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Kate Daniel
President, Woodend Landcare Group,
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Dear Kate and Woodend Landcare Group

Re: Rapid Flora and Vegetation assessment of Buffalo Stadium grassland, Woodend

The purpose of this letter is to provide a brief report on the rapid flora and vegetation assessment I undertook of the Buffalo Stadium grassland (Woodend) over a couple of days in December 2017. It provides a brief description of the flora and vegetation present (including a condition map required by the Council) and, importantly, makes brief recommendations on future management objectives and strategies for the reserve. It is beyond the scope of this assessment to undertake a thorough review of past management at the reserve and the EMP as was originally discussed.

Physical context and vegetation types

The Buffalo Stadium grassland reserve occurs on Five Mile Creek on the western margins of Woodend in the Central Victorian Uplands; part of the upper reaches of the Campaspe River which flows off the northern slopes of Mount Macedon and the Black Forest region.

From a bioregional perspective the site is some distance outside the official boundary of the Victorian Volcanic Plain (~12 kms away from the Jacksons Creek newer volcanics between Macedon and Gisborne), However, it is right on the margin of the smaller subsection of the Central Victorian Uplands often referred to as the Upper Campaspe Plains: a significant region of dissected lowland volcanic plateaus and scoria cones dominated by newer volcanic lava flows that stretch from Woodend to beyond Redesdale and Lake Eppalock to the north. Along with the greater Moolort volcanic plains between Creswick and Eddington, the Upper Campaspe Plains are physiognomically and biologically more aligned with the Volcanic Plains of western Victoria than the geologically much older upland ranges of central Victoria. While the site includes part of the Five Mile Creek flood plain, that merges with volcanic plains less than a kilometre to the west and north, according to the geology maps it mostly comprises the more or less flat lower toe-slope of Ordovician marine sandstone.

According to the EVC mapping for the region (DNRE 2002; DELWP website), this part of the Five Mile Creek valley and flood plain was once dominated by Swampy Riparian Woodland (EVC 083) associated with the active flood plain and Valley Grassy Forest (EVC 047) on the almost flat margins of Ordovician Sedimentary rocks running south more or less through the middle of the Woodend township. The Atlas Ecology EMP

(2012) provides a good overview of the different views on the classification and origin of the reserve's grassland vegetation. There has been debate as to whether the grassland is cleared/modified Valley Grassy Forest (generally in line with the EVC coverage) or whether it's a version of Plains Grassland (EVC 132) associated with volcanic and alluvial soils.

The debate about the nature and significance of the vegetation at the site is summarised in the EMP (Atlas Ecology 2012) and highlights the complexity of such interpretations in the context of inadequate sampling, natural ecotones and significant post-European arrival land use change. While there is merit in all the positions put in the past, I would support the view that the vegetation is some sort of ecotone between Plains Grassland (EVC 132), Plains Grassy Woodland (EVC 055) and Valley Grassy Forest (EVC 047) because:

- (1) the site is located on the margin of a larger lowland plain rather than a on "gently undulating lower slopes and valley floors";
- (2) the site is dominated by kangaroo grass (*Themeda triandra*) which is absent from the Valley Grassy Forest benchmark;
- (3) while there are scattered trees, the vegetation is structurally and functionally a grassland comprising a diversity of indigenous species;
- (4) the site shares at least 50% of the benchmark species of each EVC;
- (5) as part of a broader PhD study of grasslands across central Victoria (Paul Foreman unpublished data) the vegetation of the Buffalo Stadium grassland has very close affinities with remnant grasslands on volcanic soils further north near Kyneton (cemetery) and Malmsbury (Boundary Road) and also on the Moolort Plains; and
- (6) According to historic plains, the area was "Thickly wooded with white gum" (Village of Woodend no. 62 [cartographic material] 185? available from the State Library of Victoria), which could refer to either Manna Gum (*Eucalyptus viminalis*), Swamp Gum (*E. ovata*), Candlebark (*E. rubida*) and/or Red Gum (*E. camalulensis*); species affiliated with either plains or riparian zones.

Although it appears the area's treeless or open woodland structure has in part been created and maintained by past (post-European) management actions, the fact that it is so diverse and supports many grassland species that are rare or threatened at the local, regional and state/national scale, ensures the area is of great significance. The floristic data supports the view that much of the remnant grassland vegetation at the Buffalo Stadium grassland is likely a form of "Natural Temperate Grassland of the Victorian Volcanic Plain" and that would likely qualify as the ecological community listed as critically endangered under the EPBC Act 1999 (TSSC 2008). (Note that it was beyond the scope of this assessment to undertake this type of assessment.)

