Date of Survey: October 27 2012 **Follow-up Opportune collection:** December 2012.

Altitude: 170 metres

Estimated average rainfall: 575 - 600mm

Site/paddock general description

The block comprises about 100 hectares of land adjoining Allendale Road about 8 km. south-east of Gawler. The land is generally relatively steep and has been used for grazing for most of the c.160 years since this area would have been first used for farming and grazing. Some areas may have been cultivated but not in recent years. Some tree clearance is apparent and the whole 100 ha would appear to have been a mix of grassy woodland (mix of mainly red gum, blue gum and box) and grassland in 1860 with an interesting area of a few hectares of *Eucalyptus socialis*, *Melaleuca lanceolata* and *Gahnia lanigera* on one of the calcareous rises on the land. There is also native pine in some places on the adjoining road. The quadrat site itself is part of a stony outcrop in an area of open grassland.

Description of Vegetation

The vegetation in the locality was an interesting mix of native grasses, herbs and shrubs plus quite a few weed species. The vegetation type within the area surveyed was classified as **tussock grassland**.



Photo 109: Survey quadrat looking south and down the slope. Woodland patch is in the neighbouring property.



Photo 110: December 2012, Survey quadrat looking north up the slope. *Aristida behriana* flowering.

Survey Site Specific Vegetation Description

Landform Pattern:	south facing slope	Landform Element:	-
Site Slope:	-	Outcrop Cover:	-
Outcrop Lithology:	-	Surface Strew Size:	not measured
Soil Texture Class:	clay loam	Bare Earth Estimate:	5 %
Litter Estimate:	5 %	Vegetation Condition:	degraded natural

Summary of Conservation Values

The site contained a good range of native grassland species. No species of conservation status beyond regional were recorded.

Species with Southern Lofty conservation ratings occurred on site of in the locality - *Cymbopogon ambiguous* (Southern Lofty Vulnerable rating), *Cymbopogon obtectus* (Southern Lofty Rare rating), *Aristida behriana*, *Austrostipa eremophila*, *Amphipogon caricinus*, *Lomandra sororia* and *Austrostipa setacea* (all Southern Lofty Uncommon).

Current Management Regime and issues

The site at the time was being managed for commercial grazing. Restoration of a grassland and grassy woodland association will be the priority for the Para Woodland project. The area has been aerial sprayed with a broadleaf herbicide in recent years for Artichoke Thistle control which might explain the relatively low occurrence of herbaceous plant species on the site and paddock generally. Weed control will be an ongoing issue because of the current dominance of introduced grasses and clovers across the property. Weed orchid *Disa bracteata* is in low numbers, allowing potential to control and Pussy-tail Grass (*Pentameris pallida* - formerly *Pentaschistis pallida*) in small patches also to be considered for control.

Table 16a: Site flora records Para Woodlands Site BAR - KER-01

Scientific name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Acaena echinata</i>	Sheep's Burr				243	J	N	I
<i>Allocasuarina verticillata</i>	Drooping Sheoak				157	SD	N	V
<i>Amphipogon caricinus</i>	Grey-beard Grass				235	GL	1	I
<i>Aristida behriana</i>	Brush Wire-grass				3	GL	2	B
<i>Astroloma humifusum</i>	Cranberry Heath				247	P	N	V
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass				83	GL	1	IM
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				76	GL	T	BV
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass				35	GL	T	M
<i>Austrostipa blackii</i>	Crested Spear-grass				232	GT	1	I
<i>Austrostipa eremophila</i>	Rusty Spear-grass				234	GT	N	B
<i>Austrostipa mollis</i>	Soft Spear-grass				239	GT	T	B
<i>Cheilanthes austrotenuifolia</i>	Annual Rock-fern				V	X	T	V
<i>Convolvulus remotus</i>	Australian Convolvulus				245	V	T	F
<i>Cymbopogon obtectus</i>	Silky-head Lemon-grass				246	GL	T	V
<i>Gonocarpus elatus</i>	Hill Raspwort				162	J	1	V
<i>Hibbertia exultiacies</i>	Prickly Guinea-flower				236	SD	N	V
<i>Lomandra densiflora</i>	Scented Mat-rush				59	VL	N	V

Scientific name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush				25	VL	N	V
<i>Lomandra nana</i>	Small Mat-rush				244	VL	T	B
<i>Lomandra sororia</i>	Sword Mat-rush				238	VL	N	V
<i>Ptilotus spathulatus forma spathulatus</i>	Pussy-tails				73	J	N	I
<i>Schoenus apogon</i>	Bog-rush				237	VL	T	V
<i>Themeda australis</i>	Kangaroo Grass				78	GT	T	B
<i>Tricoryne elatior</i>	Tufted Yellow Rush-lily				241	J	N	I
<i>Aira sp.</i>	Hair Grass			*		GL	T	I
<i>Avena barbata</i>	Bearded Oat			*	4	GT	T	MX
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	T	I
<i>Briza maxima</i>	Large Quaking-grass			*	79	GL	T	M
<i>Bromus diandrus</i>	Great Brome			*	188	GT	T	I
<i>Centaureum tenuifolium</i>	Common Centaury			*	131	J	T	F
<i>Disa bracteata</i>	South African Orchid			*	240	J	T	I
<i>Ehrharta longiflora</i>	Annual Veldt Grass			*	210	GL	N	X
<i>Hypochaeris radicata</i>	Rough Cat's Ear			*	107	J	T	B
<i>Parentuccella latifolia</i>	Yellow Bartsia			*	242	J	T	FI
<i>Pentameris pallida</i>	Pussy-tail Grass			*	233	GL	2	BF
<i>Trifolium angustifolium</i>	Narrow-leaf Clover			*	159	J	T	F
<i>Trifolium arvense var. arvense</i>	Hare's-foot Clover			*	29	J	T	I
<i>Trifolium campestre</i>	Hop Clover			*	11	J	1	I

Table 16b: Opportune flora records close to site 2012

Scientific name	Common Name	A	SA	Int'd	Voucher
<i>Acacia paradoxa</i>	Kangaroo Thorn				100
<i>Austrostipa setacea</i>	Corkscrew Spear-grass				278
<i>Bursaria spinosa ssp. spinosa</i>	Sweet Bursaria				37
<i>Cymbopogon ambiguus</i>	Lemon-grass				220
<i>Lomandra micrantha ssp. micrantha</i>	Small-flower Mat-rush				26
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy				51

Table 16c: Native species in adjacent woodland south-east of site - in background of site photo.

Scientific name	Common Name	A	SA	Int'd	Voucher
<i>Acrotriche depressa</i>	Native Currant				-
<i>Arthropodium strictum</i>	Spring Vanilla-lily				71
<i>Austrostipa elegantissima</i>	Feather Spear-grass				84
<i>Callitris gracilis</i>	Southern Cypress Pine				490
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily				43
<i>Dodonaea viscosa ssp. spatulata</i>	Sticky Hop-bush				165
<i>Eucalyptus fasciculosa</i>	Pink Gum		R		-

Scientific name	Common Name	A	SA	Int'd	Voucher
<i>Eucalyptus leucoxylon</i> ssp. <i>leucoxylon</i>	South Australian Blue Gum				-
<i>Eucalyptus odorata</i>	Peppermint Box				V
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge				81
<i>Leptorhynchos squamatus</i> ssp. <i>squamatus</i>	Scaly Buttons				94
<i>Pittosporum angustifolium</i>	Native Apricot				193
<i>Xanthorrhoea quadrangulata</i>	Mount Lofty Grasstree				-

Xanthorrhoea quadrangulata is also on the Para Woodland property not far west of the site (Dragos Moise pers. comm.)

Fauna observations – BAR-KER-01 Site and locality.

Table 16d: Opportune bird records near site 27 October 2012 – observer Dragos Moise

Common name	Genus	Species	A	SA	Int'd	Number
Australasian Pipit	<i>Anthus</i>	<i>novaeseelandiae</i>				1
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				2
Black-faced Cuckoo-shrike	<i>Coracina</i>	<i>novaehollandiae</i>				1
Brown Falcon	<i>Falco</i>	<i>berigora</i>				1
Brown-headed Honeyeater	<i>Melithreptus</i>	<i>brevirostris</i>				3
Bronzewing	<i>Phaps</i>	<i>chalcoptera</i>				1
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>				3
Emu	<i>Dromaius</i>	<i>novaehollandiae</i>				4
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				1
Grey Currawong	<i>Strepera</i>	<i>versicolor</i>				2
Grey Shrike-thrush	<i>Colluricincla</i>	<i>harmonica</i>				1
Horsfield's Bronze-Cuckoo	<i>Chalcites</i>	<i>basalis</i>				1
Little Corella	<i>Cacatua</i>	<i>sanguinea</i>				1
Little Raven	<i>Corvus</i>	<i>mellori</i>				2
Peregrine Falcon	<i>Falco</i>	<i>peregrinus</i>		R		1
Red Wattlebird	<i>Anthochaera</i>	<i>carunculata</i>				1
Rufous Whistler	<i>Pachycephala</i>	<i>rufiventris</i>				1
Silvereye	<i>Zosterops</i>	<i>lateralis</i>				3
Striated Pardalote	<i>Pardalotus</i>	<i>striatus</i>				3
Superb Fairy-wren	<i>Malurus</i>	<i>cyaneus</i>				2
Tree Martin	<i>Petrochelidon</i>	<i>nigricans</i>				4
Weebill	<i>Smicrornis</i>	<i>brevirostris</i>				3
Welcome Swallow	<i>Hirundo</i>	<i>neoxena</i>				1
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>				1
Yellow-faced Honeyeater	<i>Lichenostomus</i>	<i>chrysops</i>				1
Yellow-rumped Thornbill	<i>Acanthiza</i>	<i>chrysorrhoa</i>				2

6.16 Para Woodlands northern site BAR – KER - 02

Local Government Area: The Barossa Council
Location: Section 710 Hundred of Barossa
Site Identification: BAR – KER - 02
Opportunistic Collection Site: Yes
AMG Zone: 54 Easting: 299307 Northing: 6164407
Date of Survey: 27 October 2012,
Follow-up Opportune collection: No.
Altitude: 210 metres
Estimated average rainfall: 575- 600 mm
Patch/Quadrat Size: 15 x 60 m

Site/paddock general description

See general description for the previous Para Woodlands site. This site was a steep generally northern facing slope with stony outcrops.

General Description of Vegetation

The vegetation in the locality was a mix of native grasses, herbs and shrubs with a high level of weed species. The area contained a relatively low diversity of native species (the lowest across the survey by some margin) which was interesting considering the site was a fairly stony north facing slope which often have a reasonable range of native species. The site was also the only one in the survey to have higher species numbers for introduced compared to native species (also by some margin). The vegetation type within the area surveyed was classified as **tussock grassland**.

Survey Site Specific Vegetation Description

Landform Pattern:	Hills	Landform Element:	Hill slope
Site Slope:	28 degrees, aspect 360 degrees	Outcrop Cover:	<10%
Outcrop Lithology:	not identified	Surface Strew Size:	51 -250 mm
Soil Texture Class:	Loam	Bare Earth Estimate:	5 %
Litter Estimate:	5 %	Vegetation Condition:	degraded natural

Summary of Conservation Values

No species with particular conservation significance beyond regional significance was recorded. Species with Southern Lofty conservation ratings occurred on site or nearby *Cheilanthes distans*, *Austrostipa puberula* and *Ptilotus spathulatus* (Southern Lofty Rare) and *Austrostipa eremophila* and *Aristida behriana* (Southern Lofty Uncommon).

Current Management Regime and issues

The site at the time was being managed for commercial grazing. Restoration of a grassland and grassy woodland association will be the priority for the Para Woodland project. See comment for other Para Woodlands site. The steep slope and stony patches make use of mechanical equipment difficult for weed control so well planned grazing regimes will need to be considered to shift the balance to supporting regeneration of native species.

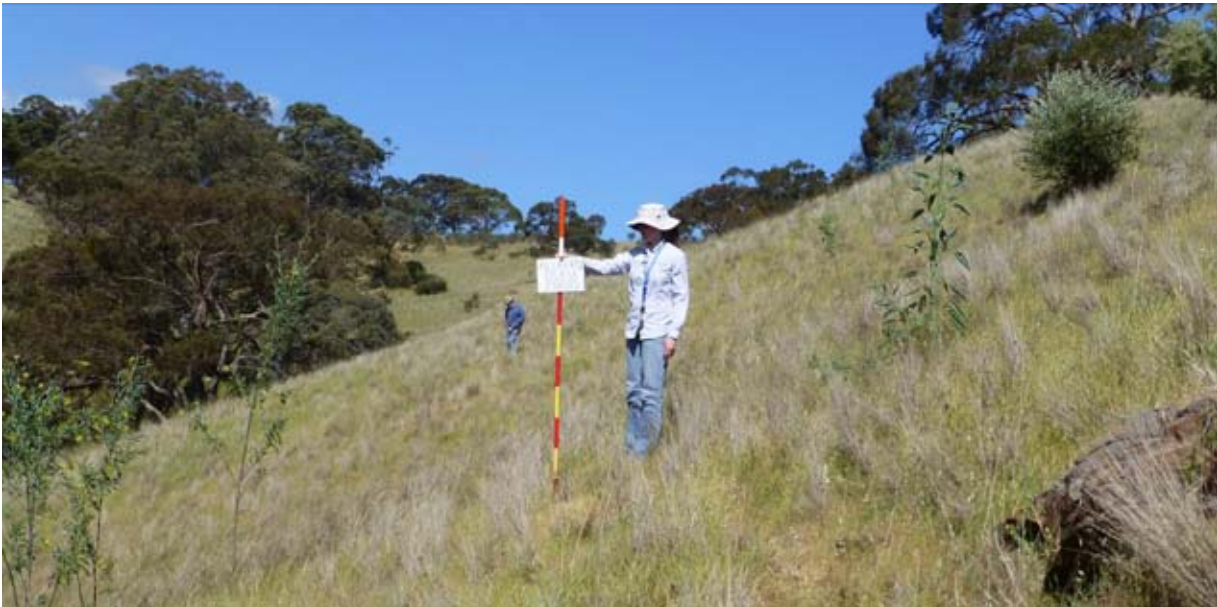


Photo 111: BAR-KER-02 December 2012, Survey quadrat looking east. Tobacco bush (*Nicotiana glauca*) prominent.



Photo 112: December 2012, Survey quadrat Pussy Tails (*Ptilotus spathulatus*) showing why it is a grazing tolerant species.

Table 17a: Site flora records Para Woodlands Site BAR - KER-02

Scientific name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Aristida behriana</i>	Brush Wire-grass				265	GL	1	B
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass				76	GL	N	B
<i>Austrostipa drummondii</i>	Cottony Spear-grass				252, 260	GT	N	B
<i>Austrostipa eremophila</i>	Rusty Spear-grass				248, 259, 261	GT	1	B
<i>Calostemma purpureum</i>	Pink Garland-lily				89	J	N	V
<i>Cheilanthes distans</i>	Bristly Cloak-fern				253	X	T	V
<i>Convolvulus angustissimus ssp. angustissimus</i>	Pink Convolvulus				250	V	T	FI

Scientific name	Common Name	A	SA	Int'd	Voucher	LF	CA	LS
<i>Enneapogon nigricans</i>	Black-head Grass				23	GL	2	T
<i>Lomandra densiflora</i>	Scented Mat-rush				59	VL	N	V
<i>Oxalis perennans</i>	Native Sorrel				21	J	T	F
<i>Ptilotus spathulatus forma spathulatus</i>	Pussy-tails				73	J	1	IM
<i>Wahlenbergia luteola</i>	Tall Bluebell				264	J	T	F
<i>Aira sp.</i>	Hair-grass			*		GL	T	I
<i>Anagallis arvensis</i>	Pimpernel			*	130	J	T	I
<i>Arctotheca calendula</i>	Cape Weed			*	69	J	N	X
<i>Avena barbata</i>	Bearded Oat			*	4	GT	1	XM
<i>Brachypodium distachyon</i>	False Brome			*	10	GL	3	M
<i>Briza maxima</i>	Large Quaking-grass			*	79	GL	T	IM
<i>Bromus diandrus</i>	Great Brome			*	249	GL	T	I
<i>Bromus hordeaceus ssp. hordeaceus</i>	Soft Brome			*	112	GL	N	I
<i>Carthamus lanatus</i>	Saffron Thistle			*	218	J	N	V
<i>Echium plantagineum</i>	Salvation Jane			**	13	J	T	F
<i>Erodium botrys</i>	Long Heron's-bill			*	256	J	N	I
<i>Hypochaeris radicata</i>	Rough Cat's Ear			*	107	J	T	V
<i>Lolium sp.</i>	Ryegrass			*		GL	T	I
<i>Moraea setifolia</i>	Thread Iris			*	8	J	T	I
<i>Neatostema apulum</i>	Hairy Sheepweed			*	255	J	T	F
<i>Nicotiana glauca</i>	Tree Tobacco			*	167	S	N	E
<i>Olea europaea ssp. europaea</i>	Olive			**	31	SD	N	V
<i>Petrorhagia velutina</i>	Childling Pink			*	251	J	T	I
<i>Romulea rosea var. australis</i>	Common Onion-grass			*	2	J	I	MX
<i>Sonchus oleraceus</i>	Common Sow-thistle			*	139	J	T	I
<i>Trifolium angustifolium</i>	Narrow-leaf Clover			*	169	J	T	I
<i>Trifolium arvense var. arvense</i>	Hare's-foot Clover			*	29	J	T	M
<i>Trifolium campestre</i>	Hop Clover			*	11	J	T	FI
<i>Trifolium scabrum</i>	Rough Clover			*	254	J	T	I
<i>Vulpia sp.</i>	Fescue			*		GL	T	MX

Table 17b: Opportune flora records close to site

Scientific Name	Common Name	A	SA	Int'd	Voucher
<i>Austrostipa nodosa</i>	Tall Spear-grass				266
<i>Austrostipa puberula</i>	Fine-hairy Spear-grass				262
<i>Convolvulus remotus</i>	Australian Convolvulus				258
<i>Elymus scaber ssp. scaber</i>	Native Wheat-grass				263
<i>Poa crassicaudex</i>	Thick-stem Tussock-grass				257
<i>Dichondra repens</i>	Kidney Plant				-

** NRM declared species for the area requiring landholder control

Fauna observations BAR- KER - 02 Site and locality

Table 17c: Opportune bird records near site 27 October 2012 – observer Dragos Moise

Common name	Genus	Species	A	SA	Int'd	Number
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				3
Black-faced Cuckoo-shrike	<i>Coracina</i>	<i>novaehollandiae</i>				2
Brown Treecreeper	<i>Climacteris</i>	<i>picumnus</i>				1
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>				6
Grey Currawong	<i>Strepera</i>	<i>versicolor</i>				1
Grey Shrike-thrush	<i>Colluricincla</i>	<i>harmonica</i>				1
Horsfield's Bronze-Cuckoo	<i>Chalcites</i>	<i>basalis</i>				1
Laughing Kookaburra	<i>Dacelo</i>	<i>novaeguineae</i>				2
Little Raven	<i>Corvus</i>	<i>mellori</i>				2
Mistletoebird	<i>Dicaeum</i>	<i>hirundinaceum</i>				1
Musk Lorikeet	<i>Glossopsitta</i>	<i>concinna</i>				2
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				1
Noisy Miner	<i>Manorina</i>	<i>melanocephala</i>				2
Pallid Cuckoo	<i>Cacomantis</i>	<i>pallidus</i>				1
Peaceful Dove	<i>Geopelia</i>	<i>placida</i>				1
Red Wattlebird	<i>Anthochaera</i>	<i>carunculata</i>				2
Red-rumped Parrot	<i>Psephotus</i>	<i>haematonotus</i>				5
Silvereye	<i>Zosterops</i>	<i>lateralis</i>				2
Striated Pardalote	<i>Pardalotus</i>	<i>striatus</i>				4
Sulphur-crested Cockatoo	<i>Cacatua</i>	<i>galerita</i>				1
Tree Martin	<i>Petrochelidon</i>	<i>nigricans</i>				4
Wedge-tailed Eagle	<i>Aquila</i>	<i>audax</i>				2
Weebill	<i>Smicrornis</i>	<i>brevirostris</i>				2
White-fronted Chat	<i>Epthianura</i>	<i>albifrons</i>				1
White-plumed Honeyeater	<i>Lichenostomus</i>	<i>penicillatus</i>				8
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	2

7. Summary of results over 14 project sites

Flora: Native species occurrence

Native species recorded over the 13 survey sites and the Spring Gully site. The 27 most commonly observed native species (at least half the sites - including nearby opportune records) are set out below in Table 18. These are typical grassland species. Of note one shrub, nine grasses, four *Lomandras* and 13 herbaceous species.