Landscape change

Prior to the current period, two historic reference points were sourced from the archives to help interpret century-scale change at the grassland. The annotation on the earliest available plan of the area "Thickly wooded with white gum" (Village of Woodend no. 62 [cartographic material] 185? available from the State Library of Victoria) suggests that the area was, at around the time of European arrival, a woodland or forest dominated by a number of species already listed. While the reference to "thickly wooded" suggests more a forest structure, it should be kept in mind that this map was made possibly more than 20 years after the arrival of Major Mitchell (who came within 2 to 3 kms of the site on Sept 30 1836) and shortly after the first squatters who directly and indirectly usurped Aborigines and Traditional Practices including burning. Given

we know the regenerative capacity of woody vegetation in the region, it is very possible the trees had considerably “thickened up” since the sudden collapse of Aboriginal society in the 1830’s and 1840’s.

The 1946 aerial image (SVY 84A Lancefield Run 5003 7 May 1946 153.9 mm FL 17,000 ft; available through TROVE) in contrast shows the same area as being almost entirely devoid of tree cover. The image also not only shows the presence of significant infrastructure (i.e. racing tracks, dams, cricket pitch, access tracks, drains, buildings and fences), but there is also the tell-tale signs of broader surface disturbance in the north and east that could have been the result of track construction in a very flat area at least partially prone to inundation. These marks appear to be machine scrapings that lowered the surface level, and are still more or less present today in the reserve north of the main drainage channel near the central dam. Interestingly, despite this disturbance, it is in these areas that some of the better quality grassland patches are still found today (with higher diversity and lower weed cover). It is assumed that much of the subsequent woody regeneration (*Eucalyptus* spp. and *Acacia* spp.) is either the result of spontaneous regeneration from a soil seed bank or other local sources perhaps following localised disturbances such as dam and drain construction. While this regeneration has likely been significantly suppressed by past fuel reduction burning (see below), it is likely that most of the woody cover we see today arose since the shift to rotational, mosaic burning in the early 1990’s:

“The reserve has historically been subject to management burns on an infrequent and ad-hoc basis. Burns were previously aimed at reducing biomass to achieve bushfire protection and fuel reduction objectives. Coordinated by the Macedon Ranges Shire Council and Woodend CFA, these burns ceased in the early 1990’s and replaced by more strategic measures that aim to reduce fire risk to nearby residences and to sustain ecological values. A mosaic, rotating schedule of burns has been adopted, with the northern, southern and central sections of the reserve burned in alternate years” (Atlas Ecology 2012).

This preliminary interpretation of landscape change makes the points that this grassland: (a) has been subject to great modification and disturbance since the arrival of Europeans in the late 1830’s (i.e. cessation of traditional burning and canopy thickening; tree clearing and mechanical disturbance; “infrequent and ad-hoc” fuel reduction burning; followed by a second round of canopy thickening); (b) because of its persistent status as public land, the area has been spared typical farming disturbances such as (set) stock grazing, supering, cropping, herbicide etc.; and (c) represents one of the better known remnants of lowland grassland vegetation in the Upper Campaspe region. Thus, the area’s current significance is both because of and in spite of its complex disturbance history and that there is a clear interplay between these disturbances and tree/grass dynamics. In short, in the absence of disturbances such as fire, that favour ground herbs over woody plants, there will inevitably be a tendency towards a woodland or forest structure with lower overall diversity and higher weed cover.

It has long been clear that prior to European arrival Aboriginal people in south east Australia exploited this dynamic in modifying their environment to improve the availability of staple resources. It is argued that at least across much of the lowland plains these practices served to maintain open woodland and treeless grassy landscapes (see discussion in Foreman 2016), and it is highly likely these practices impacted the landscape around what is now the township of Woodend. Albeit inadvertent, this legacy has been continued by more recent burning largely for fuel reduction purposes and in many respects the grassland at Buffalo Stadium is an anthropogenic or cultural landscape.

The grassland assessment and flora

Eight 20 by 20 m permanently marked quadrats were established in representative grassland vegetation across the reserve in order to assist with mapping condition as well as to establish a network of monitoring sites. All quadrats were searched for all vascular plants, plus estimates of the cover/abundance of each taxon and other relevant data including photopoints (4 oblique shots taken from each corner).

Cover/abundance categories were based on standard methods used by the Department of Environment, Land, Water and Planning (DELWP) and its predecessors (see Muir et al. 1995), namely:

- (+) <1% Projected Foliage Cover (PFC), few individuals;
- (1) <1% PFC, many individuals;
- (2) 1 to 5% PFC, any number of individuals;
- (3) 6 to 25% PFC, any number of individuals;
- (4) 26 to 50% PFC, any number of individuals; and
- (5) >50% PFC, any number of individuals.

Search time per quadrat ranged from 30 to 60 minutes, and although established over summer, the species lists are considered reasonably thorough. It is likely some additions could be made with further searching, especially in different seasons and years when there may be other flowering geophytes and ephemerals (for example *Thysanotus tuberosus subsp. tuberosus* Common Fringe-lily and *Drosera pygmaea* Tiny Sundew – see Appendix 5).

All plant taxonomy follows Walsh and Entwistle (1994, 1996 & 1999), Walsh & Stajsic (2007) and the Flora of Victoria online. Site coordinates were recorded using a Garmin Oregon 650 GPS. All spatial information was entered into ArcGIS 10.5 for preparation of maps and exported to MS EXCEL for tabular presentation and simple analyses used in this report.

In short, quadrats are area-constrained species lists with an estimate of cover-abundance to indicate if particular species dominate the site or if they have only a minor presence. Combined with past survey (see Atlas Ecology 2012), the flora for the grassland comprised 148 species (taxa) including: 40 exotics and 108 indigenous (Appendices 5 to 7).

As mentioned above, the grassland area is mostly open grassland dominated by a thick sward of Kangaroo Grass (*Themeda triandra*) with isolated patches of gradually expanding patches of woody regrowth mostly comprising Silver Wattle (*Acacia dealbata*), Blackwood (*A. melanoxylon*), Broad-leaf & Narrow-leaf Peppermint (*Eucalyptus dives* & *E. radiata*), Manna Gum (*E. viminalis*) as well as Swamp Gum (*E. ovata*).

Amongst the Kangaroo Grass is a rich variety of exotic and indigenous annual and perennial grasses, forbs, sedges and rushes. In decreasing order of frequency, the exotics included: Sweet Vernal-grass **Anthoxanthum odoratum*, Common Centaury **Centaureum erythraea*, Smooth Cat's-ear **Hypochaeris glabra* Flatweed **H. radicata*, Brown-top Bent **Agrostis capillaris*, Lesser Quaking-grass **Briza minor*, Onion Grass **Romulea rosea*, Spanish Heath **Erica lusitanica*, Yorkshire Fog **Holcus lanatus*, Tiny Flat-sedge **Isolepis levynsiana*, Hairy Hawkbit **Leontodon saxatilis subsp. saxatilis* (**L. taraxacoides subsp. taraxacoides*), Ribwort **Plantago lanceolata*.

However, only some of these species are of concern in terms of conservation management. Sweet Vernal-grass is overwhelmingly the most widespread grassy weed that is difficult to manage because it is a perennial. Brown-top Bent and Yorkshire Fog are perhaps the other more widespread and problematic exotic perennial grasses while Ribwort is perhaps the worst of the perennial exotic forbs. Along with Spanish Heath,

there are also a number of problematic exotic shrubs that have the potential to spread and degrade the grassland if left unchecked. These include: Hawthorn **Crataegus monogyna*, Blackberry **Rubus fruticosus* spp. agg., Prunus **Prunus* spp., Gorse **Ulex europaeus*, English Broom **Cytisus scoparius*. Again, the Atlas Ecology EMP (2012) goes into great detail regarding the management of weeds at the reserve.

The common indigenous ground flora comprised a diverse array of lifeforms and species – including small to prostrate shrubs, sedges, rushes, geophytes and forbs.

The low shrubs included Common Rice-flower *Pimelea humilis*, Cranberry Heath *Astroloma humifusum*, Creeping Bossiaea, *Bossiaea prostrata*, Narrow-leaf Bitter-pea, *Daviesia leptophylla*, Grey Parrot-pea *Dillwynia cinerascens* s.l.

The sedges and rushes included: Common Grass-sedge *Carex breviculmis*, Bog-sedges *Schoenus* spp., Pointed Centrolepis *Centrolepis aristata*, Joint-leaf Rush *Juncus holoschoenus*, Wattle Mat-rush *Lomandra filiformis* subsp. *filiformis*.

The geophytes (mostly monocots with fleshy or tuberous roots) included: Bulbine Lily *Bulbine bulbosa*, Milkmaids *Burchardia umbellata*, Common Onion-orchid *Microtis unifolia*, Sun Orchid *Thelymitra* spp., Chocolate Lily *Arthropodium strictum* s.l., Yellow Star *Pauridia vaginata* var. *vaginata* (*Hypoxis vaginata* var. *vaginata*).