Table 18: Native flora species - most commonly occurring

Scientific name	Common name	Sites total	Opp. total	Total
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass	14		14
<i>Austrostipa nodosa</i>	Tall Spear-grass	14		14
<i>Lomandra effusa</i>	Scented Mat-rush	13	1	14
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass	13		13
<i>Austrostipa blackii</i>	Crested Spear-grass	13		13
<i>Austrostipa eremophila</i>	Rusty Spear-grass	11	2	13
<i>Lomandra multiflora ssp. dura</i>	Hard Mat-rush	12	1	13
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant	13		13
<i>Themeda australis</i>	Kangaroo Grass	11	1	12
<i>Aristida behriana</i>	Brush Wire-grass	11		11
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily	11		11
<i>Lomandra densiflora</i>	Scented Mat-rush	11		11
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily	9	1	10
<i>Arthropodium strictum</i>	Spring Vanilla-lily	9	1	10
<i>Convolvulus angustissimus ssp. angustissimus</i>	Pink Convolvulus	9	1	10
<i>Enneapogon nigricans</i>	Black-head Grass	10		10
<i>Euphorbia drummondii</i>	Caustic Spurge	6	4	10
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia	8	2	10
<i>Lomandra micrantha ssp. micrantha</i>	Small-flower Mat-rush	7	2	9
<i>Oxalis perennans</i>	Native Sorrel	8	1	9
<i>Sida corrugata var. angustifolia</i>	Grassland Sida	9		9
<i>Stackhousia monogyna</i>	Creamy Candles	7	2	9
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	7	2	9
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy	5	3	8
<i>Bursaria spinosa ssp. spinosa</i>	Sweet Bursaria	1	6	7
<i>Chloris truncata</i>	Windmill Grass	5	2	7
<i>Ptilotus spathulatus forma spathulatus</i>	Pussy-tails	6	1	7

Flora: Introduced species occurrence

The 11 most commonly observed introduced species (at least half the sites - including nearby opportune records) are set out in Table 19. Collecting more opportune records of introduced species would have increased this list to some extent. Similarly the number of introduced species would be increased with more time spent finding the different species of *Vulpia* and *Bromus* which are quite similar but the project was not resourced to achieve this and the benefits are limited.

Of note is False Brome at all sites - no doubt the most damaging weed overall because of its capacity to fill the space between tussocks. The cover/abundance was 3 on one site, 2 on four sites, 1 on seven sites and Trace on two sites. Wild oats were also widespread with one or both *Avena* species recorded on all except the River Road site. The cover/abundance for wild oats was 2 on two sites and 1 on 11 sites. Judging by the appearance of sites in late spring 2013, the level of weed abundance and competition appeared even higher across the sites after the wet winter.

Table 19: Introduced flora species - most commonly occurring

Scientific name	Common Name	Sites Total
<i>Brachypodium distachyon</i>	False Brome	14
<i>Echium plantagineum</i>	Salvation Jane	11
<i>Avena barbata</i> (<i>Avena</i> sp)	Bearded (Wild) Oat	8 (13)
<i>Bromus diandrus</i>	Great Brome	8
<i>Cynara cardunculus</i> ssp. <i>flavescens</i>	Artichoke Thistle	8
<i>Moraea setifolia</i>	Thread Iris	8
<i>Oxalis pes-caprae</i>	Soursob	8
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	8
<i>Olea europaea</i> ssp. <i>europaea</i>	Olive	7
<i>Salvia verbenaca</i> var. <i>verbena</i>	Wild Sage	7
<i>Sonchus oleraceus</i>	Common Sow-thistle	7

Flora: Most commonly occurring plant families

Distribution of native and introduced species by Family for the 14 main sites surveyed. Native species were recorded from a total of 49 families and exotic species from 39 families with 64 families represented in total. Almost 40% of the total species (about 285 species) were in the Gramineae (Grass) family and Compositae (Daisy) family. Close to 20% were in the Liliaceae, Chenopodiaceae and Leguminosae families. The results were consistent with expectations of the spread of species to be found in grassland ecosystems in South Australia.

Table 20 shows 20 families with at least three species recorded - both site and opportune recordings.

Table 20: Native and introduced plant families - most commonly occurring

Family	Native spp. 14 sites	Weed spp. 14 sites	All species 14 sites
Gramineae	43	23	66
Compositae	27	15	42
Leguminosae	11	11	22
Liliaceae	15	3	18
Chenopodiaceae	13	0	13
Goodeniaceae	7	0	7

Family	Native spp. 14 sites	Weed spp. 14 sites	All species 14 sites
Myrtaceae	5	0	5
Plantaginaceae	3	2	5
Convolvulaceae	3	1	4
Campanulaceae	4	0	4
Adiantaceae	4	0	4
Solanaceae	0	4	4
Amaranthaceae	3	0	3
Thymelaeaceae	3	0	3
Cyperaceae	3	0	3
Crassulaceae	3	0	3
Haloragaceae	3	0	3
Plantaginaceae	3	0	3
Labiatae	1	2	3
Boraginaceae	1	2	3

Fauna: Birds (Tables 21a - 21c)

Table 21a: Summary bird data collected across all sites surveyed

Common name	Genus	Species	A	SA	Int'd	Total Sites	Total birds
Australasian Grebe	<i>Tachybaptus</i>	<i>novaehollandiae</i>				1	2
Australasian Pipit	<i>Anthus</i>	<i>novaeseelandiae</i>				5	9
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>				9	44
Australian Reed-Warbler	<i>Acrocephalus</i>	<i>australis</i>				4	9
Australian Wood-duck	<i>Chenonetta</i>	<i>jubata</i>				1	2
Black-faced Cuckoo-shrike	<i>Coracina</i>	<i>novaehollandiae</i>				4	5
Black-tailed Native-hen	<i>Tribonyx</i>	<i>ventralis</i>				1	4
Brown Falcon	<i>Falco</i>	<i>berigora</i>				4	8
Brown Goshawk	<i>Accipiter</i>	<i>fasciatus</i>				4	4
Brown Quail	<i>Coturnix</i>	<i>ypsilophora</i>		V		1	1
Brown Songlark	<i>Cincloramphus</i>	<i>cruralis</i>				3	4
Cockatiel	<i>Nymphicus</i>	<i>hollandicus</i>				1	6
Corella	<i>Cacatua</i>	sp.				1	1
Crested Pigeon	<i>Ocyphaps</i>	<i>lophotes</i>				4	18
Crested Shrike-tit	<i>Falcunculus</i>	<i>frontatus</i>		R		1	3
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>				5	32
Diamond Firetail	<i>Stagonopleura</i>	<i>guttata</i>		V		1	2
Dusky Moorhen	<i>Gallinula</i>	<i>tenebrosa</i>				1	2
Fairy Martin	<i>Petrochelidon</i>	<i>ariel</i>				1	25
Galah	<i>Eolophus</i>	<i>roseicapilla</i>				7	51
Grey Shrike-thrush	<i>Colluricincla</i>	<i>harmonica</i>				1	1

Common name	Genus	Species	A	SA	Int'd	Total Sites	Total birds
Grey Teal	<i>Anas</i>	<i>gracilis</i>				1	12
Hardhead	<i>Aythya</i>	<i>australis</i>				1	1
Laughing Kookaburra	<i>Dacelo</i>	<i>novaeguineae</i>				1	1
Little Grassbird	<i>Megalurus</i>	<i>gramineus</i>				2	2
Little Pied Cormorant	<i>Microcarbo</i>	<i>melanoleucos</i>				1	2
Little Raven	<i>Corvus</i>	<i>mellori</i>				8	31
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>				5	12
Masked Lapwing	<i>Vanellus</i>	<i>miles</i>				1	2
Mistletoebird	<i>Dicaeum</i>	<i>hirundinaceum</i>				1	1
Musk Lorikeet	<i>Glossopsitta</i>	<i>concinna</i>				3	17
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>				6	17
New Holland Honeyeater	<i>Phylidonyris</i>	<i>novaehollandiae</i>				2	10
Noisy Miner	<i>Manorina</i>	<i>melanocephala</i>				4	17
Pacific Black Duck	<i>Anas</i>	<i>supercilliosa</i>				2	11
Peaceful Dove	<i>Geopelia</i>	<i>placida</i>				1	1
Peregrine Falcon	<i>Falco</i>	<i>peregrinus</i>		R		2	3
Purple Swamphen	<i>Porphyrio</i>	<i>porphyrio</i>				2	2
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>				6	13
Rainbow Lorikeet	<i>Trichoglossus</i>	<i>haematodus</i>				2	12
Red Wattlebird	<i>Anthochaera</i>	<i>carunculata</i>				3	12
Red-rumped Parrot	<i>Psephotus</i>	<i>haematonotus</i>				4	24
Rufous Whistler	<i>Pachycephala</i>	<i>rufiventris</i>				1	1
Silvereye	<i>Zosterops</i>	<i>lateralis</i>				1	2
Singing Honeyeater	<i>Lichenostomus</i>	<i>virescens</i>				3	6
Spotted Harrier	<i>Circus</i>	<i>assimilis</i>				1	1
Striated Pardalote	<i>Pardalotus</i>	<i>striatus</i>				1	6
Stubble Quail	<i>Coturnix</i>	<i>pectoralis</i>				2	25
Superb Fairy-wren	<i>Malurus</i>	<i>cyaneus</i>				3	6
Tawny Frogmouth	<i>Podargus</i>	<i>strigoides</i>				1	1
Wedge-tailed Eagle	<i>Aquila</i>	<i>audax</i>				2	2
Weebill	<i>Smicronis</i>	<i>brevirostris</i>				1	5
Welcome Swallow	<i>Hirundo</i>	<i>neoxena</i>				3	11
White-faced Heron	<i>Egretta</i>	<i>novaehollandiae</i>				2	3
White-fronted Chat	<i>Epthianura</i>	<i>albifrons</i>				3	16
White-plumed Honeyeater	<i>Lichenostomus</i>	<i>penicillatus</i>				4	32
White-winged Chough	<i>Corcorax</i>	<i>melanorhamphos</i>		R		2	10
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>				6	8
Yellow-rumped Thornbill	<i>Acanthiza</i>	<i>chrysorrhoa</i>				1	8
Yellow-throated Miner	<i>Manorina</i>	<i>flavigula</i>				1	5

Common name	Genus	Species	A	SA	Int'd	Total Sites	Total birds
Common Blackbird	<i>Turdus</i>	<i>merula</i>			*	4	5
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>			*	5	80
Eurasian Skylark	<i>Alauda</i>	<i>arvensis</i>			*	3	6
House Sparrow	<i>Passer</i>	<i>domesticus</i>			*	6	28
Rock Dove	<i>Columba</i>	<i>livia</i>			*	4	17
Spotted Dove	<i>Stigmatopelia</i>	<i>chinensis</i>			*	2	5
Total of 66 species						176	722
Native species - 60						152	581
Introduced species - 6						24	141

Ten sites in total - average of 17 or so bird species recorded at each site, 15 native species and two or three exotic species on average.

The Para Woodland sites bird recordings included 10 additional native bird species -

Brown Tree-creeper	Grey Currawong	Tree Martin
Brown-headed Honeyeater	Horsfield's Bronze-Cuckoo	Yellow-faced Honeyeater
Bronzewing	Pallid Cuckoo	
Emu	Sulphur-crested Cockatoo	

Table 21b: Summary bird data collected – birds at most sites (at least four sites)

Common name	Genus	Species	Int'd	Sites	Total No.
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>		9	44
Little Raven	<i>Corvus</i>	<i>mellori</i>		8	31
Galah	<i>Eolophus</i>	<i>roseicapilla</i>		7	51
House Sparrow	<i>Passer</i>	<i>domesticus</i>	*	6	28
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>		6	17
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>		6	13
Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>		6	8
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>	*	5	80
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>		5	32
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>		5	12
Australasian Pipit	<i>Anthus</i>	<i>novaeeseelandiae</i>		5	9
White-plumed Honeyeater	<i>Lichenostomus</i>	<i>penicillatus</i>		4	32
Red-rumped Parrot	<i>Psephotus</i>	<i>haematonotus</i>		4	24
Crested Pigeon	<i>Ocyphaps</i>	<i>lophotes</i>		4	18
Rock Dove	<i>Columba</i>	<i>livia</i>	*	4	17
Australian Reed-Warbler	<i>Acrocephalus</i>	<i>australis</i>		4	9
Brown Falcon	<i>Falco</i>	<i>berigora</i>		4	8
Common Blackbird	<i>Turdus</i>	<i>merula</i>	*	4	5
Brown Goshawk	<i>Accipiter</i>	<i>fasciatus</i>		4	4

Table 21c: Summary – most birds observed over all sites (at least 12 birds observed)

Common name	Genus	Species	Int'd	Sites observed	Total No observed
Common Starling	<i>Sturnus</i>	<i>vulgaris</i>	*	5	80
Galah	<i>Eolophus</i>	<i>roseicapilla</i>		7	51
Australian Magpie	<i>Gymnorhina</i>	<i>tibicen</i>		9	44
White-plumed Honeyeater	<i>Lichenostomus</i>	<i>penicillatus</i>		4	32
Crimson Rosella	<i>Platycercus</i>	<i>elegans</i>		5	32
Little Raven	<i>Corvus</i>	<i>mellori</i>		8	31
House Sparrow	<i>Passer</i>	<i>domesticus</i>	*	6	28
Stubble Quail	<i>Coturnix</i>	<i>pectoralis</i>		2	25
Fairy Martin	<i>Petrochelidon</i>	<i>ariel</i>		1	25
Red-rumped Parrot	<i>Psephotus</i>	<i>haematonotus</i>		4	24
Crested Pigeon	<i>Ocyphaps</i>	<i>lophotes</i>		4	18
Musk Lorikeet	<i>Glossopsitta</i>	<i>concinna</i>		3	17
Rock Dove	<i>Columba</i>	<i>livia</i>	*	4	17
Nankeen Kestrel	<i>Falco</i>	<i>cenchroides</i>		6	17
Noisy Miner	<i>Manorina</i>	<i>melanocephala</i>		4	17
White-fronted Chat	<i>Epthianura</i>	<i>albifrons</i>		3	16
Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>		6	13
Grey Teal	<i>Anas</i>	<i>gracilis</i>		1	12
Rainbow Lorikeet	<i>Trichoglossus</i>	<i>haematodus</i>		2	12
Red Wattlebird	<i>Anthochaera</i>	<i>carunculata</i>		3	12
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>		5	12

Fauna: Reptiles, mammals and amphibians (Tables 22a-22c)

Reptiles. At least 16 reptile species observed at or near sites. More reptile species have been recorded at other times in the Dead Man's Pass and Gawler East areas.

Table 22a: - Reptiles recorded at all sites

Common name	Genus	Species	A	SA	Int'd	Sites	Number
A large striped ctenotus	<i>Ctenotus</i>	sp.				3	4
A small brown skink	<i>Morethia</i>	sp..				1	1
A small Tympanocryptis-like dragon	<i>Agamidae</i>	sp.				1	1
A worm-lizard	<i>Aprasia</i>	sp.				1	1
Adelaide Snake-eye Skink	<i>Morethia</i>	<i>adelaideensis</i>				3	4
Adelaide Snake-lizard	<i>Delma</i>	<i>molleri</i>				2	2
Bougainville's Skink	<i>Lerista</i>	<i>bougainvillii</i>				1	1
Dwarf Skink	<i>Menetia</i>	<i>greyii</i>				2	4
Eastern Bearded Dragon	<i>Pogona</i>	<i>barbata</i>				3	3
Eastern Bluetongue Lizard	<i>Tiliqua</i>	<i>scincoides</i>				2	5
Eastern Brown Snake	<i>Pseudonaja</i>	<i>textilis</i>				2	2

Common name	Genus	Species	A	SA	Int'd	Sites	Number
Eastern Striped Skink	<i>Ctenotus</i>	<i>robustus</i>				1	1
Flinders Ranges Worm-lizard	<i>Aprasia</i>	<i>pseudopulchella</i>	V			1	1
Grass Skink	<i>Lampropholis</i>	<i>guichenoti</i>				1	2
Red-bellied black snake	<i>Pseudechis</i>	<i>orphyriacus</i>				1	1
Sleepy Lizard, Shingleback	<i>Tiliqua</i>	<i>rugosa</i>				3	4
Three-toed Earless Skink	<i>Hemiergis</i>	<i>decreasiensis</i>				1	2

Mammals – eight introduced mammals (including stock) and five native mammals recorded

Table 22b: Mammals recorded at all sites.

Common name	Genus	Species	A	SA	Int'd	Sites	Number
Brushtail Possum	<i>Trichosurus</i>	<i>vulpecula</i>		R		1	2
Euro	<i>Macropus</i>	<i>robustus</i>				1	2
Short-beaked Echidna	<i>Tachyglossus</i>	<i>aculeatus</i>				2	2
Western Grey Kangaroo	<i>Macropus</i>	<i>fuliginosus</i>				4	15
White-tailed Water Rat	<i>Hydromys</i>	<i>chrysogaster</i>				1	1
Black/Common Rat	<i>Rattus</i>	<i>rattus</i>			*	1	2
Brown Hare	<i>Lepus</i>	<i>europaeus</i>			*	1	1
Cat	<i>Felis</i>	<i>catus</i>			*	3	6
Cattle	<i>Bos</i>	<i>taurus</i>			*	1	25
Fox	<i>Vulpes</i>	<i>vulpes</i>			*	6	11
House Mouse	<i>Mus</i>	<i>musculus</i>			*	1	20
Rabbit	<i>Oryctolagus</i>	<i>cuniculus</i>			*	4	12
Sheep	<i>Ovis</i>	<i>aries</i>			*	2	350

Bats. No recordings of bats occurred but previous recording in the region would suggest that 5 or 6 native bat species would be recorded if the project had covered this.

Table 22c: Amphibians recorded at all sites. 3 frog species recorded

Common name	Genus	Species	A	SA	Int'd	Sites	Number
Clicking Froglet	<i>Crinia</i>	<i>signifera</i>		2		2	50
Eastern Banjo Frog	<i>Limnodynastes</i>	<i>dumerilli</i>		3		3	15
Spotted Grass Frog	<i>Limnodynastes</i>	<i>tasmaniensis</i>		2		2	40

Summary of native and introduced species for main 14 sites (as at March 2014)

Across all 14 sites a total of 188 different native species were recorded for the survey. In total 474 native species records were made for the 14 sites – an average of 34 species per site. This number of recorded species exceeded expectations at the start of the study and compares well with good quality grassland sites elsewhere in the State.

Across all 14 survey sites a total of 252 introduced species were recorded – an average of 18 species per site. With more detailed assessment of introduced species a few more would be recorded at most sites e.g. *Vulpia* species were not pursued to species on most sites. Despite the long history of impacts the number of native species remaining still well outnumbers exotics at most sites.

Table 23a: Average species numbers for main 14 sites refer to Table 26 for full details

	Hor1	Hor2	Duff	Flag	McK	RosMNR	Fords	Sha1	Sha2	RosRai	DMP	Gor	Steb	SpG
Natives total 477 average 34 per site	19	31	42	22	64	34	28	33	39	29	49	22	20	45
Exotics total 252 average 18 per site	17	19	18	13	10	20	19	12	15	16	32	18	15	28

Table 23b records the % of introduced species for each site. The River Road site was outstanding with introduced species only comprising 14% of species but several other good sites had around 30–40%. The figures totalled for survey site and opportune records for locality also have the River Road outstanding with 113 species (and counting).

Table 23b: Summary of native and introduced species on quadrats and in near locality 14 main sites. Full details Tables 26 and 27.

	Hor1	Hor2	Duff	Flag	McK	RosMNR	Fords	Sha1	Sha2	RosRai	DMP	Gor	Steb	SpG
Total native species on site	19	31	42	22	64	34	28	33	39	29	49	22	20	45
Total exotic species on site	17	19	18	13	10	20	19	12	15	16	32	18	15	28
Total all species on site	35	50	59	35	74	54	47	45	54	45	81	39	35	71
% exotic spp. for site	47	38	31	37	14	37	40	27	28	35	40	46	43	40
Opp. native species near site	3	2	5	15	47	6	42	9	4	12	21	0	2	5
Total natives spp. on/near site	21	33	45	37	111	40	70	42	43	42	70	22	22	50

Appendix 2 provides a summary of the criteria under the EPBC listing of Irongrass grassland for assessing the quality of the grassland. The survey did not exactly measure for this classification but indicative assessments are shown. Overall this assessment indicates that the sites surveyed were quite high quality remnants.

Table 24a: EPBC Class suggested assessment based on 2007 EPBC Listing criteria. Refer to Table 28 for full details.

	Hor1	Hor2	Duff	Flag	McK	RosMNR	Fords	Sha1	Sha2	RosRai	DMP	Gor	Steb	SpG**
Herbs excluded for EPBC rating	4	5	3	3	4	4	3	2	2	5	5	4	1	6
Herbs counting for EPBC rating	3	12	19	10	42	13	11	15	21	5	20	7	3	17
Grass species for quadrat	9	9	8	9	15	9	11	9	11	11	14	6	13	13
Total native species for quadrat	19	31	42	22	64	34	28	33	39	29	49	22	20	45
EPBC Class likely	B/C	A/B	A	B	A	A	A	A	A	N/A*	A	B	B/C	A/B

* *Roseworthy town is a Eucalyptus largiflorens grassy woodland site. ** area for the species numbers is greater than 0.25 ha for EPBC class – no accurate figure for smaller areas.*

Appendix 3 provides a summary of the criteria which Prescott and Turner suggest Irongrass grasslands can be understood. River Road as a Category 1 site is exceptional. It is doubtful if a better site exists in the general region – certainly nothing known to survey participants. Category 2 and 3 sites are fair quality sites affected by grazing (Category 3 sites) or lack of grazing or other disturbance such as fire leading to build-up of weed species and excess thatch (Category 2 sites). **Table 24b** is a summary of the analysis in Appendix 3.

Table 24b Prescott & Turner State & Transition Model - suggested assessment for each survey site

	Hor1	Hor2	Duff	Flag	McK	RosMNR	Fords	Sha1	Sha2	RosRai	DMP	Gor	Steb	SpG
Category of site estimated	4	2	3	2	1	2	2	2	2	N/A	2	4	?	3

Table 25 shows a summary of the number of species which were only recorded at a single place in the survey. For this purpose the two Shanahan Road rail sites were considered a single site because of their close proximity. Almost half of the native species (84 out of 188) species were only found at one place. Again the River Road site stands out with 36 species there not being recorded at any other site (and counting). The Shanahan Road, Dead Man's Pass and Fords sites contributed most of the other single site records. The Roseworthy town site has 5 single locality species but most are not grassland species e.g. *Rhagodia parabolica*, *Acacia notabilis* & *Eucalyptus largiflorens*. These numbers are one criteria for prioritising conservation management of the sites.

Table 25: Native Species on 1 quadrat/site only

	Hor1	Hor2	Duff	Flag	McK	RosMNR	Fords	Sha1	Sha2	RosRai	DMP	Gor	Steb	SpG
49 Species on 1 quadrat/site only	1	0	2	2	20	0	3	10	10	2	4	1	2	2
35 Species Opp near 1 quadrat only	0	0	2	2	16	2	7	0	0	3	4	0	0	0
84 Species at 1 locality only	1	0	4	4	35	2	10	Both Sha 11	Both Sha 11	5	7	1	2	1

8. Discussion of results

Native flora records

The finding of 192 native species on the 14 main locations recorded through quadrats or opportune records far exceeded expectations. At the commencement of the survey records from previous years observations of the nine sites south of Kapunda had totalled fewer than 100 species. To add 90 or more species was an excellent result. The majority of additional species were derived from the sites north of Kapunda, but many also arose from more detailed recording of previously studied sites. In addition to the 192 for the 14 sites, 13 additional species were recorded at the Para Woodland sites and nearby and another 15 or so species were observed from creek lines near sites. Summer 2015 has added 4 (to 192) additional native species for main 14 sites and 4 on adjoining River Road properties. These new records have not been added to summary tables for this 2015 update of the Report.

The uncovering of the River Road paddock was particularly important in expanding the scope of the survey with 35 (39 in 2015) species recorded there that were not on any other survey sites. This site not only has a large number of species - it also has large numbers of many of the species. Finding a few representatives of a species on a site adds to knowledge but clearly the risk of the species disappearing when only having small numbers at a site is high. Finding hundreds/sometimes thousands of representatives of a species at a site provides a solid basis for future management of the species and the opportunity to provide viable seed or plant material to assist in restoration or revegetation of other sites.

The plant lists from the survey have much in common with plant lists provided from surveys of remnant grasslands in the mid-north of the State. For example, of the 60 most common native species in 143 survey quadrats used for the Recovery Plan for irongrass grassland, all but *Austrostipa nitida* and *Austrodanthonia pilosa* were recorded in this survey (and the two missed species are located at other Biological Survey sites nearby).³⁷

Grassland ecological associations

The grassland ecological associations on the survey areas are variously described as irongrass tussock grasslands or tussock grasslands. The conservation status of grasslands in the Lower North has not been rigorously assessed, in part because of the confusion about their extent. Neagle³⁸ in 1995 listed *Lomandra* tussock grasslands and *Danthonia* sp., *Themeda* tussock grasslands as very rare and Priority 1 and Priority 2 for conservation focus in the whole of the agricultural regions of South Australia. These ratings have been maintained over the years at least up to 2009 by DEWNR staff.

The ratings have some consequence under South Australian legislation. There is no structure for protection of ecological associations under the *National Parks and Wildlife Act* Schedules but the *Native Vegetation Act* clearance principles give some recognition to endangered flora associations. The conservation concern that was the basis for EPBC nominations for irongrass grasslands could no doubt be the basis for EPBC consideration of *Themeda/Danthonia-Rytidosperma/Austrostipa* or like tussock grasslands in the Lower North.

The grasslands which fit the EPBC irongrass grassland criteria now have a level of protection - but only in the case of proposed development such as occurred with the Gawler East/Spring Gully referral. Areas which are being grazed or where grazing is not occurring but weed invasion is not being

³⁷ Turner, J. (2012) *National Recovery Plan for the Iron-grass Natural Temperate Grassland of South Australia ecological community*. DENR, South Australia at pages 61-62. See also:

Hyde M. (2000) *Mokota Conservation Park A Baseline Biodiversity Study* NCSSA, TPAG

Hyde M. K. (1992) *South Australian Temperate Grasslands Survey, Mid North District* DHUD

Robertson M. A. (1998) *A Biological Survey of Grasslands and Grassy Woodlands of the Lofty Block Region, South Australia* DEHAA

³⁸ Neagle, N. (1995) An update of the Conservation Status of the Major Plant Associations of South Australia DELM

controlled can continue to suffer ongoing degradation. In the Lower North there is an urgent need for further resources to be contributed to assist in the conservation of grassland remnants.

Table 24a on page 127 sets out the potential EPBC irongrass grassland Class assessments for the relevant sites in this survey. The results of this survey justify the extension of the EPBC map “Areas where Iron-grass Natural Temperate Grassland of South Australia may occur” further south than Gawler.³⁹

Management of grassland remnants.

One finding which seems clear from the survey is that well managed grazing may be one of the best methods for cost effective management of some native grasslands. The River Road site is as good a proof as is likely to be available of the benefits of appropriate grazing. The Dead Man’s Pass and Duff Road sites have also had many years of grazing and yet have retained significant integrity.

The survey covered a number of rail corridor sites where grazing has generally not been occurring. For all of the period from about 1860 until about 1990 the Roseworthy to Kapunda rail line grassland remnants would have seen very limited grazing because of the train operations. Since the train line ceased operating there has been some opportunistic stock grazing along the line but not apparently to much extent on the sites surveyed. The evidence is that there has been build-up of weeds, both grassy and herbaceous weeds, which have no doubt out-competed many native species already and are threatening the survival of some of the remaining native species.

Disturbance caused by grazing, by small digging animals, by a range of reptiles that dig burrows, by scratching birds and animals as well as by fire are essential components of the development of Australian grassland ecosystems. The removal of many of these influences puts grassland ecosystems at continuing risk. Maintaining such natural disturbance or recreating it through other means is a major priority and challenge for grassland management.

The Bibliography and References in Part 10 of this report provide considerable assistance with understanding management of grasslands to retain and improve biodiversity. Unfortunately there are few general rules to apply – understanding the history and local geography of a site is vital. Monitoring and some experimentation will be needed to ensure future biodiversity.

Victorian/Morgan data on grassland species loss

The loss of grassland species over time is apparent but there is little data in South Australia to show the nature of the loss. Data has been collected in grassland remnants on the western areas of Melbourne (some in urban, some in rural settings). Dr. John Morgan from La Trobe University has provided data on 31 remnant sites⁴⁰ where species lists were made in the 1980s and then remade in the early 2000s – an average period between recording in the order of 15 years. Sites ranged in size from 0.03ha (300 sq. m) to 10 ha but most were less than 1 ha.

These western Melbourne plains (mostly volcanic/basaltic origin) are different to the Lower North in a number of ways – the soils are much richer generally and rainfall is higher. Hence a higher likelihood of vigorous species such as kangaroo grass and introduced weeds producing high levels of thatch and shading out the small herbaceous grassland species. Burning is practiced on a range of these Victorian sites such as rail corridors and public lands to reduce build-up of fire hazard. Researchers have noted that this burning has been a factor in retaining biodiversity.

³⁹ Shackley A., (2012) *Understanding pre-European Adelaide plains and foothills vegetation associations –managing remnants and recreating grasslands.* (Published Salisbury Council website) - pages 31-33 show expanding coverage near Gawler.

⁴⁰ Morgan, J. (2005) Survey results from assessment in 1980s and 2000s of 31 remnant grassland sites west of Melbourne. Unpublished. Information kindly provided by Dr Morgan in 2013.

A range of data was recorded for the 31 sites including whether sites were burnt. Only herbaceous and shrub species were recorded – grass species were not recorded (difficulty with identification and timing of recording).

The 19 sites which had been burnt had an average of 28 species recorded on first occasion and 24 of these species were re-recorded on the second occasion (527 overall reduced to 450 - 15% average reduction). For the 12 sites unburnt over the data time an average of 25 relevant species were present on first recording and 19 of these species were re-recorded on the second occasion (304 overall reduced to 223 – average 27% reduction). Overall average reduction for 31 sites was 19%.

The size of remnants appeared to have no impact on level of reduction in species present and the rural/urban difference which appeared in the raw figures seems to have been mainly an effect of more rural blocks being burned.

Shrub species (11%), not surprisingly, had significantly lower losses than herbaceous species such as daisies and lilies (both geophytes - bulb species such as lilies, and hemicryptophytes – species regrowing from buds such as daisies, had a loss rate of 21%).

Of interest as well, though, was that the second round of recording revealed an average of 12 additional native species per lot on burnt remnants and 8 on unburnt remnants. The reasons for this are no doubt complex and include both more rigorous searching and some species which do not always appear each year. Hence the recorded losses of 15% and 27% for burnt and unburnt sites might be somewhat overstated.

A range of different positive and negative factors will be at work across these Victorian sites but it is clear that loss of species is occurring at a significant level – caused by weed competition, competition from more vigorous/taller natives and other factors (dumping of rubbish, bad weed control techniques etc.). Overall figures like these provide a challenge for landholders and natural resource managers. No management is a major problem. Limited management is better but may still not be good enough to stabilise most grassland ecosystems.

Fauna results – birds

Apart from the Flagstaff Hill Road (and to an extent Duff Road) sites, none of the other survey sites represent grassland only habitat when looking at birds. All of the other sites have a range of trees and shrubs within close enough proximity to allow birds whose principal habitat is woodland to use the sites as part of their range. At the same time grasslands historically were interspersed with wooded hills and creek lines containing trees and shrubs so there is no easy delineation of fauna habitat. Grasslands will also usually contain a range of shrub species which readily fulfil the needs of smaller bird species for nest sites and some shelter from raptors and ground based predators.

Some of the bird species seen in the survey which would be categorized as grassland specialists - the Stubble Quail, Brown Quail, Australian Pipit, Brown Songlark and Australian Lapwing. All of these species make their nests on bare ground or in grass nests on the ground and can survive without needing trees or shrubs for shelter or nesting.

Quite a few other species would see grasslands as a major habitat – including many of the raptors recorded as well as other species. Other species are regular users of grasslands but mainly on the fringes of woodlands – an example would be seed eating Diamond Firetail finches.

Other bird species observed would not be expected to be seen unless there is nearby woodland – Kookaburras, White-winged Choughs and Crimson Rosellas are good examples.

All of the introduced birds observed (apart from Eurasian Songlarks) fall into the category of non-grassland species. Without shelter and nesting places provided by human/farm settlements and woodland areas they would be removed by predators in a grassland setting. None of these introduced species were seen at the Flagstaff Hill Road and Duff Road sites.

Grassland specialist species such as Plains Wanderers and Australian Bustards are now very rarely seen even in the Mid North grasslands, let alone in the Lower North. But historically these species would have undoubtedly been regular visitors of the region (see for examples Hailes notes about bustards on page 6 of this report on the grasslands south of Gawler)⁴¹ and information on Plains Wanderers on the Adelaide Plains.⁴² We can only hope that there will be an opportunity for such species to return one day to their ancestral habitats.

Fauna results – reptiles

The range of reptiles recorded is indicative of the adaptability of these animals. Species such as Eastern Brown Snakes, Sleepy Lizards, Eastern Bluetongues, legless lizards and some of the skinks are clearly well adapted to grassland life. The associated recording of a Flinders Ranges Worm-lizard at Spring Gully Gawler East was a highlight.

The rediscovery of Pygmy Blue-tongue lizards near Burra about 20 years ago has provided a major boost in interest in the grasslands in which these cryptic animals survive and thrive. No signs of this species were seen on the survey sites but they have been located recently not far from the Flagstaff Hill Road site. Historically they were recorded near Gawler (original 1863 specimens forwarded to Germany by Dr. Richard Schomburgk recorded as collected near Gawler)⁴³ and suitable habitat for them exists in many areas of the grassy foothills and hills of the Lower North.

Fauna results – mammals

The small native mammals adapted to grasslands (bilbies, hopping mice and the like) have long since disappeared from the Lower North area – victims to habitat change and introduced predators. The bigger Western Grey Kangaroos and Euros survive but these are as much woodland as grassland animals. The Red Kangaroos moved on. The mammals best adapted to open grasslands in the region now seem to be the rabbits and foxes. Southern Hairy-nosed Wombats are also well adapted to grasslands with native grasses such as spear grasses a major part of their diet. They are also living in close proximity to the Flagstaff Hill Road site and only a few kilometres from the Duff Road and River Road sites. But they have been subject to culling by landholders and their ability to spread will be interesting to observe over future years.

Fauna results – frogs

The frog species recorded as part of the survey require water for breeding and will generally only be regularly found in grassland areas where creeks or farm dams and troughs provide this. Having two Eastern Banjo Frogs appear on the Shanahan Road rail reserve was indicative of the wet 2013 winter and the capacity of this species to move about or live in difficult environments.

Fauna - other

This survey did not look at invertebrates. These are a major part of any ecosystem and need to be understood. The Recovery Plan for irongrass grassland contains a useful introduction and summary of the position for the grasslands of the Mid North and Lower North of South Australia.⁴⁴

⁴¹ Hailes N. (1988) *Recollections* at page 35. The book consists of articles by Nathaniel Hailes on early years of South Australia published in the *South Australian Register* in 1876 and 1877.

⁴² Taylor, Sue (2012) *John Gould's Extinct and Endangered Birds of Australia National Library of Australia*. At page 91 Taylor recorded that George Grey, South Australia Governor between 1841-1845, gave Gould Plains Wanderers and noted they were regularly seen on the Adelaide Plains at that time. Grey also made a herbarium collection of plants from South Australia, assisted by Eliza Reid among others – believed to be in Kew Herbarium or British Museum of Natural History.

⁴³ Armstrong, G., Reid, J.R.W. & Hutchinson, M.N. (1993). Discovery of a population of the rare scincid lizard *Tiliqua adelaidensis* (Peters). *Records of the South Australian Museum*. 36:153-155

⁴⁴ Turner, J. (2012) op. cit footnote 37 Especially Appendix 7 at pages 65-66

9. Historical information – *Swainsona*, Blandowski, *Acacia paradoxa*

There are a lot of gaps in our understanding of grassland ecosystems and the component species. However, there is much fascinating information available which can be accessed to provide a better picture. Paintings, diaries, historical writings, government records, herbarium records and other sources can all provide information on the history of our natural environment. With the Internet, the finding of this information is becoming much easier. With botany, some understanding of Latin and German also is of assistance, which leaves a lot of us struggling. Below are some examples of putting together pieces of a jigsaw puzzle from different sources.

Swainsona spp. story

Given the most fortunate finding of significant patches of both *Swainsona behriana* and *Swainsona stipularis* in this survey it is worth recording some historical connections of these species in the area. Australia's most famous botanist Dr. Ferdinand Mueller (as he was then) wrote a letter about South Australian flora in 1850 where he said⁴⁵:- “To the already known kinds of the beautiful *Swainsona* my researches add three new ones, very valuable in horticulture, *S. phacaefolia*, *S. viciaefolia*, *S. behriana*.” Clearly Mueller is claiming a role in finding and recording these species.

Swainsona phacaefolia (also spelt *S. phacifolia*) is now *Swainsona stipularis*.⁴⁶ The oldest Herbarium record in Australia (and likely the world) for this species was collected by Mueller on 16 September 1848 at “Gawlertown” - record held in the Melbourne Herbarium. Mueller also collected this species in the Mid North, Flinders Ranges and Victoria but all later than his South Australian Register article.

The oldest accessible records for *Swainsona behriana* in Australia are an anonymous record dated 1847 and records in 1849 (around Mt Barker) and 1850 (Norwood area) collected by William Blandowski (a German naturalist visiting and living in Australia 1849-1859). There is also, however, also an early undated collection from Mueller reported from the Mt Barker district (where Mueller lived on coming to South Australia in late 1847). These records are held in the Melbourne Herbarium.⁴⁷

Hermann Behr (whose name is represented in *Swainsona behriana*) was in SA in 1844/45 and 1848/49 collecting plants in the Gawler, Barossa, Barossa Ranges, Adelaide Hills and “Murray Scrub”. There is a confusing record of a *Swainsona* collected by Behr in South Australia in 1844/45. Behr took his 1844/45 collection back to Germany where Professor Schlechtendahl wrote a report on the specimens and named some 62 species he considered were new species. Item 197 was named *Swainsona galegiformis* R. Br., with a brief description in Latin/German and reference to collection in “Barossa-Range. September”⁴⁸. *Swainsona galegifolia* (minor name change) is only recorded otherwise in the eastern states. In 1864 there is also mention of a specimen of *Swainsona galegifolia* from South Australia attributed to “Herb. F. Mueller but without the precise station”⁴⁹. So confusion here but evidence that Behr recorded at least one *Swainsona* in 1844/45.