The grasses include tussock and non-tussock species: Kangaroo Grass *Themeda triandra*, Mat Grass *Hemarthria uncinata* var. *uncinata*, Weeping Grass *Microlaena stipoides* var. *stipoides*, Five-awned Spear-grass *Pentapogon quadrifidus* var. *quadrifidus*, Wallaby-grasses *Rytidosperma* spp., Weeping Love-grass *Eragrostis parviflora*, Tussock-grasses *Poa* spp.

And the forbs include annual and perennials: Common Raspwort *Gonocarpus tetragynus*, Sundews *Drosera* spp., Leafy Fireweed *Senecio squarrosus* s.l., Small St John's Wort *Hypericum gramineum*, Sheep's Burr *Acaena echinata*, Varied Raspwort *Haloragis heterophylla*, Broad-leaf Stinkweed *Opercularia ovata*, Grassland Wood-sorrel *Oxalis perennans*, Australian Buttercup *Ranunculus lappaceus*, Smooth Solenogyne *Solenogyne dominii*, Slender Speedwell *Veronica gracilis*.

Grassland condition

The grassland reserve section of Buffalo Stadium (9.39 ha) was broadly classed into three types: (1) Best quality grassland (1.5 ha or 16%); (2) Widespread moderate quality grassland (5.9 ha or 63%); and (3) Non-grassland or weed scape (1.9 ha or 21%) (Figure 1; Appendices 3 and 4). The mapping was visually assessed from the imagery and only incidentally validated on the ground, plus some limited quantification in the quadrats (due to limited time).

The best quality grassland areas comprised three discrete patches, which tended to be away from woody regrowth, where associated with low lying areas that are subject to seasonal waterlogging (perhaps artificially created), and where generally most species-rich and had the lowest cover of weeds – but especially Sweet Vernal-grass. It is likely the water logging aids in maintaining diversity by reducing the abundance of some weeds and encouraging some of the ephemeral natives such as Slender and Dwarf *Aphelia* *Aphelia* spp., Pointed and Hairy Centrolepis *Centrolepis* spp. and Club-sedges *Isolepis* spp. without excluding common grassland species.

Widespread moderate quality grassland is the most abundant type and was found throughout the reserve. These Kangaroo Grass dominated areas tended not to be associated with low lying areas and were still moderately species-rich, but with weed cover (esp. Sweet Vernal-grass) noticeably higher than the best quality grassland patches.

The balance of the reserve area supported marginal patches of non-grassland or weed scape – typically highly disturbed areas now overwhelmed by weeds or patches of woody regrowth (Eucalyptus spp. and Acacia spp.) typically with a weedy ground layer.

Figure 1: Breakdown of grassland condition map (see Appendix 3 and 4)

Row Labels	Area (ha)		Type/Condition	Distribution
Highest Quality	1.53	16.3%	1. <u>Best quality grassland</u>	Eastern, central (largest) and western patches
Weedy Grassland	5.91	63.0%	2. Widespread <u>moderate quality grassland</u>	Widespread/throughout
New Dam & Spoil	0.88	9.4%	3. <u>Non-grassland</u>	Around central dam
Old Racecourse	0.16	1.7%	3. <u>Non-grassland</u> or weed scape (some Widespread grassland)	Sect. of old racecourse track in east
Other	0.90	9.6%	3. <u>Non-grassland</u> or weed scape	Marginal areas usually with weeds or woody veg.
Grand Total	9.39			

Note: The best quality grassland category was dominated by kangaroo grass, generally with the highest densities of associated natives and a lower cover of weeds (Sweet Vernal Grass <50% and typically much less - <25%); These areas were often co-incident with low lying places that look to have been historically scaped and are now seasonally or intermittently water logged – accounting for the poor growth of many weeds;
The moderate quality grassland category was areas with high kangaroo grass cover and a good scattering of associated natives, but a high cover of weeds (esp. sweet vernal grass, typically >50%);
The non-native grassland was an exotic “weed scape” with little or no native grassy ground cover;

Management recommendations

The Atlas Ecology EMP (2012) details six primary aspects of reserve management; beyond biodiversity, there is: Climate Variability, Cultural Management, Recreation Management, Adjoining Uses and Monitoring. It is beyond the scope of this project to critique the various strategies and actions listed under each, and so this report will be limited to some broad comments on the conservation management of the grassland mostly from a biodiversity perspective.