Mueller was in South Australia from late 1847 until late 1852. Mueller and Behr met and possibly briefly collected together during Behr's 1848/49 visit in the Gawler/Barossa area. Given Mueller's role in naming *Swainsona behriana* and his 1850 letter commentary, it is interesting to speculate where Mueller (and presumably Behr) may have observed *Swainsona behriana*. The type specimen in Melbourne Herbarium seems to be undated for collection – it was supplied by Mueller via Dr. Sonder in Hamburg and has the Latin description “In planitic graminosa ad Adelaide” roughly translating as

⁴⁵ Mueller, F. (1850) “Notes on South Australian Botany” in *South Australian Register*, 19 February 1850

⁴⁶ Mueller F. M. (1853) description of *Swainsona stipularis* in *Linnaea*, 25: 393 – with reference to the 1850 *South Australian Register* article but not the pre-1850 specimen collections. Also via Australian Plant Census website.

⁴⁷ Accessed through Atlas of Living Australia website.

⁴⁸ Schlechtendahl D.F.C. (1848) Bestimmung und Beschreibung der von Dr. Behr in Sudaustralien gesammelten Pflanzen. *Linnaea* 20: 559-672 at page 670

⁴⁹ Bentham, G. (1864) *Flora Australiensis Vol 2*, page 217

“grass plain at/near Adelaide”.⁵⁰ See also picture on page 134. There are a number of later collections of *Swainsona behriana* in the region of this survey including Professor Tate 1880 (Munno Para hills), and 20th century near Roseworthy, Freeling and Moppa, and more recently at Koonunga, Nain Hills and Greenock (latter two not vouchered for Herbarium). The 1927 article by Black (footnote 50) re-established *Swainsona behriana* as the formal name of the species which was appropriate.

There is an 1864 reference to *Swainsona lessertiifolia* var *tephrotricha* with occurrences for South Australia including “near Bethanie, Behr; St Vincent’s Gulf, Burra-Burra, F. Mueller”.⁵¹ Black has renamed *Swainsona lessertiifolia* var *tephrotricha* as/back to *Swainsona behriana*⁵². So this seems to provide a definite link (supplied by Mueller to Bentham as part of their collaboration for the *Flora Australiensis* books) about a H. Behr collection from Bethany. A mystery remains where the Behr specimen is – in Halle Herbarium in Germany with most of the Behr 1844/45 collection from South Australia or perhaps the anonymous 1847 collection in Melbourne is from Behr and misdated.

The other *Swainsona* that Mueller mentions in his 1850 article was *Swainsona lessertiifolia* – records are held in Melbourne Herbarium collected in 1848 (Adelaide Hills c. Summertown and near Kaiser Stuhl), 1849 (near Adelaide) and 1850 (again c. Summertown) - all collected by Mueller.

Flora Australiensis also confirms that Ferdinand Mueller’s reference to *Swainsona viciaefolia* in the 1850 article is a reference to *Swainsona lessertiifolia*⁵³. *Swainsona lessertiifolia* was also reported near Kapunda in 1938 by a Field Naturalist Society trip attended by H. Ising and J. B. Cleland. The group reported walking from near the Light River at Fords into the town.⁵⁴ Other species reported from the trip are present as State Herbarium specimens, but these *Swainsona* do not show up – they were described as having purple flowers which is consistent with either *Swainsona lessertiifolia* or *S. behriana*. Other notable records from the trip including *Leptorhynchus orientalis* and *L. tetrachaetus* are present as State Herbarium specimens – more searching may produce the *Swainsona* records.

The historical evidence then supports the ecosystems around Gawler and region being home to *Swainsona behriana* and *Swainsona stipularis* and probably *Swainsona lessertiifolia*.⁵⁵

The remnants found in this survey of the first two species may provide the populations needed to produce viable seed and ensure the survival of local provenance plants. And maintain an interesting historical connection.

William Blandowski: Gawler grassland connection.

William Blandowski in 1858 made this interesting statement (note Lancefield is more in the Goulbourn catchment but on the way towards the Loddon and Campaspe rivers from Melbourne).

“having passed the bold and steep Dividing Ranges at Lancefield, I descended into the rich and extensive grassy plains between the Campaspe and Loddon Rivers, which are strikingly similar to the Gawlertown plains, in South Australia”.⁵⁶

Blandowski came to South Australia in 1849 and spent some years collecting specimens for German museums (plants, animals, geological, etc. before moving to Victoria. He was appointed as the first

⁵⁰ Black J M (1927) Additions to the Flora of South Australia *Trans. and Proc. of the Royal Society of South Australia* 51: at 379-380

⁵¹ Bentham, G. (1864) *Flora Australiensis* Vol 2, page 222

⁵² Black, J M *ibid* at page 380 (in part along with a second group of *Swainsona oroboides* var. *hirsuta*)

⁵³ Bentham, G. (1864) *Flora Australiensis* Vol 2 page 222. Reference made to *S. viciaefolia*, F. Muell. in Dietr. Fl. Univ. n. ser. t. 17. Australian Plant Census has no link to the Bentham 1864 reference but does refer to Dietrich, D.N.F., (1861) *Flora Universalis Neue Serie*: t. XVII. No further information found on this connection.

⁵⁴ *South Australian Naturalist* Vol. 19 (4) 1938 Pages 14-16

⁵⁵ Further information also available in Mueller, F. (1853). Diagnoses et descriptions plantarum novarum, quas in Nova Hollandia australi praecipue in regionibus interioribus detexit et investigat *Linnaea* 25: 367-445. *Swainsonas* at pages 392-393. Thompson, J. (1993) A revision of the genus *Swainsona* (Fabaceae) *Telopea* 5(3):520 has good *Swainsona* descriptions

⁵⁶ Blandowski, W. (1858) Natural History of the Lower Murray *Trans. of the Philosophical Institute of Victoria* Vol.2: 124 at 127

Zoologist of the Victorian Museum in 1854. Blandowski led an expedition collecting natural history specimens in north-western Victoria and along the Murray and Darling for about nine months, returning to Melbourne via Adelaide in late 1857.

Blandowski has some 200 plant specimens recorded in Australian herbariums for 1849/50 but mainly from Adelaide, Port Adelaide and Adelaide Hills areas. It is not known if he travelled to Gawler but it is likely that he would have in order to travel to the German communities at Buchfelde near Gawler and the Barossa as did other German naturalists of the time. The “Gawlertown plains” south of Gawler can be seen from the Adelaide Hills but it seems likely that Blandowski had a closer look.

The “rich and extensive grassy plains between the Campaspe and Loddon Rivers” would be in an area of similar rainfall to the Gawler plains – up to 450 mm in the south reducing to less than 400 mm near the River Murray and to the north-east at Kerang, and soil types would have some similarity – mainly red-brown earths and calcareous soils.

The Campaspe-Loddon area is also the home to the Terrick Terrick National Park created some 20 years ago as a major grassland reserve, important for habitat of the Plains Wanderer and many other rare grassland fauna and flora. Also of interest, *Leptorhynchus orientalis* was recorded by Ferdinand von Mueller at Gawler in September 1849.⁵⁷ There are a few other early records for South Australia but none for many decades. If the species is to grow again in South Australia then a possible source of seed is a significant population recorded over the last 20 years in the Terrick Terrick National Park.



Examples of excellent information available now via the Internet. Left - *Swainsona behriana* voucher from Melbourne Herbarium, from Ferdinand von Mueller not dated, marked “In planitic graminosa ad Adelaide”⁵⁸ and right, Behr type collection October 1844 in Halle Herbarium - *Ptilotus erebescens* collected “auf trockenen Hügeln bei Gawlertown” - translating as “on dry hills at Gawlertown”.⁵⁹

Tracking *Acacia paradoxa*

Acacia paradoxa (previously *Acacia armata*) is usually regarded as an indigenous species of the Adelaide Hills and nearby regions. There seems good reason to doubt this. J. B. Cleland noted in 1932:⁶⁰

“Mr Simpson doubts whether *Acacia armata*, the Kangaroo Bush, was indigenous to the Adelaide district. He believes that it was introduced from Kangaroo Island - hence the name - and that seed was sold at 10/- per pound in the forties. Fifty years ago, Unley and many other suburbs were full of hedges of this *Acacia*.”

⁵⁷ Atlas of Living Australia information, see also *South Australian Naturalist* Vol. 19 (4) 1938 pages 14-16

⁵⁸ Access website through JSTOR Global Plants plants.jstor.org/specimen/tcd0015750?s=t

⁵⁹ Access website Virtual Herbaria herbarium.univie.ac.at/database/detail.php?ID=136882

⁶⁰ Cleland J B (1928) The original flora of the Adelaide Plains *South Australian Naturalist* Vol.10:1-6 at page 3

There is an interesting history⁶¹ of the original collections of *Acacia paradoxa* by the French Baudin expedition to Australia in 1801 – 3 specimens held in France – location of collection – “Ile des Kangourou” (Kangaroo Island) and by Robert Brown on the Flinders expedition who collected *Acacia paradoxa* at Memory Cove Port Lincoln and Kangaroo Island. *Acacia paradoxa* was growing in Kew Gardens London in about 1810 and Josephine Napoleon’s garden in France in 1812-17.

As early as 1843 the newspapers in Adelaide refer to seed available from Kangaroo Island.⁶²

“Sir.... I would mention the prickly mimosa,.... this simple plant, and of which there are thousands of acres at Kangaroo Island, is that which must eventually fence in all our lands; it is of that nature in the Island, that it is in many places perfectly impenetrable; it is so armed that no animal will approach it; it is highly valuable, for its seed may be carefully collected, and would amply repay the collector, for many landholders here would gladly avail themselves of the opportunity of purchasing;” An Early Colonist.

Adelaide colonists were already growing *Acacia* fences - the *Southern Australian* in February 1844:⁶³

“...Mr. Birdseye has a piece of hedge of the prickly plant at the back of his house....and it has grown thick, strong, and luxuriant from the ground upwards, so that it forms....a complete barrier to pigs, goats, bullocks, or horses. Mr. Wheland had also lately a similar hedge in Doctor Everard's old garden; but the plants, being of greater age, were much stronger, and had stems as thick as the leg.....Mr. Birdseye's plants have grown to their present size in eighteen months.... Mr Birdseye has ordered from Kangaroo Island a quantity of the seed, where it can be procured in any quantity.”

In 1852 the judging of live hedges at a competition was reported.⁶⁴ The “Live Fences” judges said:

No. 4. Messrs. Kelly Brothers. Kangaroo Island acacia. Three years old, from seed. Trimmed every year, at the latter end of May. Remarks.- A very nice fence, and in beautiful order. Superior to Nos. 1 and 2, from being trimmed. **Prize.**”

Growing of *Acacia paradoxa* hedges proceeded. The *South Australian Register* in 1862⁶⁵ reported:.

“Live Fences. Nor must we overlook our native thorn, the prickly bush of Kangaroo Island, which is to be found ornamenting and protecting not a few farms and gardens in various parts of the province. This shrub might probably have been recommended as the general fence of the colony but for its highly inflammable and dangerous character.”

John E. Brown was Conservator of Forest for South Australia 1878 -1890. Mr. Brown wrote “*A Practical Treatise on Tree Culture in South Australia*”⁶⁶ in 1881 with many copies sold, extending to a third edition. The *SA Weekly Chronicle*⁶⁷ in 1882 summarised some of Mr. Brown’s advice for hedge plants.

“Acacia (the Kangaroo Island Acacia). -..Keep well trimmed up, and a good hedge will be the result”. Others:

“*Lycium Horridum* (African Box Thorn) - This grows well on the plains, “*Olea Europaea* (the Olive). - Makes an excellent hedge”, “*Rosa Rubiginosa* (Sweetbriar). With care and attention this makes a fairly good hedge fence”, “*Tamarix Gallica* (Tamarisk Tree) - A good hedge plant. Will grow alike in water and the driest soil, also in salt ground”

Information is also available in interstate local papers about promotion and growing of *Acacia paradoxa* in Victoria and New South Wales at the same time.

The conclusion is not hard to draw with the name, the lack of any mention of its existence already in the Adelaide area or further north and with seed needing to be brought in from Kangaroo Island, that there was no accessible population of *Acacia paradoxa* in the Adelaide Hills or further north where farming and grazing occurred by the early 1840s. Efforts to plant it in early farming days clearly succeeded when the fencing materials were mainly post and rail and later imported wire fencing. It seems appropriate to put *Acacia paradoxa* in a very doubtful status for Adelaide Hills and Lower North.

⁶¹ Barker, R. M. (2007) The botanical legacy of 1802: South Australian plants collected by Robert Brown and Peter Good on Matthew Flinders' Investigator and by the French scientists on Baudin's Géographe and Naturaliste *J. Adelaide Bot. Gard.* 21: 5-44

⁶² *Southern Australian* Tuesday 19 September 1843 page 3

⁶³ *Southern Australian* “The Prickly Mimosa, or Acacia, of Kangaroo Island” Tuesday 13 February 1844 page 2

⁶⁴ *South Australian Register* Wednesday 18 February 1852 page 3

⁶⁵ *South Australian Register* Saturday 9 August 1862 at page 2

⁶⁶ Brown J. E. (1881) *A Practical Treatise on Tree Culture in South Australia* SA Government Printer

⁶⁷ *Weekly Chronicle* Saturday 25 February 1882 at page 24

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Appendix 1

Table 26: Totals for all native species by site. Species occurring at only one site have shaded background. As at March 2014.

SA Botanical Region	Botanical name	Common Name	SA	NL	SL	Opp	Sites	NL	Hor1	Hor2	Duff	MU	Flag	Mck	RosM	SL	For	NL	Sha1	NL	Sha2	RosT	DMP	SL	Gor	SL	SL	SpG
	<i>Acacia acinacea</i>	Wreath Wattle		U		1	2				X			X														0
	<i>Acacia notabilis</i>	Notable Wattle			K	1																0						
	<i>Acacia paradoxa</i>	Kangaroo Thorn				1	1		X					0														
	<i>Acacia pycnantha</i>	Golden Wattle				2	3		X	X		0			X	0												X
	<i>Actinobole uliginosum</i>	Flannel Actinobole					1							X														
	<i>Allocasuarina verticillata</i>	Drooping Sheoak				1	1										X											
	<i>Amphipogon caricinus</i> ssp. <i>caricinus</i>	Grey-beard Grass		R	U		1							X														
	<i>Amyema miquelii</i>	Box Mistletoe				1								0														
	<i>Aristida australis</i>	Wire-grass	R	K	K		1																			X		
	<i>Aristida behriana</i>	Brush Wire-grass			U		11		X	X		X		X	X	X	X					X	X	X	X	X	X	X
	<i>Aristida contorta</i>	Curly Wire-grass		R	K	1											0											
	<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily				1	9		X			X		X	X	0		X	X	X	X	X	X	X				X
	<i>Arthropodium strictum</i>	Spring Vanilla-lily				1	9		X	X	X				X	0		X	X	X	X	X	X	X				X
	<i>Asperula conferta</i>	Crowded Woodruff				1	4				X			X		0		X	X	X	X							
	<i>Atriplex semibaccata</i>	Berry Saltbush				2	4		X	X	X		X	0	0								X					
	<i>Atriplex suberecta</i>	Lagoon Saltbush				2																0	0					
	<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass					3		X					X			X											
	<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass					14		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	<i>Austrodanthonia eriantha</i>	Hill Wallaby-grass			U		1							X														
	<i>Austrodanthonia fulva</i>	Leafy Wallaby-grass		K	U		3									X		X										
	<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass					13		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	<i>Austrostipa blackii</i>	Crested Spear-grass					13		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	<i>Austrostipa curticola</i>	Short-crest Spear-grass			U		4			X					X							X						
	<i>Austrostipa drummondii</i>	Coitony Spear-grass				1	5				X						0					X	X	X				X
	<i>Austrostipa elegantissima</i>	Feather Spear-grass			U		2				X			X														
	<i>Austrostipa eremophila</i>	Rusty Spear-grass			U	2	11		X	X	X	0	0	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	<i>Austrostipa exilis</i>	Heath Spear-grass		T	T	1																0						

SA Botanical Region	Botanical name	Common Name	SA	NL	SL	Opp	Sites	NL Hor1	NL Hor2	NL Duff	MU Flag	NL Mck	SL RosM	NL For	NL Sha1	NL Sha2	SL RosT	SL DMP	SL Gor	SL Steb	SL SpG
	<i>Austrostipa flavescens</i>	Coast Spear-grass				1						0									
	<i>Austrostipa gibbosa</i>	Swollen Spear-grass	R	T	R	1	1								0	X					
	<i>Austrostipa nodosa</i>	Tall Spear-grass				14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	<i>Austrostipa pilata</i>	Prickly Spear-grass	V	T	T	1	X														
	<i>Austrostipa puberula</i>	Fine-hairy Spear-grass		T	K	1	2				X	0					X				
	<i>Austrostipa scabra</i> ssp. <i>falcata</i>	Slender Spear-grass				1						X									
	<i>Austrostipa setacea</i>	Corkscrew Spear-grass		R	U	2						X		X							
	<i>Boerhavia domini</i>	Tar-vine				2	4				X				0			X	X	0	X
	<i>Bothriochloa macra</i>	Red-leg Grass	R	K	R	1														X	
	<i>Bulbine bulbosa</i>	Bulbine-lily				1	4		X	X		X		X		0					
	<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria				6	1	0	X	X		0	0	0	0		0				
	<i>Caesia calliantha</i>	Blue Grass-lily				2	1		X	X		0		0							
	<i>Calandrinia eremaea</i>	Dryland Purslane		U	U	1						X									
	<i>Callitris gracilis</i>	Southern Cypress Pine		U	U	1						0					PI				
	<i>Calocephalus citreus</i>	Lemon Beauty-heads		U	R	1	3		X			0			X	X					
	<i>Calostemma purpureum</i>	Pink Garland-lily					6					X	X	X				X	X		X
	<i>Carex bichenoviana</i>	Notched Sedge				2												0			0
	<i>Cheilanthes austrotenuifolia</i>	Annual Rock-fern				1	1					X		0							
	<i>Cheilanthes distans</i>	Bristly Cloak-fern		R	R	2												X	X		X
	<i>Cheilanthes lasiophylla</i>	Woolly Cloak-fern			E	1												X			
	<i>Cheilanthes seiberi</i>	Narrow Rock-fern			R	1						X									
	<i>Chenopodium desertorum</i> ssp. <i>microphyllum</i>	Small-leaf Goosefoot				1						0									
	<i>Chloris truncata</i>	Windmill Grass				3	5	0			X	0					X	0	X	X	X
	<i>Chrysocephalum apiculatum</i>	Yellow Buttons					3		X	X		X	X								
	<i>Chrysocephalum semipapposum</i>	Clustered Everlasting			R	2	3		X	X	0	X	X	X		0					
	<i>Chthonocephalus pseudovax</i>	Ground-heads				1						0									
	<i>Convolvulus angustissimus</i> var. <i>angustissimus</i>	Pink Convolvulus				1	9	X	X		0	X	X	X	X	X	X				X
	<i>Convolvulus angustissimus</i> var. <i>peninsu-</i>	Grassland Convolvulus				2	3			X		0		0	X	X					

SA Botanical Region	Common Name	SA	NL	SL	Opp	Sites	NL	Hor1	NL	Hor2	NL	Duff	MU	Flag	Mck	NL	RosM	SL	For	NL	Sha1	NL	Sha2	RosT	SL	DMP	SL	Gor	SL	Steb	SL	SpG		
	Australian Convolvulus				2	1									0											0					X			
	Crassula				1	4				X					X											X	X				X			
	Spreading Crassula				2	5		0		X					X										X	X					X			
	Long-flower Cryptandra	R		T	1	1			X						0																			
	Tall Scurf-pea				1									0																				
	Lemon-grass			V	2											0										0								
	Spiny Flat-sedge					1																	X					X						
	Native Carrot					1																												
	Pale Flax-lily	R		V		1														X														
	Black-anther Flax-lily					11		X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
	Silky Blue-grass			V	1	2											X									0						X		
	Silky Umbrella grass					1																											X	
	Coiton Panic-grass			K	1	2										0										X						X		
	Emu-grass			K	3										0											0								
	Sticky Hop-bush					1											X																	
	Scarlet Sundew					3									X												X							
	Whittaker's Sundew					2									X																			
	Clammy Goosefoot					1																												X
	Climbing Saltbush				2																					0								
	Native Wheat-grass				1	5								0	X						X	X				X	X							
	Ruby Saltbush				1	2									0										X	X								
	Ruby Saltbush				2	3									0										X	X	X							X
	Black-head Grass					10		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Umbrella Grass				2	3											0																	
	Hairy Willow-herb			V	1																													
	Weeping Emubush				1	1																												

⁶⁸ Enchylaena tomentosa prostrate form is separately recorded here but not included as a separate species for the purposes of species totals.
A Biological Survey of Lower North Grasslands of South Australia

SA Botanical Region	Common Name	SA	NL	SL	Opp	Sites	NL Hor1	NL Hor2	NL Duff	MU Flag	NL Mck	SL RosM	NL For	NL Sha1	NL Sha2	SL RosT	SL DMP	SL Gor	SL Steb	SL SpG
Erodium cicutarium	Blue Heron's-bill				2						0		0							
Eucalyptus largiflorens	River Box		V	V		1										X				
Eucalyptus leucoxylon ssp. pruinosa	Inland S A Blue Gum				1	1					0					X				
Eucalyptus odorata	Peppermint Box				1				0											
Eucalyptus porosa	Mallee Box				1	2											0		X	X
Euphorbia drummondii	Caustic Spurge				4	6	X		X		0	0	0	0		X	X	X		X
Eutaxia microphylla var. microphylla	Small-leaf Bush-pea				1						0									
Geranium retrorsum	Grassland Geranium				1								0							
Glycine rubiginosa	Twining Glycine				1								0							
Gonocarpus elatus	Hill Raspwort					3					X		X				X			
Goodenia albiflora	White Goodenia		U	U	1								0							
Goodenia pinnatifida	Cut-leaf Goodenia		U	U	2	8	X		X	0	X	X	0	X	X		X	X	X	X
Goodenia pusilliflora	Small-flower Goodenia				1						0									
Goodenia willisiana	Silver Goodenia				1											0				
Halgania cyanea	Rough Blue-flower					1			X											
Haloragis acutangula	Smooth Raspwort				1	2					0			X	X					
Haloragis aspera	Rough Raspwort		U	R		5					X	X	X	X	X					
Helichrysum luteoalbum	Jersey Everlasting				1	1												X	0	
Hyalosperma glutinosum ssp. glutinosum	Golden Sunray				1				X											
Hyalosperma semisterile	Orange Sunray				1	2			X	0	X									
Hypoxis vaginata var. vaginata	Yellow Star					4			X		X			X	X					
Isoetopsis graminifolia	Grass Cushion					1					X									
Juncus flavidus	Yellow Rush				1						0									
Juncus subsecundus	Finger Rush				1						0									
Lagenifera huegelii	Coarse Bottle-daisy				1						0									
Leiocarpa tomentosa	Woolly Plover-daisy					1												X		
Leiocarpa websteri	Narrow Plover-daisy		?		1	1								0	X					
Lepidium papillosum	Warty Peppercress				1						0									
Lepidosperma viscidum	Sticky Sword-sedge				2	3			X		X	X		0		0				
Leptorhynchos squamatus ssp. squamatus	Scaly Buttons					1					X									

SA Botanical Region	Common Name	SA	NL	SL	Opp	Sites	NL	NL	NL	NL	NL	NL	MU	NL	Mck	RosM	NL	NL	NL	NL	NL	NL	NL	SL	SL	SL	SL	SL	SL	SL	SL	SL							
Botanical name	Common Name		NL	SL	Opp	Sites	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL				
<i>Leptorhynchos tetrachaetus</i>	Little Buttons		U	X		1									X																								
<i>Levenhookia dubia</i>	Hairy Stylewort					1									X																								
<i>Linum marginale</i>	Native Flax					1																																	
<i>Lomandra collina</i>	Sand Mat-rush				2																																		
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush					11																																	
<i>Lomandra effusa</i>	Scented Mat-rush			R	1	13	X	X	X	X	X	X	X	0	X	X	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
<i>Lomandra micrantha</i> ssp. <i>micrantha</i>	Small-flower Mat-rush		K		2	7	X	X	X	X	X	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
<i>Lomandra multiflora</i> ssp. <i>dura</i>	Hard Mat-rush				1	12	X	X	X	X	X	X			X	X	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
<i>Lomandra nana</i>	Small Mat-rush		K			1																																	
<i>Lotus australis</i>	Australian Trefoil				1													0																					
<i>Lythrum hyssopifolia</i>	Lesser Loosestrife				1										0																								
<i>Maireana brevifolia</i>	Short-leaf Bluebush				5	1			0						0																								
<i>Maireana encyphaenoides</i>	Wingless Fissure-plant			U		13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush	R	V	V	3	2			X	0	X	0	0		0																								
<i>Melaleuca brevifolia</i>	Short-leaf Honey-myrtle				1													0																					
<i>Microtis arenaria</i>	Notched Onion Orchid					1																																	
<i>Minuria leptophylla</i>	Minnie Daisy					1																																	
<i>Neurachne alopecuroidea</i>	Fox-tail Mulga-grass					1																																	
<i>Opercularia scabrada</i>	Stalked Opercularia				1													0																					
<i>Opercularia turpis</i>	Twiggy Opercularia				1												0																						
<i>Oxalis perennans</i>	Native Sorrel				1	8	X	X							0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Panicum effusum</i> var. <i>effusum</i>	Hairy Panic			K		1																																	
<i>Pimelea curviflora</i> ssp. <i>sericea</i>	Curved Riceflower		K	R		1																																	
<i>Pimelea glauca</i>	Smooth Riceflower				1	2										X	0	X																					
<i>Pimelea micrantha</i>	Silky Riceflower			R	3	3			X	0						X	0																						
<i>Pitiosporum angustifolium</i>	Native Apricot			R	3	2									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Plantago gaudichaudii</i>	Narrow-leaf Plantain		U	R	1	2									0																								
<i>Plantago hispida</i>	Hairy Plantain				2										0																								
<i>Plantago varia</i>	Variable Plantain				1																																		
<i>Pleurosus rutifolius</i>	Blanket Fern					2																																	

SA Botanical Region	Botanical name	Common Name	SA	NL	SL	Opp	Sites	NL	NL	Hor2	Duff	NL	Flag	MU	NL	Mck	RosM	SL	NL	NL	Sha1	Sha2	RosT	SL	DMP	Gor	SL	SL	SpG
	<i>Poa clelandii</i>	Matted Tussock-grass				1										0													
	<i>Poa crassicaudex</i>	Thick-stem Tussock-grass				2									0														
	<i>Poa labillardieri</i> var. <i>labillardieri</i>	Tussock-grass				3									0									0					0
	<i>Podolepis canescens</i>	Grey Copper-wire Daisy		T	X		1						X																
	<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy	R	E	E		2								X						X	X							
	<i>Pogonolepis muelleriana</i>	Stiff Cup-flower			U		1									X													
	<i>Pomaderris paniculosa</i> ssp. <i>paniculosa</i>	Mallee Pomaderris				1			0																				
	<i>Ptilotus erubescens</i>	Hairy-tails	R	T	R		1									X													
	<i>Ptilotus nobilis</i> ssp. <i>angustifolius</i>	Yellow-tails			?		1																	0					
	<i>Ptilotus spathulatus</i> forma <i>spathulatus</i>	Pussy-tails			R		1	6	X	X	X	X	X	X	0	X	X	X	X					X	X			X	
	<i>Pycnosorus globosus</i>	Billy-buttons	V	R			1															X							
	<i>Rhagodia parabolica</i>	Mealy Saltbush			R		1																X	PI					
	<i>Rhodanthe laevis</i>	Smooth Daisy			U		1									X													
	<i>Rhodanthe pygmaea</i>	Pigmy Daisy			U		1									X													
	<i>Rumex dumosus</i>	Wiry Dock	R				2																						
	<i>Salsola australis</i>	Buckbush				1	3	0	0	0	0	0	X										X	X					
	<i>Scaevola albida</i>	Pale Fanflower				1	2							0			X	0	X										
	<i>Scierolaena diacantha</i>	Grey Bindyi				1																							
	<i>Senna artemisioides</i> nothosp. <i>coriacea</i>	Broad-leaf Desert Senna				2											0						0						
	<i>Setaria constricta</i>	Knotty-butt Setaria			R		2																X						
	<i>Setaria jubiflorum</i>	Warrego Summer-grass				1																		0					
	<i>Sida corrugata</i> var. <i>angustifolia</i>	Grassland Sida			R		9	X	X							X	X	X	X	X	X	X	X	X	X	X	X	X	X
	<i>Sida corrugata</i> var. <i>corrugata</i>	Corrugated Sida				1	1						0											X					
	<i>Stackhousia monogyna</i>	Creamy Candles				2	7	X								X	X	X	X	X	X	X	X	0					X
	<i>Swainsona behriana</i>	Behr's Swainson-pea	R	T	E		1									X													
	<i>Swainsona stipularis</i>	Orange Swainson-pea		K	E	1	1														0	X							
	<i>Teucrium racemosum</i>	Grey Germander			T	1	3									0					X	X							X
	<i>Themeda australis</i>	Kangaroo Grass				1	11	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	<i>Thysanotus patersonii</i>	Twining Fringe-lily				1										0													
	<i>Triptilodiscus pygmaeus</i>	Small Yellow-heads			U		1									X													

SA Botanical Region	Botanical name	Common Name	SA NL	SL	Opp	Sites	NL	NL	Hor1	NL	Hor2	NL	Duff	MU	Flag	NL	Mck	RosM	SL	NL	For	NL	Sha1	NL	Sha2	NL	RosT	SL	DMP	SL	Gor	SL	Steb	SL	SpG			
	<i>Velleia arguta</i>	Toothed Velleia		R	1	1								0														X										
	<i>Velleia paradoxa</i>	Spur Velleia	Q	U		1									X																							
	<i>Vittadina australasica</i> var. <i>australasica</i>	Sticky New Holland Daisy		R		1								X																								
	<i>Vittadina blackii</i>	Narrow-leaf New Holland Daisy		R	3	5				X	X		X	X		0	0	X			0					0								X				
	<i>Vittadina cervicularis</i> var. <i>cervicularis</i>	Waisted New Holland Daisy		4	4	1				X						0	0				0				0									0				
	<i>Vittadina cuneata</i> var. <i>cuneata</i>	Fuzzy New Holland Daisy		5	5					X				X		X					X				X									X				
	<i>Vittadina gracilis</i>	Woolly New Holland Daisy		3	7				X	X	X		X	X	X	0	0	X			X	0	0		X		0											
	<i>Vittadina megacephala</i>	Giant New Holland Daisy		R	2	6			X	X	X		X	X	X	0	0				X				X									0				
	<i>Wahlenbergia communis</i>	Tufted Bluebell				1										X																						
	<i>Wahlenbergia gracilentia</i>	Annual Bluebell			1											0																						
	<i>Wahlenbergia luteola</i>	Yellow-wash Bluebell			1	1										X					0																	
	<i>Wahlenbergia preissii</i>	Bluebell			1											0																						
	<i>Walwalleya prolata</i>	Rigid Panic		R	3	3				0					0	0					X	X		X	X		0								X			
	<i>Wurmbea dioica</i> ssp. <i>brevifolia</i>	Early Nancy			2	1										0	0				0	0		X	X													
	<i>Wurmbea dioica</i> ssp. <i>dioica</i>	Early Nancy				3										X					X	X		X	X													
	<i>Zygophyllum glaucum</i>	Pale Twinleaf		T	1																						0											
					173	477																																
Lichens							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Liverworts																X												X								X		
Mosses							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Total quad natives						19	31	42	22	64	34	28	33	39	29	49	22	49	22	20	45																	
Total Opp natives						3	2	4	15	49	6	42	9	5	11	21	0	2	5																			
Total area natives						22	33	47	37	113	40	70	42	44	39	70	22	22	50																			
Total quad exotics						17	19	18	13	10	20	19	12	15	16	32	18	15	28																			
84 One locality only						1	0	4	4	35	2	10	11	-	5	7	1	2	2																			
48 One site only Quad						1	0	2	2	20	0	3	10	0	2	4	1	2	2																			
36 One site only Opp						0	0	2	2	15	2	7	1	0	3	4	0	0	0																			

Table 27: Occurrence and Summary of introduced species by site

Scientific name	Common Name	Hor1	Hor2	Duff	Flag	McK	RosM	For	Sha1	Sha2	RosR	DMP	Gor	Steb	SpG	ΣSite	ΣOpp
<i>Acacia cyclops</i>	Western Coastal Wattle										0						1
<i>Aira elegantissima</i>	Delicate Hair-grass	x	x			x										3	
<i>Aira sp</i>	Hair Grass							x				x			x	3	
<i>Allium vineale</i>	Crow Garlic								0								1
<i>Anagallis arvensis</i>	Pimpernel								x			x			x	3	
<i>Arctotheca calendula</i>	Cape Weed			x								x				2	
<i>Arundo donax</i>	Giant Reed						x									1	
<i>Asparagus asparagoides f. asparagoides</i>	Bridal Creeper										0	x				1	1
<i>Asphodelus fistulosus</i>	Onion Weed						x	x			x				x	4	
<i>Aster subulata</i>	Aster weed														0		1
<i>Asteriscus spinosus</i>	Golden Pallenis						x	x			0				x	3	1
<i>Avena barbata</i>	Bearded Oat		x		x		x	x			x	x	x	x		8	
<i>Avena fatua</i>	Wild Oat								x	x						2	
<i>Avena sp</i>	Wild Oat			x											x	2	
<i>Brachypodium distachyon</i>	False Brome	x	x	x	x	x	x	x	x	x	x	x	x	x	x	14	
<i>Brassica tournefortii</i>	Wild Turnip											x				1	
<i>Briza maxima</i>	Large Quaking-grass				x	x		x				x			x	5	
<i>Bromus diandrus</i>	Great Brome			x			x			x	x	x	x	x	x	8	
<i>Bromus hordeaceus</i>	Soft Brome		x					x							x	3	
<i>Bromus madritensis</i>	Compact Brome		x								x					2	
<i>Bromus rubens</i>	Red Brome	x							x							2	
<i>Bromus sp</i>	Brome Grass				x											1	
<i>Carthamus lanatus</i>	Saffron Thistle					0						x			x	2	1
<i>Casuarina glauca</i>	Swamp Oak						x									1	
<i>Centaurea melitensis</i>	Malta Thistle								x	x						2	
<i>Centaureum tenuifolium</i>	Branched Centaury								x							1	
<i>Convolvulus arvensis</i>	Field Bindweed												x			1	
<i>Conyza bonariensis</i>	Flax-leaf Fleabane													x		1	
<i>Cynara cardunculus ssp. flavescens</i>	Artichoke Thistle		x				x	x		x	x	x	x		x	8	

Scientific name	Common Name	Hor1	Hor2	Duff	Flag	McK	RosM	For	Sha1	Sha2	RosR	DMP	Gor	Steb	SpG	ΣSite	ΣOpp
<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch			0							0		x	x		2	1
<i>Ecballium elaterium</i>	Squirting Cucumber										0						1
<i>Echium plantagineum</i>	Salvation Jane	x	x	x	x		x		x		x	x	x		x	11	
<i>Ehrharta longiflora</i>	Annual Veldt Grass											x	x	x		3	
<i>Erodium cicutarium</i>	Cut-leaf Heron's-bill	x														1	
<i>Euphorbia peplus</i>	Petty Spurge											0					1
<i>Euphorbia terracina</i>	False Caper											x				1	
<i>Fumaria</i> sp.	Fumitory											x				1	
<i>Galenia pubescens</i> var. <i>pubescens</i>	Coastal Galenia				0							x		x		2	1
<i>Galium murale</i>	Small Bedstraw	x												x		2	
<i>Gazania linearis</i>	Gazania					x										1	
<i>Gomphocarpus cancellatus</i>	Broad-leaf Colton-bush										0						1
<i>Hedyotis rhagadioloides</i>	Cretan weed					x										1	
<i>Helminthotheca echioides</i>	Ox-tongue														x	1	
<i>Hordeum glaucum</i>	Blue Barley-grass			x												1	
<i>Hordeum murinum</i>	Barley-grass														x	1	
<i>Hypochoeris glabra</i>	Smooth Cat's Ear	x				x										2	
<i>Hypochoeris radicata</i>	Rough Cat's Ear		x				x									2	
<i>Hypochoeris</i> sp	Cat's Ear											x				1	
<i>Lepidium africanum</i>	Common Peppergrass			x												1	
<i>Lepidium</i> sp.	Lepidium											x				1	
<i>Linum strictum</i>	Upright Yellow Flax							x		x						2	
<i>Lolium rigidum</i>	Wimmera Ryegrass			x											x	2	
<i>Lolium</i> sp	Ryegrass											x	x	x		4	
<i>Marrubium vulgare</i>	Horehound	x	x		0			x							x	4	1
<i>Medicago polymorpha</i> var. <i>polymorpha</i>	Burr Medic												x			1	
<i>Medicago scutellata</i>	Snail Medic										0						1
<i>Medicago truncatula</i>	Barrel Medic			x						x						2	
<i>Moraea miniata</i>	Two-leaf Cape Tulip						x	0								1	1
<i>Moraea seifolia</i>	Thread Iris		x	x	x	x	x	x		x		x				8	

Scientific name	Common Name	Hor1	Hor2	Duff	Flag	McK	RosM	For	Sha1	Sha2	RosR	DMP	Gor	Steb	SpG	Σ Site	Σ Opp
<i>Neostema apulum</i>	Hairy Sheepweed	x														1	
<i>Nicotiana glauca</i>	Tree Tobacco							x					0			1	
<i>Oenothera stricta</i> ssp. <i>stricta</i>	Evening Primrose						0										1
<i>Olea europaea</i> ssp. <i>europaea</i>	Olive	x	x				x				x	x		x	x	7	
<i>Oxalis pes-caprae</i>	Soursob		x	x			x		x	x	x	x	x			8	
<i>Parentucellia latifolia</i>	Yellow Bartsia											x				1	
<i>Pennisetum setaceum</i>	Fountain Grass											0					1
<i>Pennisetum villosum</i>	Feather-top								0			0					2
<i>Pennisetum clandestinum</i>	Kikuyu												x			1	
<i>Pentstemonis airoides</i>	False Hairgrass					x											1
<i>Piptatherum miliaceum</i>	Rice Millet						x				x	x	x			4	
<i>Plantago lanceolata</i> ssp. <i>lanceolata</i>	Ribwort						x				x					2	
<i>Plantago scabra</i>	Sand Plantain									x						1	
<i>Poa bulbosa</i>	Bulbous Meadow-grass			x												1	
<i>Prunus dulcis</i>	Almond tree		0									x				1	1
<i>Rapistrum rugosum</i> ssp. <i>rugosum</i>	Turnip Weed							x	x	x					x	4	
<i>Reichardia tingitana</i>	False Sowthistle			x							x					2	
<i>Romulea rosea</i> var. <i>australis</i>	Common Onion-grass		x	x	x							x	x		x	6	
<i>Romulea</i> sp.	Onion Grass						x	x								2	
<i>Rosa canina</i>	Dog Rose		0														
<i>Rostraria cristata</i>	Mediterranean Hairgrass													x		1	
<i>Rumex crispus</i>	Curly Dock												x		x	2	
<i>Salvia verbenaca</i> var. <i>verbenaca</i>	Wild Sage	x	x	x	x				x	x					x	7	
<i>Scabiosa atropurpurea</i>	Pincushion		x		0		x					x				3	1
<i>Schinus molle</i>	Pepper-tree		0				x								x	3	
<i>Scorzononia laciniata</i>	Scorzonera									x						1	
<i>Senecio pterophorus</i>	African daisy										0						1
<i>Solanum elaeagnifolium</i>	Silver-leaf Nightshade										0						1
<i>Solanum nigrum</i>	Black Nightshade		x		0						x					2	1
<i>Sonchus oleraceus</i>	Common Sow-thistle						x	x	x	x		x		x	x	7	

Scientific name	Common Name	Hor1	Hor2	Duff	Flag	McK	RosM	For	Sha1	Sha2	RosR	DMP	Gor	Steb	SpG	ΣSite	ΣOpp
<i>Trifolium angustifolium</i>	Narrow-leaf Clover							X			X	X	X	X	X	6	
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	X	X		X	X		X				X		X	X	8	
<i>Trifolium campestre</i>	Hop Clover	X	X		X			X				X			X	6	
<i>Trifolium fragiferum</i> ssp. <i>fragiferum</i>	Strawberry Clover			X												1	
<i>Trifolium scabrum</i>	Rough Clover			X												1	
<i>Vicia monantha</i>	Spurred Vetch									X						1	
<i>Vicia sativa</i>	Common Vetch						X				X		X			3	
<i>Vulpia bromoides</i>	Squirrel-tail Fescue	X														1	
<i>Vulpia myuros</i> forma <i>myuros</i>	Rats-tail Fescue							X				X	X			3	
<i>Vulpia</i> sp.	Fescue	X	X	X	X	X								X	X	7	
<i>Withania somnifera</i>	Winter Cherry														X	1	
Total																252	20
Total exotic species on quadrat (site - Spring Gully)		17	19	18	13	10	20	19	12	15	16	32	18	15	28	252	
Opportune exotic species near quadrat/site		0	3	1	3	1	1	0	2	0	7	3	0	2	1	20	
Total exotic species recorded at or near quadrat/site		17	22	19	16	11	22	15	14	15	23	35	18	17	29	272	
Total native species for quadrat/site		19	31	42	22	64	34	28	34	39	29	49	22	20	45	477	
Total all species on quadrat/site		36	50	60	35	74	54	47	46	54	45	81	40	35	73	729	
% exotic sp. for site		47	38	30	37	14	37	40	26	28	36	40	45	43	38		

Table 28: Full data for EPBC Class A, B & C assessments for 14 sites. Also State and Transition summary for sites.