The preliminary landscape change discussion earlier highlights the necessity of maintaining frequent disturbances such as fire in order to maintain grassland structure (preventing woody regeneration) as well as diversity (see competitive exclusion effect in Morgan 2001; Lunt et al. 2012). Leaving aside any debate about the nature and significance of the grassland’s likely anthropogenic origin, it is clear that in order to maintain (and improve) its current biodiversity values, similar disturbance regimes must be maintained indefinitely.

It has been previously noted that burning has occurred historically (prior to the early 1990’s) on an “infrequent and ad-hoc basis” (Atlas Ecology 2012). And while there have been burns since this time, this regime has been insufficient to prevent a significant level of tree encroachment and probably a level of species loss.

The last known burns appear to have occurred in March 2010 (far east or Zone C; Source - Google Earth) and again in March 2012 (far west or Zone A; Source - Atlas Ecology 2012). If this is the case, since 2010, the mean frequency of burning has been 1 in every 12 years. Not only is this way outside the actions recommended in the EMP (“burnt every three years or on an ‘as needs’ basis”), it is also clearly an unsustainable and dangerous trajectory for the grassland (“the absence of fire (i.e. more than five years) would constitute a *major threat* to some grassland species” [my emphasis]).

It is possible some species previously recorded for this reserve have already been lost or are now at dangerously low population levels. In fact, many of the species previously recorded were not picked up in this assessment and may already be locally extinct or very close to it. This includes some 20 herbaceous wildflowers such as Yam Daisy (*Microseris walteri*, syn: *Microseris* sp. 3), Pale Swamp Everlasting (*Coronidium gunnianum*, syn: *C. scorpioides aff rutidolepis*), Golden Weather-grass (*Hypoxis hygrometrica*) and Narrow-leaf New Holland Daisy (*Vittadinia muelleri*). Another group of ten similar previously recorded species were only noted from one site during this assessment. And a further group of nine species (including Common Fringe-lily *Thysanotus tuberosus* subsp. *tuberosus* and Matted Flax-lily *Dianella amoena*) previously not recorded were also only found at one location during this assessment (see Appendices 5 to 7).

While it is clear that further searching will likely turn up more species (including those not yet recorded for the site), the point is that there are more species apparently disappearing from the site than those being found and that much of the botanical diversity is only represented by single records which most likely represent small populations, highly vulnerable to local extinction in the absence of burning.

It is critical the land manager move to reinstate or establish a regime similar to that recommended in the Atlas Ecology EMP (2012), i.e. “every three years or on an ‘as needs’ basis”. **The most practical way to deliver this sort of regime would be to rotationally burn one of the three zones every year.** While from time to time wet conditions may restrict the window of opportunity during Autumn, it still should be feasible to burn at some point each year. If for some reason this doesn’t happen in any one year, it should be made a priority to resume the regime in the following year. Under this scenario, **managers should anticipate the need to burn part of the reserve every year and plan accordingly.** If annual burning becomes a reality, there would be merit in specifying an additional management zone that is annually burnt (see below).

There is considerable evidence that many of the grasslands subject to traditional Aboriginal burning were fired annually; a regime that could have great benefit in terms of suppressing the dominance of Kangaroo Grass, controlling weeds and encouraging wildflowers. Given we know that such inter-tussock species are scarce at the reserve or have already disappeared, there will be limits to how much or how quickly such species could recover once frequent burning is reinstated. Thus, it would also be useful to introduce supplementary species establishment to help facilitate or kick-start the recovery of wildflowers such as the tuberous perennial forbs and geophytes (including many orchids and lilies that were once reported in great density and abundance from this region; see Mollison 1980). Given the obvious links to traditional Aboriginal burning practices, these sort of management strategies should be implemented in close collaboration with relevant Traditional Owner groups.

Likewise, in terms of weed control, in the absence of a formal assessment of works actually undertaken, it appears much of the annual control program has been inadequately or not at all implemented. Of the three lifeform groups listed (trees and shrubs, herbs and grasses), it appears only the woody species have been targeted in any way (Atlas Ecology 2012). Given a frequent burning regime would go a long way toward

controlling many of these woody species (with well targeted follow up it may be possible to even completely eliminate some of them), greater priority could be focused on some of the problematic herbaceous species, especially: Sweet Vernal-grass, Ribwort, Cocksfoot, Yorkshire Fog Grass and Toowoomba Canary-grass. Annual grasses such as Large and Lesser Quaking-grass *Briza* spp. (and others) could be well contained with more frequent burning.

Finally, it is critical a suitable level of monitoring and evaluation accompany implementation of these important conservation management strategies. Again while it is beyond the scope of this report to spell out the details, in short the program should consist of a **series of outputs** assessed at least annually (burning frequency, timing, patchiness and intensity; frequency, coverage and effectiveness of weed control by species; frequency, coverage and effectiveness of supplementary wildflower establishment by species) as well as a **series of outcomes** assessed at least annually or five-yearly depending on the metric (extent and trajectory of native and exotic woody coverage; structural openness, evenness, species diversity and weediness of grassland). Note, reassessing the permanent quadrat network will contribute towards the measurement of the second of these sets of outcomes.

Ideally, management of the reserve should be underpinned by an appropriate annual budget and annual works planning process and capacity either within Council or funded and outsourced (as an integrated operational package) to a suitable contractor with obligations to submit regular evaluation reports against the key outputs. And there should be a separate contract to an independent ecological consultant to periodically evaluate key outcomes.

Note that it is beyond the scope of this report to provide detailed operational management advice and the onus will be on the land owner/manager to ensure that all the appropriate planning and preparation is undertaken before any ecological burning program commences/continues.

In conclusion, the grassland vegetation at Buffalo Stadium is an very important landscape and ecological feature of the Macedon region – potentially of state and national significance if it qualifies as the ecological community under the EPBC listing.

I would strongly encourage you to work closely with the Council and the local community to maintain this important asset and consider improving it with the strategies suggested.

I hope this information is useful to you and I wish you good luck in looking after and enjoying the grassland at Buffalo Stadium in the future.

Please get back to me if you'd like follow-up information/advice.