“Ex Herb” = Excluded Herb is a grazing resistant species not counted for EPBC class assessment. “BL Herb” is a herbaceous broadleaf species counted for EPBC class assessment. “Grass” is a native tussock grass species counted for EPBC class assessment. Tree, shrub, sedge and irongrass species do not count for the herbaceous broadleaf or grass species categories in assessment for the purpose of this Report. They count for total native species. There are some grey areas in categories where views may differ. Sub-species of *Convolvulus*, for example.

Botanical name	Common Name	EPBC	Hor1	Hor2	Duff	Flag	McK	RosM	Ford	Sha1	Sha2	RosT	DMP	Gor	Steb	SpG
<i>Acacia acinacea</i>	Wreath Wattle				X		X									0
<i>Acacia notabilis</i>	Notable Wattle											0				
<i>Acacia paradoxa</i>	Kangaroo Thorn		X				0									
<i>Acacia pycnantha</i>	Golden Wattle		X	X	0	0		X	0							X
<i>Actinobole uliginosum</i>	Flannel Actinobole	BL Herb					X									
<i>Allocasuarina verticillata</i>	Drooping Sheoak								X							
<i>Amphipogon carcinus</i>	Grey-beard Grass	Grass					X									
<i>Amyema miquelii</i>	Box Mistletoe						0									
<i>Aristida australis</i>	Wire-grass	Grass													X	
<i>Aristida behriana</i>	Brush Wire-grass	Grass	X	X		X	X	X	X			X	X	X	X	X
<i>Aristida contorta</i>	Curly Wire-grass	Grass							0							
<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily	BL Herb		X		X	X	X	0	X	X	X	X			X
<i>Arthropodium strictum</i>	Spring Vanilla-lily	BL Herb		X	X		X	X	0	X	X	X	X			X
<i>Asperula conferta</i>	Crowded Woodruff	BL Herb			X		X		0	X	X					
<i>Atriplex semibaccata</i>	Berry Saltbush	BL Herb		X	X	X	0		0				X			
<i>Atriplex suberecta</i>	Lagoon Saltbush	BL Herb										0	0			
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass	Grass	X				X		X							
<i>Austrodanthonia caespitosa</i>	White-top Wallaby-grass	Grass	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Austrodanthonia eriantha</i>	Hill Wallaby-grass	Grass					X									
<i>Austrodanthonia fulva</i>	Leafy Wallaby-grass	Grass						X		X	X					
<i>Austrodanthonia setacea</i>	Small-flower Wallaby-grass	Grass	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Austrostipa blackii</i>	Crested Spear-grass	Grass	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Austrostipa curticola</i>	Short-crest Spear-grass	Grass		X				X			X	X				
<i>Austrostipa drummondii</i>	Cottony Spear-grass	Grass			X				0			X	X		X	X
<i>Austrostipa elegantissima</i>	Feather Spear-grass	Grass			X		X									

Botanical name	Common Name	EPBC	Hor1	Hor2	Duff	Flag	McK	RosM	Ford	Sha1	Sha2	RosT	DMP	Gor	Steb	SpG
<i>Austrostipa eremophila</i>	Rusty Spear-grass	Grass	x	x	x	0	0	x	x	x	x	x	x		x	x
<i>Austrostipa exilis</i>	Heath Spear-grass	Grass										0				
<i>Austrostipa flavescens</i>	Coast Spear-grass	Grass					0									
<i>Austrostipa gibbosa</i>	Swollen Spear-grass	Grass								0	x					
<i>Austrostipa nodosa</i>	Tall Spear-grass	Grass	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<i>Austrostipa pilata</i>	Prickly Spear-grass	Grass	x													
<i>Austrostipa puberula</i>	Fine-hairy Spear-grass	Grass				x	0						x			
<i>Austrostipa scabra</i> ssp. <i>falcata</i>	Slender Spear-grass	Grass					x									
<i>Austrostipa setacea</i>	Corkscrew Spear-grass	Grass					x	x	x							
<i>Boerhavia dominii</i>	Tar-vine	BL Herb				x			0				x	x	0	x
<i>Bothriochloa macra</i>	Red-leg Grass	Grass													x	
<i>Bulbine bulbosa</i>	Bulbine-lily	BL Herb		x	x		x	x	x		0					
<i>Bursaria spinosa</i> ssp. <i>spinosa</i>	Sweet Bursaria		0		x		0	0	0	0		0				
<i>Caesia calliantha</i>	Blue Grass-lily	BL Herb			x		0		0							
<i>Calandrinia eremaea</i>	Dryland Purslane	BL Herb					x									
<i>Callitris gracilis</i>	Southern Cypress Pine						0						PI			
<i>Calocephalus citreus</i>	Lemon Beauty-heads	BL Herb		x			0			x	x					
<i>Calostemma purpureum</i>	Pink Garland-lily	BL Herb					x	x	x				x	x		x
<i>Carex bichenoviana</i>	Notched Sedge												0			0
<i>Cheilanthes austrotenuifolia</i>	Annual Rock-fern	BL Herb					x		0							
<i>Cheilanthes distans</i>	Bristly Cloak-fern	BL Herb											x			x
<i>Cheilanthes lasiophylla</i>	Woolly Cloak-fern	BL Herb											x			
<i>Cheilanthes selberi</i>	Narrow Rock-fern	BL Herb					x									
<i>Chenopodium desertorum</i> ssp. <i>microphyllum</i>	Small-leaf Goosefoot	BL Herb					0									
<i>Chloris truncata</i>	Windmill Grass	Grass	0			x						x	0	x	x	x
<i>Chrysocephalum apiculatum</i>	Yellow buttons	BL Herb			x		x	x								
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	BL Herb			x	0	x	x			0					
<i>Cithonocephalus pseudevax</i>	Ground-heads	BL Herb					0									
<i>Convolvulus angustissimus</i> var. <i>angustissimus</i>	Pink Convolvulus	Ex Herb	x	x		0	x	x	x	x	x	x				x

Botanical name	Common Name	EPBC	Hor1	Hor2	Duff	Flag	McK	RosM	Ford	Sha1	Sha2	RosT	DMP	Gor	Steb	SpG
<i>Convolvulus angustissimus</i> ssp. <i>peninsularum</i>	Grassland Convolvulus	BL Herb			x		0		0	x	x					
<i>Convolvulus remotus</i>	Australian Convolvulus	BL Herb					0						0			x
<i>Crassula colligata</i> ssp. <i>colligata</i>	Crassula	BL Herb					x						x	x	x	x
<i>Crassula colorata</i> var. <i>acuminata</i>	Dense Crassula	BL Herb			x		x		0				x		x	
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula	BL Herb	0		x		x		0				x		x	x
<i>Cryptandra campanulata</i>	Long-flower Cryptandra				x		0									
<i>Cullen australasicum</i>	Tall Scurf-pea					0										
<i>Cymbopogon ambiguus</i>	Lemon-grass	Grass							0				0			
<i>Cyperus gymnocaulos</i>	Spiny Flat-sedge													x		
<i>Daucus glochidiatus</i>	Native Carrot	BL Herb									x					
<i>Dianella longifolia</i> var. <i>grandis</i>	Pale Flax-lily	BL Herb							x							
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily	BL Herb		x	x		x	x	x	x	x	x	x	x	x	x
<i>Dichanthium sericeum</i> ssp. <i>sericeum</i>	Silky Blue-grass	Grass						x					0			x
<i>Digitaria ammophila</i>	Silky Umbrella grass	Grass														x
<i>Digitaria brownii</i>	Cotton Panic-grass	Grass							0				x		x	
<i>Distichlis distichophylla</i>	Emu-grass	Grass					0		0				0			
<i>Dodonaea viscosa</i> ssp. <i>spatulata</i>	Sticky Hop-bush								x							
<i>Drosera glanduligera</i>	Scarlet Sundew	BL Herb					x		x				x			
<i>Drosera whittakeri</i>	Whittaker's Sundew	BL Herb					x		x							
<i>Dysphania pumilio</i>	Clammy Goosefoot	BL Herb														x
<i>Einadia nutans</i> ssp. <i>nutans</i>	Climbing Saltbush	BL Herb					0						0			
<i>Elymus scabrus</i> var. <i>scabrus</i>	Native Wheat-grass	Grass				0	x			x	x		x	x		
<i>Enchylaena tomentosa</i> (prostrate form)	Ruby Saltbush						0					x	x			
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush						0		0			x	x			x
<i>Erneapogon nigricans</i>	Black-head Grass	Grass	x	x	x	x	x	x	x			x	x		x	x
<i>Enteropogon acicularis</i>	Umbrella Grass	Grass						0					x	0	x	x
<i>Epilobium hirtigerum</i>	Hairy Willow-herb											0				
<i>Eremophila longifolia</i>	Weeping Emubush								0				x			
<i>Erodium cicutarium</i>	Blue Heron's-bill	BL Herb					0		0							
<i>Eucalyptus largiflorens</i>	River Box											x				

Botanical name	Common Name	EPBC	Hor1	Hor2	Duff	Flag	McK	RosM	Ford	Sha1	Sha2	RosT	DMP	Gor	Steb	SpG
<i>Eucalyptus leucoxylon</i> ssp. <i>pruinosa</i>	Inland S. Aust. Blue Gum						0					X				
<i>Eucalyptus odorata</i>	Peppermint Box				0											
<i>Eucalyptus porosa</i>	Mallee Box												0		X	X
<i>Euphorbia drummondii</i>	Caustic Spurge	Ex Herb	X		X		0	0	0	0		X	X	X		X
<i>Eutaxia microphylla</i> var. <i>microphylla</i>	Small-leaf Bush-pea						0									
<i>Geranium retrorsum</i>	Grassland Geranium	BL Herb							0							
<i>Glycine rubiginosa</i>	Twining Glycine	BL Herb							0							
<i>Gonocarpus elatus</i>	Hill Raspwort	BL Herb					X		X							
<i>Goodenia albiflora</i>	White Goodenia	BL Herb							0							
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia	BL Herb			X	0	X	X	0	X	X		X	X		X
<i>Goodenia pusilliflora</i>	Small-flower Goodenia	BL Herb					0									
<i>Goodenia willisiana</i>	Silver Goodenia	BL Herb										0				
<i>Halgania cyanea</i>	Rough Blue-flower				X											
<i>Haloragis acutangula</i>	Smooth Raspwort	BL Herb					0			X	X					
<i>Haloragis aspera</i>	Rough Raspwort	BL Herb					X	X	X	X	X					
<i>Helichrysum luteoalbum</i>	Jersey Everlasting	BL Herb												X	0	
<i>Hyalosperma glutinosum</i> ssp. <i>glutinosum</i>	Golden Sunray	BL Herb			X											
<i>Hyalosperma semisterile</i>	Orange Sunray	BL Herb			X	0	X									
<i>Hypoxis vaginata</i> var. <i>vaginata</i>	Yellow Star	BL Herb			X		X			X	X					
<i>Isoetopsis graminifolia</i>	Grass Cushion	BL Herb					X									
<i>Juncus flavidus</i>	Yellow Rush						0									
<i>Juncus subsecundus</i>	Finger Rush						0									
<i>Lagenifera huegelli</i>	Coarse Bottle-daisy	BL Herb					0									
<i>Leiocarpa tomentosa</i>	Woolly Plover-daisy	BL Herb											X			
<i>Leiocarpa websteri</i>	Narrow Plover-daisy	BL Herb								0	X					
<i>Lepidium papillosum</i>	Warty Peppercress	BL Herb					0									
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge				X		X	X		0		0				
<i>Leptorhynchos squamatus</i> ssp. <i>squamatus</i>	Scaly Buttons	BL Herb					X									
<i>Leptorhynchos tetrachaetus</i>	Little Buttons	BL Herb					X									
<i>Levenhookia dubia</i>	Hairy Stylewort	BL Herb					X									
<i>Linum marginale</i>	Native Flax	BL Herb									X					

Botanical name	Common Name	EPBC	Hor1	Hor2	Duff	Flag	McK	RosM	Ford	Sha1	Sha2	RosT	DMP	Gor	Steb	SpG
<i>Lomandra collina</i>	Sand Mat-rush								0		0					
<i>Lomandra densiflora</i>	Scented Mat-rush			X	X		X	X	X	X	X	X	X	X		X
<i>Lomandra effusa</i>	Scented Mat-rush		X	X	X	X	X	X	0	X	X	X	X	X	X	X
<i>Lomandra micrantha</i> ssp. <i>micrantha</i>	Small-flower Mat-rush		X	X	X	0	X	X	?	X	X	0	?			
<i>Lomandra multiflora</i> ssp. <i>dura</i>	Hard Mat-rush		X	X	X		X	X	0	X	X	X	X	X	X	X
<i>Lomandra nana</i>	Small Mat-rush												X			
<i>Lotus australis</i>	Australian Trefoil	BL Herb							0							
<i>Lythrum hyssopifolia</i>	Lesser Loosestrife	BL Herb					0									
<i>Maireana brevifolia</i>	Short-leaf Bluebush				0		0		0			0	0			X
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant	Ex Herb	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush				X	0	0					X	0			X
<i>Melaleuca brevifolia</i>	Short-leaf Honey-myrtle								0							
<i>Microtis arenaria</i>	Notched Onion Orchid	BL Herb									X					
<i>Minuria leptophylla</i>	Minnie Daisy	BL Herb								X						
<i>Neurachne alopecuroidea</i>	Fox-tail Mulga-grass	Grass					X									
<i>Opercularia scabrida</i>	Stalked Opercularia								0							
<i>Opercularia turpis</i>	Twiggy Opercularia							0								
<i>Oxalis perennans</i>	Native Sorrel	Ex Herb	X	X			0	X	X	X	X	X	X	X		X
<i>Panicum effusum</i> var. <i>effusum</i>	Hairy Panic	Grass											X			
<i>Pimelea curviflora</i> ssp. <i>sericea</i>	Curved Riceflower									X						
<i>Pimelea glauca</i>	Smooth Riceflower							X	0	X						
<i>Pimelea micrantha</i>	Silky Riceflower				X	0		X	0				0			X
<i>Pitiosporum angustifolium</i>	Native Apricot					0	0	0	0			X	X			
<i>Plantago gaudichaudii</i>	Narrow-leaf Plantain	BL Herb					0			X	X					
<i>Plantago hispida</i>	Hairy Plantain	BL Herb					0				0					
<i>Plantago varia</i>	Variable Plantain	BL Herb									0					
<i>Pleurosus rutifolius</i>	Blanket Fern	BL Herb											X			X
<i>Poa clelandii</i>	Matted Tussock-grass	Grass					0									
<i>Poa crassicaudex</i>	Thick-stem Tussock-grass	Grass					0		0							
<i>Poa labillardieri</i> var. <i>labillardieri</i>	Tussock-grass	Grass							0				0			0
<i>Podolepis canescens</i>	Grey Copper-wire Daisy	BL Herb				X										

Botanical name	Common Name	EPBC	Hor1	Hor2	Duff	Flag	McK	RosM	Ford	Sha1	Sha2	RosT	DMP	Gor	Steb	SpG
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy	BL Herb								X	X					
<i>Pogonolepis muelleriana</i>	Stiff Cup-flower	BL Herb					X									
<i>Pomaderris paniculosa</i> ssp. <i>paniculosa</i>	Mallee Pomaderris				0											
<i>Ptilotus erubescens</i>	Hairy-tails	BL Herb					X									
<i>Ptilotus nobilis</i> ssp. <i>angustifolius</i>	Yellow-tails	BL Herb											0			
<i>Ptilotus spathulatus</i> forma <i>spathulatus</i>	Pussy-tails	Ex Herb	X	X	X	X	X	0	0				X			X
<i>Pycnosorus globosus</i>	Billy-buttons	BL Herb									X					
<i>Rhagodia parabolica</i>	Mealy Saltbush											X	PI			
<i>Rhodanthe laevis</i>	Smooth Daisy	BL Herb					X									
<i>Rhodanthe pygmaea</i>	Pigmy Daisy	BL Herb					X									
<i>Rumex dumosus</i>	Wiry Dock	BL Herb							X					X		
<i>Salsola australis</i>	Buckbush	BL Herb	0	0	0	X						X	X			
<i>Scaevola albida</i>	Pale Fanflower	BL Herb						X		X						
<i>Sclerolaena diacantha</i>	Grey Bindyi					0										
<i>Senna artemisioides</i> nothosp. <i>coriacea</i>	Broad-leaf Desert Senna							0				0				
<i>Setaria constricta</i>	Knotty-butt Setaria	Grass							X				X			
<i>Setaria jubiflorum</i>	Warrago Summer-grass	Grass											0			
<i>Sida corrugata</i> var. <i>angustifolia</i>	Grassland Sida	Ex Herb	X	X	X	X	X	X				X	X	X	X	X
<i>Sida corrugata</i> var. <i>corrugata</i>	Corrugated Sida	Ex Herb				0							X			
<i>Stackhousia monogyna</i>	Creamy Candles	BL Herb	X				X	X	X	0	X	X	0			X
<i>Swainsona behriana</i>	Behr's Swainson-pea	BL Herb					X									
<i>Swainsona stipularis</i>	Orange Darling Pea	BL Herb								0	X					
<i>Teucrium racemosum</i>	Grey Germander	BL Herb					0			X	X					X
<i>Themeda australis</i>	Kangaroo Grass	Grass	X	0	X	X	X	X	X	X	X	X	X	X	X	X
<i>Thysanotus patersonii</i>	Twining Fringe-lily	BL Herb					0									
<i>Triptilodiscus pygmaeus</i>	Small Yellow-heads	BL Herb					X									
<i>Velleia arguta</i>	Toothed Velleia	BL Herb				0										
<i>Velleia paradoxa</i>	Spur Velleia	BL Herb					X									
<i>Vittadinia australasica</i> var. <i>australasica</i>	Sticky New Holland Daisy	BL Herb			X	X										
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy	BL Herb	X	X	X	X	0	X	0				0			X

Botanical name	Common Name	EPBC	Hor1	Hor2	Duff	Flag	McK	RosM	Ford	Sha1	Sha2	RosT	DMP	Gor	Steb	SpG
<i>Vittadinia cervicularis</i> var. <i>cervicularis</i>	Waisted New Holland Daisy	BL Herb			x		0		0				0			0
<i>Vittadinia cuneata</i> var. <i>cuneata</i>	Fuzzy New Holland Daisy	BL Herb		x		x	x						x			x
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	BL Herb	x	x	x	x	0	x	x	0		0	x			
<i>Vittadinia megacephala</i>	Giant New Holland Daisy	BL Herb	x	x	x	x	x	0					x			0
<i>Wahlenbergia communis</i>	Tufted Bluebell	BL Herb					x									
<i>Wahlenbergia gracilentata</i>	Annual Bluebell	BL Herb					0									
<i>Wahlenbergia luteola</i>	Yellow-wash Bluebell	BL Herb					x		0							
<i>Wahlenbergia preissii</i>	Bluebell	BL Herb					0									
<i>Walwhalleya proluta</i>	Rigid Panic	Grass		0			0			x	x		0			x
<i>Wurmbea dioica</i> ssp. <i>brevifolia</i>	Early Nancy	BL Herb					0			0	x					
<i>Wurmbea dioica</i> ssp. <i>dioicea</i>	Early Nancy	BL Herb					x			x	x					
<i>Zygophyllum glaucum</i>	Pale Twinleaf	BL Herb											0			
Lichens			x	x	x	x	x	x	x	x	x	x	x	x	x	x
Liverworts							x						x			x
Mosses			x	x	x	x	x	x	x	x	x	x	x	x	x	x

Records of species numbers for main 14 sites as at March 2014

Exotics	17	19	18	13	10	20	19	12	15	16	32	18	15	28
Natives on quadrat	19	31	42	22	64	34	28	33	39	29	49	22	20	45
Natives opportune	3	2	5	15	47	6	42	9	5	11	21		2	5
Total natives quadrat +opp	22	33	47	37	111	39	70	42	44	40	68	22	22	50
EPBC Herbaceous on quadrat	2+1	12	19	10	42	13	11	15	21	5	20	7	3	18
EPBC Excluded Herbaceous	4	5	5	2	4	4	3	3	3	5	5	4	1	6
EPBC Grasses on quadrat	9	9	8	9	15	9	11	9	11	11	14	6	13	13
Total natives on quadrat	19	31	42	22	64	33	28	33	39	29	49	22	20	45
EPBC Class indication	B/C	A	A	B	A	A	A	A	A	N/A	A	B	B/C	A/B
State/Transition Class indication	4	2	3	2	1	2	2	2	2	N/A	2	4	?	3

Appendix 2 Environmental Protection and Biodiversity Conservation Act (EPBC) class condition criteria^{69 70}

An EPBC condition class A patch must be at least 0.1 ha in size and in an area of 0.25 ha have more than 30 native species, at least 10 native broad-leaved herbaceous species not on the disturbance resistant list, at least five native perennial grass species and at least 1 grass or *Lomandra* tussock per metre on a 50m transect.

An EPBC condition class B patch must be at least 0.25 ha in size, and in an area of 0.25 ha have more than 15 native species, at least three native broad-leaved herbaceous species not on the disturbance resistant list, at least four native perennial grass species and at least 1 grass or *Lomandra* tussock per metre on a 50m transect.

An EPBC condition class C patch must have at least five native species and at least one native grass species.

Species identified as grazing/disturbance resistant species are: *Ptilotus spathulatus forma spathulatus*; *Sida corrugata*; *Oxalis perennans*; *Convolvulus augustissimus*; *Euphorbia drummondii* and *Maireana enchylaenoides*. These are Herbs excluded from counting for EPBC class analysis.

Keeping in mind that the sites surveyed were only 900 square metres, additional species would be expected (including many of those shown as Opportune for sites) with a full 0.25 ha area. The exception to that is the Spring Gully site where the area relevant to the species listed is in excess of a hectare and hence an assessment for EPBC would have a lower number of species - hence the A/B uncertainty. All sites would be expected to have little difficulty meeting the 50 tussocks on a 50 metre transect although no measurements were actually taken.

The assessment of EPBC classes is still evolving. In some writings there is a picture of the Iron-grass Natural Temperate Grassland having a significant percentage of cover abundance comprising irongrass species but elsewhere there is recognition that iron grass species can be quite patchy. Grasslands often have a mosaic appearance with concentrations of different species according to soil, aspect, rocky outcrops and the like.

One question of interest is that the classification system only partially includes irongrass species themselves. While they are clearly counted for total native species and for tussock density, they do not seem to be counted in the sub-category of grasses.

With the assessment of Iron-grass Natural Temperate Grassland having been based on South Australia's Mid North grasslands, it is not surprising that there are some difficulties applying the parameters to the Lower North grasslands involved in this study. Hopefully the information provided in this survey will be helpful in understanding some of the issues to be further investigated.

⁶⁹ Australian Government (2007), EPBC Act Policy Statement 3.7 Nationally Threatened Species and Ecological Communities: Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia, Australian Government Department of the Environment and Water Resources, Canberra

⁷⁰ Turner, J. (2012). *National Recovery Plan for the Iron-grass Natural Temperate Grassland of South Australia ecological community*. Department of Environment and Natural Resources, South Australia. Table 1 at page 10. This assessment updates to some extent the 2007 document in notes to Table 1 and related discussion.

Appendix 3 Summary on the Prescott & Turner State and Transition 2010 template for assessing remnant irongrass grasslands and survey sites using criteria suggested

Comment paragraphs – Adrian Shackley wording.

State and Transition Model

Ann Prescott and David Turner prepared an assessment for the Department of Environment and Natural Resources (now DEWNR) called “State and transition model for the Iron-grass (*Lomandra effusa*) natural temperate grassland community” in July 2010⁷¹.

The wording below is brief excerpts from the Prescott and Turner document to provide some information relevant to the assessment of sites in this survey. Generally the sites have been shown to be good quality remnant grasslands - the bold **Comment** paragraphs are a brief explanation/assessment by Adrian Shackley related to the survey sites.

State 0 – Pre-European intact grassland.

The species list was realistically over 150 species with up to 10 grass genera and 20 grass species, and with 100 annuals and geophytes. By definition no weeds.

State 1 – Remnant intact grassland

.....up to 10 grass genera and 20 grass species. The most species rich sites would be those which comprise a diversity of landforms including broad low rocky ridges of shallow but heavy soil, as well as containing shallow drainage lines with better developed soil.

A range of herbaceous species such as native peas, lilies, and usually orchids would be present. There will be limited thatch biomass (less than 20%) in the native grass tussocks and visible gaps between tussocks, although the actual amount of bare ground will be minimal and a thin crust of cryptogams would cover most exposed ground surface.

State 1 indicators

Minor annual grass and herbaceous weeds present (less than 5% biomass) over at least some of the area. Loss of some flowering and seeding events. Reduced overall biomass of native species. Loss of height structure with flow-on of some fauna habitat loss. Species list may have up to 60 species.

Comment: The River Road site fits State 1 in most respects which is surprising after more than 150 years of grazing and nearby agricultural use. It is the only site in this survey with such a high rating and testament to a history of careful management of grazing by the owners over many years. No other sites of such high quality are known anywhere within a wide range.

State 2 – Grassland dominated by excess annual grass thatch

State 2 represents the community with excess exotic thatch biomass between the native grass tussocks.

This state is mainly derived from State 1 in environments where annual weeds have become established and biomass accumulation is not regulated. In this case, thatch build up has occurred both within the native grass tussocks and between the tussocks by annual weedy grasses to a point at which it has reduced the vigour and flowering of the native tussocks and the annual weed thatch has smothered and out-competed the native wildflowers.

Weed grasses may include Wild Oats *Avena* spp., False brome *Brachypodium distachyon*, Quaking Grass *Briza* sp., Brome Grass *Bromus* sp., Annual Cat’s-tail *Rostraria cristata*, and Fescue *Vulpia* sp.

⁷¹ Prescott, Ann and Turner David (2010) State and transition model for the iron-grass (*Lomandra effusa*) natural temperate grassland community Version 2.0. A report to the Adelaide and Mount Lofty Ranges Natural Resources Management Board

herbaceous weeds may include *Hypochaeris glabra*, *Medicago* sp. and Sowthistle *Sonchus oleraceus*.

The State is characterised by reduced species richness per site, annual weed invasion, and exotic annual grass thatch favouring the germination of additional exotic annual grass.

State 2 indicators

Build-up of lying thatch, usually *Avena* spp. to a depth of over 5 centimetres, may vary seasonally. Reduced recruitment of native species (lack of juvenile plants). Cryptogram crust reduced or lack of cryptograms. Annual introduced and perennial native grasses present. Some loss of native species, especially geophytes. Likely increase in soil nitrates.

Comment: The majority of sites in this survey fit fairly well in this category. This is because of their position in the Roseworthy to Kapunda rail corridor which has resulted in apparently little history of cultivation (noting the dumped earth from rail cuttings which is part of the Shanahan Road sites) or fertiliser spreading and only intermittent grazing. The build-up of weeds and thatch has been significant on most sites indicating disturbance of some kind. The close proximity of cropping and grazing adjacent the rail sites would have led to significant impacts even without direct site impacts. Similarly with the Thiele Highway and Flagstaff Hill Road site. The Dead Man's Pass site also fits here with significant grazing impacts until some 35 years ago resulting in loss of native species and weed invasion.

State 3 – Grassland impacted by grazing

This State describes remnant native grassland impacted by regular but discontinuous grazing by stock for economic gain... The first major impact of regular grazing is the effect on individual plant vigour and the structural appearance of the community.

Changes to the composition of the community are the second major impact resulting from grazing. Palatable species such as lilies, daisies and orchids are preferentially grazed and are the first species to disappear from a grazing-impacted grassland.

The third major effect of regular grazing is the importation of the seeds of annual grasses and of a wider range of weed seeds through stock droppings and through putting out hay bales as feed in dry seasons. There is a greater loss of inter-tussock species, being replaced by introduced annual grasses.

The last major effect of regular stock grazing is at the soil level. The hard hooves of stock lead to some bearing of the ground, with soil crust damage, and increased erosion potential.

Native grasses remaining in the system are likely to include some of the following: *Aristida behriana*, *Austrodanthonia caespitosa*, *Austrodanthonia setacea* var *setacea*, *Austrostipa blackii*, *Austrostipa drummondii*, *Austrostipa elegantissima*, *Austrostipa eremophila*, *Austrostipa nitida*, *Austrostipa nodosa*, *Austrostipa scabra*, *Elymus scaber* var *scaber*, *Lomandra densiflora*, *Lomandra effusa*, *Lomandra multiflora* ssp. *dura*, and *Themeda australis*.

Native herbaceous species are likely to include: *Convolvulus erubescens*, *Euphorbia drummondii*, *Glycine clandestina*, *Goodenia pinnatifida*, *Goodenia pusilliflora*, *Maireana enchylaenoides*, *Oxalis perennans*, *Calostemma purpureum*, *Ptilotus spathulatus*, *Vittadinia cuneata*, *Vittadinia gracilis*, and *Wahlenbergia luteola*.

Meets EPBC Act Condition A, and the better end of Condition B.

Comment: The Duff Road, Dead Man's Pass and Spring Gully sites fit fairly well in this category. They have had intermittent grazing (heavier on the Spring Gully site) but clearly no cultivation allowing irongrass tussocks to survive and a range of herbaceous native species. Invasion by weeds has occurred but thatch build-up has been limited by the grazing.

State 4 – Grassland seriously impacted by grazing

This State describes remnant native grassland impacted by regular and continual grazing by stock for economic gain. State 4 comes as the result of further degradation from State 3 where the impact of grazing has modified the community to a significant degree with loss of species, soil modifications, and

(while grazing practices are active) serious modification of the tussock and inter-tussock appearance of the community.

There will be loss of native inter-tussock species, and an increase in non-palatable species, including annual grasses in winter and broad-leaf ground layer weeds such as Stork's Bill (*Erodium cicutarium*), Cape Weed (*Arctotheca calendula*), and Salvation Jane (*Echium plantagineum*) in summer.

Commonly occurring native grasses in this State are likely to include some of the following: *Aristida behriana*, *Austrodanthonia caespitosa*, *Austrostipa eremophila*, *Austrostipa nitida*, *Enneapogon nigricans*, *Lomandra effusa*, and *Lomandra multiflora* ssp. *dura*.

Very commonly occurring native herbaceous species in this State are likely to include some of the following: *Goodenia pinnatifida*, *Glycine clandestina*, *Vittadinia cuneata*, *Vittadinia gracilis*, and *Wahlenbergia luteola*. In addition; the grazing resistant native *Ptilotus spathulatus*, *Oxalis perennans*, *Convolvulus erubescens*, *Euphorbia drummondii*, and *Maireana enchylaenoides*, as defined by the EPBC Act (EPBC 2007).

There will be soil compaction leading to poorer water retention and greater erosion, and increased bare soil particularly in summer when plant growth is insufficient to adequately carry the stocking rate. This State will still meet EPBC Act Condition B.

State 4 indicators

Change in structure of soil with compaction and erosion. Bare ground in summer or covered with broadleaf non-palatable weeds such as *Erodium cicutarium*. Common broad-leaf, perennial/geophyte weeds can include: *Gynandriris setifolia*, *Romulea* spp., *Salvia verbenaca*, *Echium plantagineum*, *Arctotheca calendula*, *Erodium* spp., *Carthamus* sp..

Non-Lomandra tussock species will be less than 5 cm high and exhibit a growth form parallel to the ground, any grass inflorescence will also be short and parallel to the ground. Native grass tussocks are the only refuge for forbs. Recruitment confined to tussocks. Species list may have up to 15 native species. Nearby watering points allows year-round grazing.

Comment: The Thiele Highway paddock and Gordon Road sites fit fairly well in this category. Heavy impacts of grazing at least for significant periods of their history.

State 5 – Grassland impacted by nutrient enrichment

State 6 – Nutrient enriched heavily grazed grassland

State 7a – Perennial weed dominated grassland

State 7b – Perennial weed dominated grassland – nutrient enriched

State 8 - Restored Grasslands. 8a – Restored grassland, State 8b – Restored nutrient enriched grassland, State 8c – Restored species poor grassland, State 8d – Restored species poor nutrient enriched grassland

State 9a – Constructed grassland, State 9b – Constructed woodland

State 10 – Regularly ploughed ex-grassland

Comment: The Stebonheath site does not fit any Transition State well. Being a longstanding road reserve it should not have been affected but clearly grazing or perhaps spraying or nutrient impact from fertilisers has caused almost all native herbaceous species to be lost.

The Roseworthy town site is a grassy woodland site and not in the same grassland category. However, as a *Eucalyptus largiflorens* open woodland it would be expected to fit as a State 2 if a similar assessment for grassy woodland toll were available.

Appendix 4 Information on Conservation ratings used in this Report

Australian Conservation Status

The codes are based on the listing of species under the Environment Protection and Biodiversity Conservation Act 1999. There is no Rare category under the EPBC Act.

- CE** **Critically Endangered:** facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
- E** **Endangered:** facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
- V** **Vulnerable:** facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

South Australian Conservation Status

The codes are based on Schedules 7-9 of the National Parks and Wildlife Act 1972 (SA).

- E** **Endangered:** (Schedule 7) in danger of becoming extinct in the wild.
- V** **Vulnerable:** (Schedule 8) at risk from potential or long term threats which could cause the species to become endangered in the future.
- R** **Rare:** (Schedule 9) low overall frequency of occurrence (may be locally with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant threats, but warrants monitoring and protective measures to prevent reduction of population sizes.

Regional South Australian Conservation Status

(based on Lang, P.J. & Kraehenbuehl, D.N. "Plants of Particular Conservation Significance in South Australia's Agricultural Regions. DENR". Not been updated for a few years so gaps appear.

- X** Extinct/Presumed extinct: not located for more than 50 years.
- E** Endangered: rare and in danger of becoming extinct in the wild.
- T** Threatened: likely to be either Endangered or Vulnerable but insufficient data for precise assessment.
- V** Vulnerable: rare and at risk from potential threats or long term threats that could cause the species to become endangered in the future.
- K** Uncertain: likely to be either Threatened or Rare but insufficient data available for precise assessment.
- R** Rare: has a low overall frequency of occurrence (may be locally with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant or widespread threats, but warrants monitoring and protective measures to prevent reduction of population sizes.
- U** Uncommon: less species of interest. Not rare enough to warrant special protective measures.
- Q** Not yet assessed but flagged as being of possible significance.
- ?** No rating available because of new record for region, species reclassification etc.

Appendix 5 Conservation rated species in Northern Lofty Herbarium Region by site
(or locality near site - opportune records are in [] brackets)

Scientific name	Common Name	A	SA	NL	Site [Opp near site]
<i>Acacia acinacea</i>	Wreath Wattle			U	MCK, Duff
<i>Amphipogon caricinus ssp. caricinus</i>	Grey-beard Grass			R	MCK
<i>Aristida contorta</i>	Curly Wire-grass			R	[Fords]
<i>Austrodanthonia fulva</i>	Leafy Wallaby-grass			K	Sha 01& 02
<i>Austrostipa gibbosa</i>	Swollen Spear-grass		R	T	Sha 02
<i>Austrostipa pilata</i>	Prickly Spear-grass		V	T	Hor 01
<i>Austrostipa puberula</i>	Fine-hairy Spear-grass			T	[MCK] Flagstaff
<i>Austrostipa setacea</i>	Corkscrew Spear-grass			R	MCK
<i>Calocephalus citreus</i>	Lemon Beauty-heads			U	[McK] Hor02, Sha 1&2
<i>Chthonocephalus pseudevax</i>	Ground-heads			?	[MCK]
<i>Cryptandra campanulata</i>	Spiny Cryptandra		R	?	[MCK] Duff
<i>Dianella longifolia var. grandis</i>	Pale Flax-lily		R	T	Fords
<i>Distichlis distichophylla</i>	Emu-grass			K	[MCK]
<i>Drosera glanduligera</i>	Scarlet Sundew			R	MCK, Fords
<i>Goodenia albiflora</i>	White Goodenia			U	[Fords]
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia			U	MCK Duff Sha 1&2
<i>Haloragis aspera</i>	Rough Raspwort			U	[MCK] Fords Sha 1&2
<i>Leiocarpa websteri</i>	Narrow Plover-daisy			?	Sha 02
<i>Leptorhynchus tetrachaetus</i>	Little Buttons			U	MCK
<i>Lomandra micrantha ssp. micrantha</i>	Small-flower Mat-rush			K	MCK Duff Hor 1&2 [Flag] Sha 1&2
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush		R	V	[MCK] Duff [Flag]
<i>Pimelea curviflora ssp. sericea</i>	Curved Riceflower			K	Sha 01
<i>Plantago gaudichaudii</i>	Narrow-leaf Plantain			U	Sha 02
<i>Podolepis canescens</i>	Grey Copper-wire Daisy			T	Flagstaff
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy		R	E	Sha 01& 02
<i>Ptilotus erubescens</i>	Hairy-tails		R	T	MCK
<i>Pycnosorus globus</i>	Billy-buttons		V	R	Sha 02
<i>Rumex dumosus</i>	Wiry Dock		R	?	Fords, Gordon Rd.
<i>Swainsona behriana</i>	Behr's Swainson-pea		V	T	[MCK [
<i>Swainsona stipularis</i>	Orange Swainson-pea			K	[Sha 01] Sha 02
<i>Velleia paradoxa</i>	Spur Velleia			Q	MCK
<i>Wahlenbergia preissii</i>	Bluebell			?	[MCK [

Appendix 6 Conservation rated species in Southern Lofty Herbarium Region by site
(or locality near site - opportune records are in [] brackets)