Yours sincerely,



Paul Foreman,
Director and Senior Ecologist/Botanist
Blue Devil Consulting



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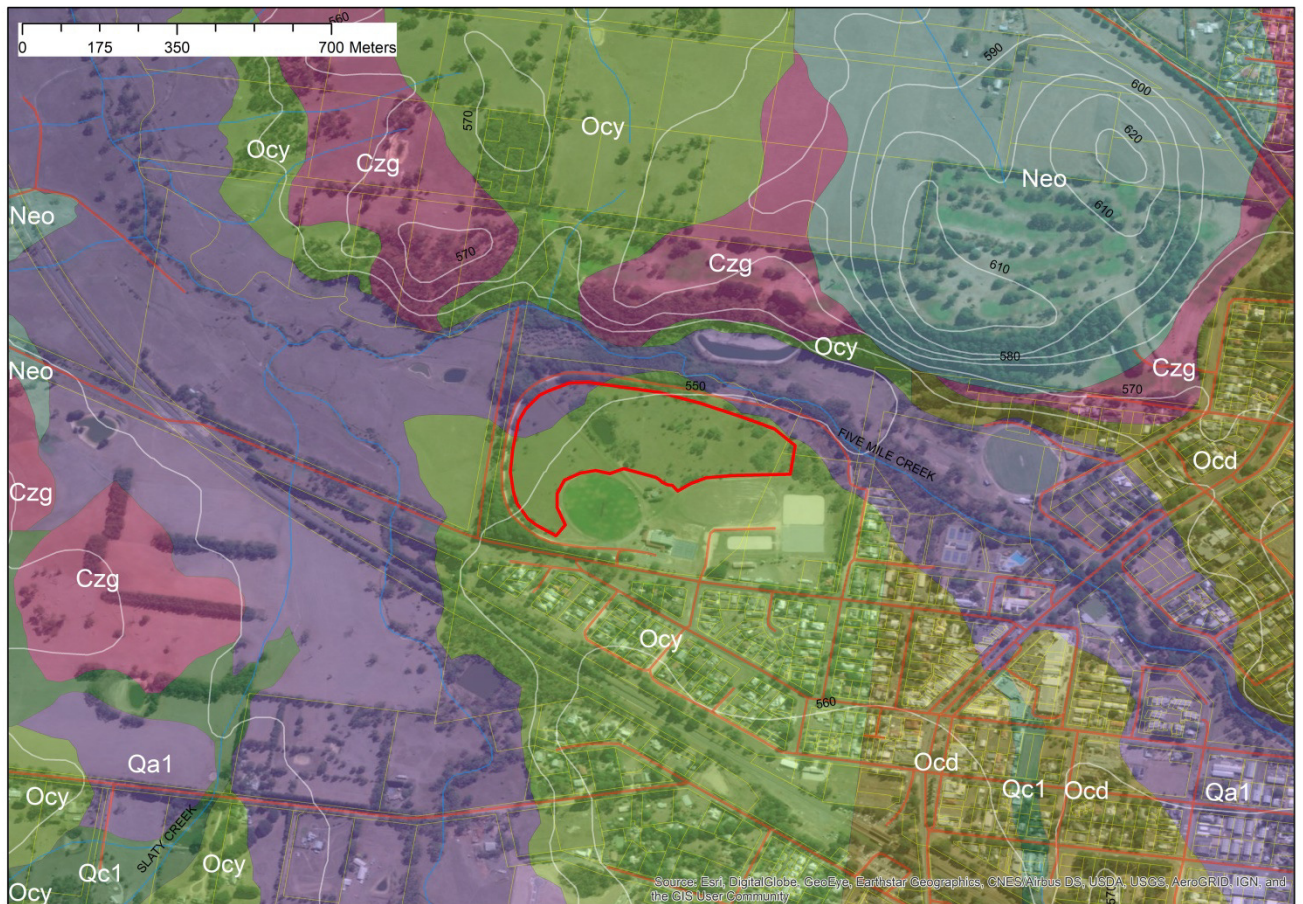
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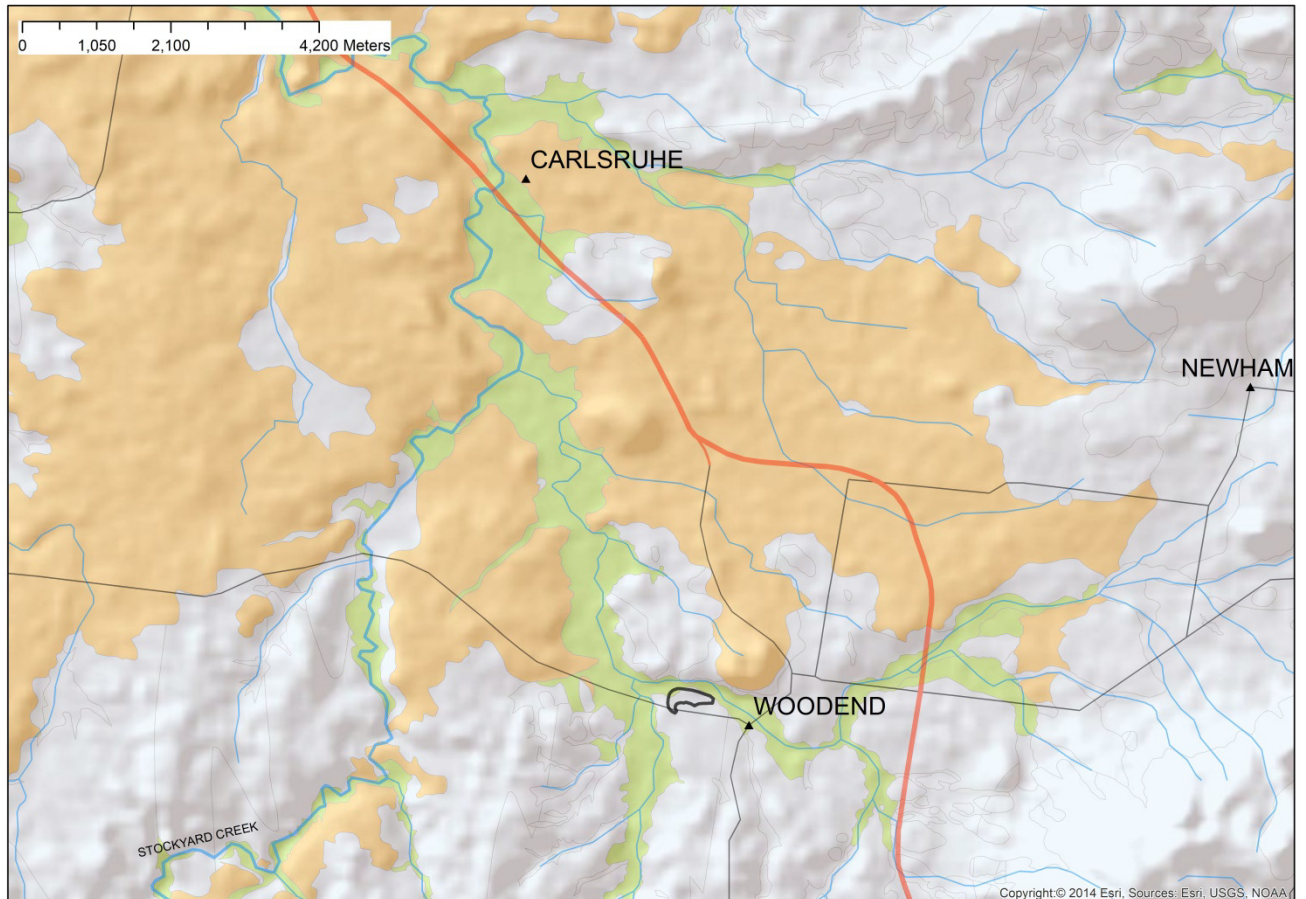