Scientific name	Common Name	A	SA	SL	Site [near site]
<i>Acacia notabilis</i>	Notable Wattle			K	[Ros Rai]
<i>Aristida australis</i>	Wire-grass		R	K	Stebonheath
<i>Aristida behriana</i>	Brush Wire-grass			U	Ros MNR Ros Rai DMP Gordon, Steb Sp Gully
<i>Austrodanthonia fulva</i>	Leafy Wallaby-grass			U	Ros MNR
<i>Austrostipa curticoma</i>	Short-crest Spear-grass			U	Ros MNR Ros Rai
<i>Austrostipa eremophila</i>	Rusty Spear-grass			U	Ros MNR Ros Rai DMP Stebonheath Sp Gully
<i>Austrostipa exilis</i>	Heath Spear-grass			T	Ros Rai
<i>Austrostipa puberula</i>	Fine-hairy Spear-grass			K	DMP
<i>Bothriochloa macra</i>	Red-leg Grass		R	R	Stebonheath
<i>Carex bichenoviana</i>	Notched Sedge			U	DMP, Sp Gully
<i>Cheilanthes distans</i>	Bristly Cloak-fern			R	DMP Sp Gully
<i>Cheilanthes lasiophylla</i>	Woolly Cloak-fern			E	DMP
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting			R	Ros MNR
<i>Cymbopogon ambiguus</i>	Lemon-grass			V	[DMP]
<i>Dichanthium sericeum ssp. sericeum</i>	Silky Blue-grass			V	Ros MNR [DMP] [Sp Gully]
<i>Digitaria ammophila</i>	Spider Grass			?	Spring Gully
<i>Digitaria brownii</i>	Cotton Panic-grass			K	DMP Stebonheath
<i>Eremophila longifolia</i>	Weeping Emubush			V	DMP
<i>Eucalyptus largiflorens</i>	River Box			V	Ros Rai
<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia			U	Ros MNR DMP Gordon Sp Gully
<i>Haloragis aspera</i>	Rough Raspwort			R	Ros MNR
<i>Leiocarpa tomentosa</i>	Woolly Plover-daisy			?	DMP
<i>Lomandra effusa</i>	Scented Mat-rush			R	Ros MNR Ros Rai DMP Gordon Steb Sp Gully
<i>Maireana enchylaenoides</i>	Wingless Fissure-plant			U	Ros MNR Ros Rai DMP Gordon Sp Gully
<i>Maireana rohrlachii</i>	Rohrlach's Bluebush		R	V	[DMP] Sp Gully
<i>Panicum effusum var. effusum</i>	Hairy Panic			K	DMP
<i>Pimelea micrantha</i>	Silky Riceflower			R	Ros MNR [DMP] Sp Gully
<i>Pittosporum angustifolium</i>	Native Apricot			R	Ros Rai DMP
<i>Ptilotus nobilis ssp. angustifolius</i>	Yellow-tails			?	[DMP]
<i>Ptilotus spathulatus forma spathulatus</i>	Pussy-tails			R	DMP Sp Gully
<i>Rhagodia parabolica</i>	Mealy Saltbush			R	Ros Rai
<i>Rumex dumosus</i>	Wiry Dock		R	?	Gordon
<i>Setaria constricta</i>	Knotty-butt Setaria			R	DMP
<i>Sida corrugata var. angustifolia</i>	Grassland Sida			R	Ros MNR Ros Rai DMP Gordon Steb Sp Gully
<i>Velleia arguta</i>	Toothed Velleia			R	DMP
<i>Vittadinia blackii</i>	Narrow-leaf New Holland Daisy			R	Ros MNR [DMP] Sp Gully
<i>Vittadinia megacephala</i>	Giant New Holland Daisy			R	DMP [Sp Gully]
<i>Walwhalleya prolata</i>	Rigid Panic			R	[DMP] Sp Gully
<i>Zygophyllum glaucum</i>	Pale Twinleaf			T	[DMP]

Appendix 7 Naturemaps Rail & Roadside vegetation map relevant to Survey Sites (Comment – Adrian Shackley wording)

Location	Shanahan Road SHA 01 and SHA 02 26/11/2002 Rail survey
Length of section	700 meters
Side of rail line	Eastern
Association	Danthonia sp. / Stipa sp. Tussock Grassland
Dominant species	Danthonia sp. (NC), Austrostipa sp., Themeda triandra
Other native sp. mentioned	Themeda triandra, Danthonia sp. (NC), Dianella revoluta var. revoluta, Lomandra sp., Walwhalleya proluta
Alien species	Avena barbata, Convolvulus arvensis, Hordeum glaucum, Vulpia sp
Conservation rating	Moderate
Conservation rating description	Contains a high priority vegetation association in poor condition or a lower priority vegetation association in moderate condition

Comment: Reasonable description - misses non-grass species which would be visible in late November.

Location	ROS MNR 26/11/2002 Rail survey
Length of section	50 meters
Side of rail line	Eastern
Association	Danthonia sp. / Stipa sp. Tussock Grassland
Dominant species	Austrostipa sp., Danthonia sp. (NC),
Native sp. mentioned	Austrostipa sp., Danthonia sp Dianella revoluta, Themeda triandra
Alien species	-
Emergent sp.	Acacia pycnantha,,
Overall condition	Moderate to Good
Conservation rating	Moderate
Conservation rating description	Contains a high priority vegetation association in poor condition or a lower priority vegetation association in moderate condition

Comment: Reasonable description - misses non-grass species which would be visible in late November.

Location	ROS MNR - north of above 26/11/2002
Length of section	350 metres
Side of rail line	Eastern
Association	Acacia pycnantha Shrubland
Dominant native species	Acacia pycnantha
All native sp. mentioned	Themeda triandra, Danthonia sp., Austrostipa sp., Dichanthium sericeum ssp. sericeum, Walwhalleya proluta
Alien species	- Avena barbata, Cynara cardunculus ssp. flavescens, Schinus molle
Emergent sp.	Olea europaea ssp,
Overall condition	Moderate to Good
Conservation rating	High
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Reasonable description - misses non-grass species which would be visible in late November.

Location	Ros Rai 26/11/2002
Length of section	1200 metres
Side of rail line	Eastern
Association	Themeda triandra Grassland

Dominant species	Themeda triandra, Austrostipa sp., Cynodon sp
All native sp. mentioned	Themeda triandra, Austrostipa sp.,
Alien species	Cynodon sp., Echium plantagineum, Asphodelus fistulosus, Paspalum dilatatum, Cynara cardunculus ssp. flavescens -
Emergent sp.	Eucalyptus porosa, Dianella sp., Bursaria spinosa ssp. spinosa,,
Overall condition	Moderate
Conservation rating	Very High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in poor condition or a lower priority vegetation association in moderate condition

Comment: Section not aligning well on Naturemaps. *E. porosa* not correct. Missing non-grass species.

Location	Ros Rai - north of above 26/11/2002
Length of section	400 metres
Side of rail line	Eastern
Association	Eucalyptus porosa Woodland
Dominant native species	Eucalyptus porosa
All native sp. mentioned	Bursaria spinosa ssp. spinosa, Dianella sp
Alien species	Oxalis pes-caprae, Gramineae sp., Compositae sp., Lycium ferocissimum, Olea europaea ssp.
Emergent sp.	
Overall condition	Moderate
Conservation rating	High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Section not aligning well on Naturemaps. *E. porosa* not correct. Missing non-grass species.

Location	Fords 26/11/2002
Length of section	250 metres
Side of rail line	Eastern
Association	Acacia pycnantha Shrubland
Dominant native species	Acacia pycnantha
All native sp. mentioned	-
Alien species	Avena barbata, Echium plantagineum
Emergent sp.	
Overall condition	Poor
Conservation rating	High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Section is not aligning well on Naturemaps. Cutting causing vision problem on top of cutting. Missing *Dodonaea* and non-grass species.

Location	Fords - north of above 26/11/2002
Length of section	100 metres
Side of rail line	Eastern
Association	Themeda triandra Tussock grassland
Dominant native species	Themeda triandra
All native sp. mentioned	-
Alien species	Avena barbata, Echium plantagineum
Emergent sp.	

Overall condition	Poor
Conservation rating	Very High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Section is not aligning well on Naturemaps. Missing *Dodonaea* and non-grass species.

Location	Fords north of above 26/11/2002
Length of section	150 metres
Side of rail line	Eastern
Association	Acacia pycnantha Shrubland
Dominant species	Acacia pycnantha, Olea europaea ssp.,
All native sp. mentioned	Austrostipa sp., Danthonia sp. Lomandra sp.,,
Alien species	Avena barbata, Bromus diandrus, Nicotiana glauca
Emergent sp.	
Overall condition	Moderate
Conservation rating	High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Section is not aligning well on Naturemaps. Missing non-grass species.

Location	Fords north of above 26/11/2002
Length of section	100 metres
Side of rail line	Eastern
Association	Allocasuarina verticillata Low Woodland
Dominant species	Allocasuarina verticillata
All native sp. mentioned	Cymbopogon ambiguus, Dianella revoluta var. revoluta, Austrostipa sp.,,
Alien species	Avena barbata, Olea europaea ssp., Asphodelus fistulosus
Emergent sp.	
Overall condition	Moderate
Conservation rating	High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Section not aligning well on Naturemaps. Missing non-grass species. Cutting vision problem.

Location	Fords north of above 26/11/2002
Length of section	600 metres
Side of rail line	Eastern
Association	Themeda triandra Tussock grassland
Dominant species	Themeda triandra, Danthonia sp.
All native sp. mentioned	Themeda triandra, Aristida behriana, Cymbopogon ambiguus,,
Alien species	Avena barbata, Olea europaea ssp.
Emergent sp.	Acacia pycnantha, Olea europaea ssp.,
Overall condition	Moderate
Conservation rating	Very High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment:. Section is not aligning well on Naturemaps. Missing non-grass species.

Location	Thiele Highway 14/06/2005
Length of section	150 metres - shown about 400 metres south of Hor 02
Side of road	Eastern (note West side similarly described???)
Association	Themeda triandra, Lomandra effusa Tussock Grassland
Dominant species	Themeda triandra, Lomandra effusa.
All native sp. mentioned	Austrostipa sp., Danthonia sp
Alien species	Avena sp., Scabiosa atropurpurea.
Emergent sp.	
Overall condition	Good
Conservation rating	Very High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in excellent or near excellent condition

Comment: Description is interesting - unless changed since 2005 there isn't any roadside *Lomandra* 500 metres south of Falland Road except in paddock on east side, nothing on west side. If it is out by 500m then description is helpful but missing non-grass sp. and not correct for western verge?

Location	Thiele Highway north of above 14/06/2005
Length of section	550 metres -
Side of road	Eastern
Association	Non-endemic Native or Exotic spp. Woodland Plantation
Dominant species	Olea europaea ssp
All native sp. mentioned	Acacia paradoxa
Alien species	Scabiosa atropurpurea, Avena sp., Piptatherum miliaceum, Panicum miliaceum
Emergent sp.	
Overall condition	Very Poor
Conservation rating	Nil Conservation Rating
Conservation rating description	Very little or no native vegetation present

Comment: This is section showing as site for HOR 02 but not aligning. See Comment above.

Location	Duff 13/05/2002
Length of section	800 metres
Side of road	Southern??
Association	Native grassland comprising mostly native species
Dominant species	Austrostipa sp
All native sp. mentioned	Lomandra multiflora ssp. dura, Danthonia sp., Dianella revoluta var. revoluta, Themeda triandra, Lomandra densiflora
Alien species	Avena sp
Emergent sp.	Bursaria spinosa ssp. spinosa, Eucalyptus odorata
Overall condition	Moderate
Conservation rating	Very High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Description is helpful. *Lomandra densiflora* not seen in this survey.

Location	Duff further east 13/05/2002 - this is covering actual site
Length of section	300 metres
Side of road	Northern on system but clearly meant to be Southern??
Association	Lomandra spp. Open Tussock Grassland
Dominant species	Lomandra densiflora,,
All native sp. mentioned	Eutaxia microphylla, Lepidosperma viscidum, Teucrium racemosum, Dianella revoluta var. revoluta, Chrysocephalum semipapposum
Alien species	
Emergent sp.	Acacia acinacea, Pomaderris paniculosa ssp. paniculosa, Bursaria spinosa ssp. spinosa
Overall condition	Moderate
Conservation rating	Very High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Description is good in covering a number of native shrubs. Hard to get herbaceous species in May. *Eutaxia microphylla* might be *Cryptandra campanulata*? Not seen *Teucrium* - keep looking.

Location	Anlaby Road (Blackhill Rd) just south of River Road - River Road not surveyed. 13/05/2002
Length of section	100 metres
Side of road	Eastern
Association	Native grassland comprising mostly native species
Dominant species	Danthonia sp. Austrostipa sp.,
Native sp. mentioned	Themeda triandra
Alien species	
Emergent sp.	
Overall condition	Poor
Conservation rating	Very High Conservation Rating
Conservation rating description	Contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition

Comment: Description is helpful - but pity about no record for River Road - should have shown good condition vegetation.

Comment summary:

Road and rail surveys are costed on the basis that recording is done at 40kph so not a lot of data would be recorded. Fortunately some surveyors, such as for the Light Council roadsides, obviously did stop and check out more interesting places. Rail surveys would probably be at a slower speed because higher speed not feasible on unused rail line.

While these surveys are useful for some purposes and would be useful for associations of mainly trees and shrubs, they clearly are deficient in providing clues on grasslands. Timing of surveys outside of spring time will also make it hard to produce good data on herbaceous species.

Appendix 8 Evidence of original vegetation from Surveyors notes in Survey Books

Site	Hundred	Original Sections	Section/lot today	Diagram Book	Survey date	Diagram Book surveyor Comments	Diagram Book "Decoded" (Adrian Shackley)
River Road	Kapunda	320	320	Kapunda Page 19	1858	No specific data for s 320. Adjacent original sections 318, 319 are "Good land no timber" and "Good land part timber"	Mix of grassland and grassy woodland
Duff Road	Kapunda	206 adj 285, 286	206	Kapunda Page 16	1855	No specific data for s 206. Adjacent sections 285, 286 are both "Good arable land"	Grassland
Thiele Highway pad-dock & verge	Kapunda	1508 but not original section	A 134 FP	Kapunda Page 51	?	Diagram Book has no descriptive data - probably first surveyed as part of Kapunda town in 1840s	NA
Flagstaff Hill Road	Belvidere	251 (and near 252, 242, 243)	s251 plus other later plans	Belvidere Page 15	1858	251 - "Very hilly pasture land" adjacent lots - "Good arable and pasture land" or similar.	Grassland
Fords rail site	Light	490, 400	rail section adj 490, 400	Light Page 25	no date	"Rocky pasture, part arable"	Grassland
Shanahan Rd rail corridor 1 & 2	Nuriootpa	386, 387	386, 387	Nuriootpa Page 14	c1855	"Good arable land"	Grassland
Roseworthy MN Road site	Nuriootpa	719, 721 (353, 354 before rail	NA	Nuriootpa Page 26	1855	"Good arable land slightly....." [words unclear - maybe "undulating"? but not "timbered"]	Grassland
Roseworthy Town rail site	Mudla Wirra	70	NA	Mudla Wirra Page 5	1855	"Good arable land, thinly timbered". Other lots along rail line adjacent to MNR - 142, 149 labelled "Good arable land" and "Open Plain".	Grassy woodland
Dead Man's Pass	Nuriootpa	3	Council reserve	Gawler Special Survey	1839	Part of Special Survey for Gawler - no original survey report.	NA
Stebonheath Road	Munno Para	3293 3296	Road reserve	Munno Para Page 12	1852	Open arable land. No surface water	Grassland
Para Woodland sites 1 & 2	Barossa	101, 102, 104	Lot 711 D79212	Barossa Page 46	1861? - mark on book not date of 1st survey	101 Rough pasture land lightly wooded, 102 Good pasture land hilly wooded, 104 Rough pasture land, hilly, lightly wooded, surface water [South Para]. Note the more wooded section south-east of lot 711 with denser trees today was s103 - Rough pasture land, hilly, thickly wooded in part.	Grassland and grassy woodland

Appendix 9 Comparison of DEWNR Pre-European vegetation map with Survey 836 results

Survey Locations	Survey 836 description	DEWNR Pre-European map	Adrian Shackley Comment
Thiele Highway paddock HOR 01	Tussock grassland. <i>Lomandra effusa</i> +/- <i>Lomandra multiflora</i> open grassland.	<i>Eucalyptus odorata</i> + <i>E. leucoxylo</i> ssp. <i>pruinosa</i> Woodland over a grassy and herbaceous understorey.	Change needed. Pre-Euro Grassland boundary needs a shift
Roadside verge adjoining Thiele Highway HOR 02	Tussock grassland	<i>Eucalyptus odorata</i> + <i>E. leucoxylo</i> ssp. <i>pruinosa</i> Woodland over a grassy and herbaceous understorey.	Change needed. Pre-Euro Grassland boundary needs a shift
Duff Road, Kapunda	<i>Lomandra</i> spp. grassland. <i>Lomandra effusa</i> +/- <i>Lomandra multiflora</i> Open Grassland.	<i>Lomandra effusa</i> + <i>Austrostipa</i> spp. + <i>Austrodanthonia</i> spp. Tussock Grassland	Close - both <i>Lomandra</i> s present
Flagstaff Quarry/Road Reserve, Flagstaff Hill Rd, Kapunda	Low open grassland.	<i>Lomandra effusa</i> + <i>Austrostipa</i> spp. + <i>Austrodanthonia</i> spp. Tussock Grassland	<i>Lomandra effusa</i> in patches in surrounding paddocks but not everywhere
River Road, Kapunda	Tussock grassland	<i>Eucalyptus leucoxylo</i> ssp. <i>pruinosa</i> Woodland over a grassy and herbaceous understorey (e.g. <i>Themeda</i>)	Close but many areas with few trees. Nearby <i>Eucalyptus odorata</i> woodland designation needs a shift
Roseworthy Rail Reserve, Main North Road, Fords Rd, Rail reserve, Council reserve, Fords south of Kapunda	Tussock grassland	<i>Themeda triandra</i> Tussock Grassland	Accurate
Rail Reserve Shanahan Road, Freeing 01	Open grassland	<i>Eucalyptus leucoxylo</i> ssp. <i>pruinosa</i> Woodland over a grassy and herbaceous understorey (e.g. <i>Themeda triandra</i>)	Could change to grassland but note Sheoak on rises. <i>Eucalypts</i> present near site are Red Gum & Peppermint Box (<i>E. odorata</i>) although Blue gum not far away.
Rail Reserve Shanahan Road, Freeing 02	Tussock grassland	<i>Themeda triandra</i> Tussock Grassland	OK - fair level of <i>Themeda</i> present
Rail Reserve, south of Roseworthy	Open grassy woodland (<i>Eucalyptus largiflorens</i> open grassy woodland)	<i>Eucalyptus odorata</i> Woodland over a grassy and herbaceous understorey.	Shift boundary of <i>Eucalyptus largiflorens</i> grassy woodland to cover site. Nearby <i>E. odorata</i> woodland area needs change
Dead Man's Pass, Gawler	Tussock Grassland	<i>Eucalyptus porosa</i> Woodland over a grassy and herbaceous understorey. <i>Callitris gracilis</i> is often associated as an understorey tree.	<i>E. porosa</i> is only in smaller creek lines - only scattered tree patches and grassland outside creek lines.
Gordon Road, Gawler	Tussock grassland	<i>Eucalyptus porosa</i> +/- <i>Eucalyptus socialis</i> woodland	DEWNR map incorrect. Change to <i>Themeda australis</i> Tussock Grassland or similar as in adjacent c2010 pre-European map update.

Survey Locations	Survey 836 description	DEWNR Pre-European map	Adrian Shackley Comment
Stebonheath Road, Playford	Tussock Grassland	Eucalyptus porosa +/- Eucalyptus socialis woodland	DEWNR map incorrect - change to Themeda australis Tussock Grassland or similar
Spring Gully	Irongrass tussock grassland. Lomandra effusa +/- Lomandra multiflora ssp. dura Irongrass tussock grassland.	Eucalyptus porosa Woodland over a grassy and herbaceous understorey. Callitris gracilis often an understorey.	E. porosa is only in smaller creek lines - only scattered tree patches. Grassland outside creek lines.
Para Woodland 1 KER 01 Allendale Road	Tussock Grassland	Eucalyptus leucoxylon ssp. leucoxylon Woodland over a grassy and herbaceous understorey and sparse cover of shrubs	Some evidence of clearing but likely to have been original mix of grassland/grassy woodland. Mix of Eucalypt species present including Blue Gums
Para Woodland 2 KER 02 Allendale Road	Tussock Grassland	Eucalyptus leucoxylon ssp. leucoxylon Woodland over a grassy and herbaceous understorey and sparse cover of shrubs	Some evidence of clearing but likely to have been original mix of grassland/grassy woodland. Mix of Eucalypt species present including SA Blue Gums in vicinity.