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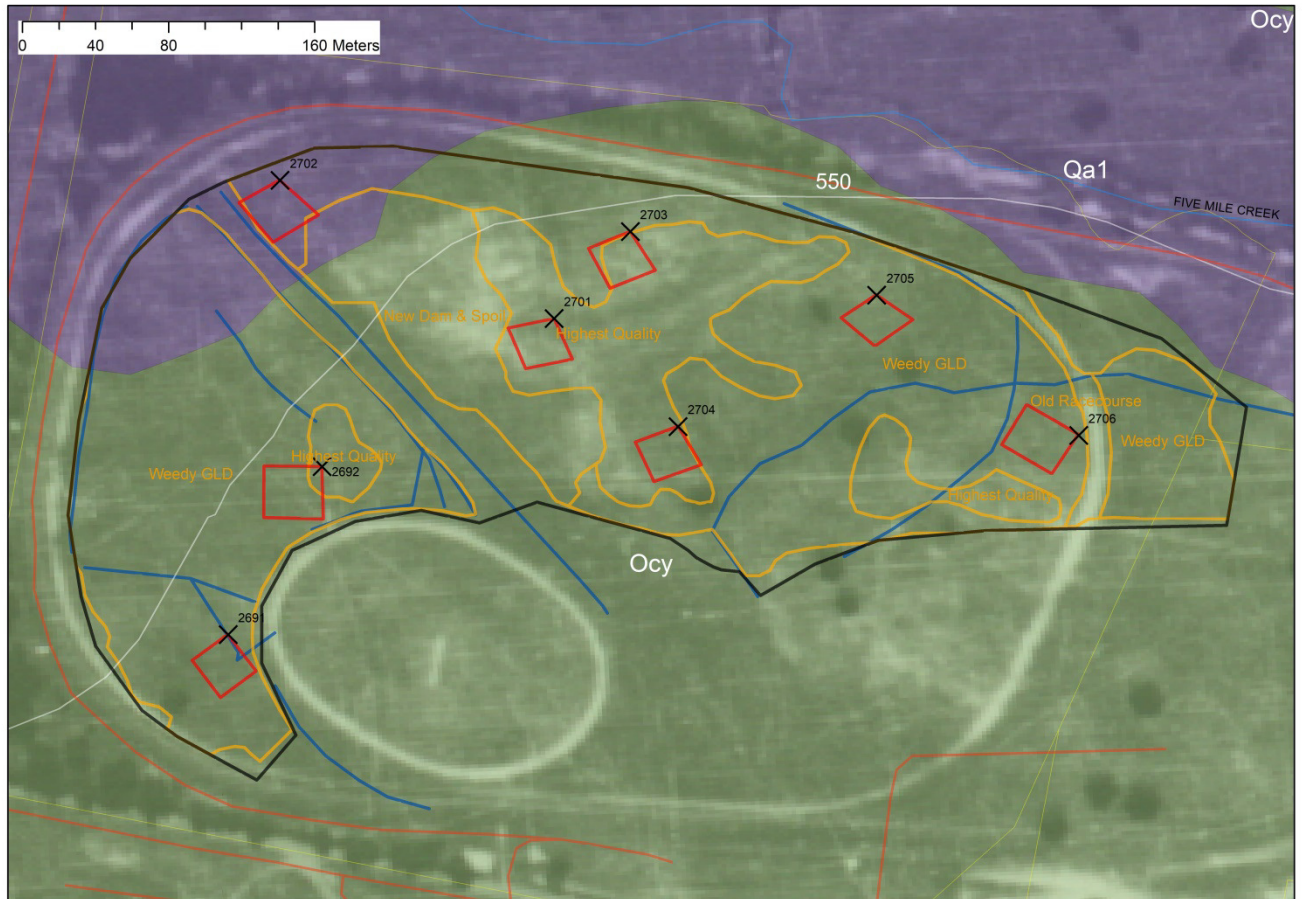
Appendix 1: Map of the grassland portion of Buffalo Stadium grassland reserve (Red) in the context of geology, terrain, cadastre, hydrology and a satellite image.

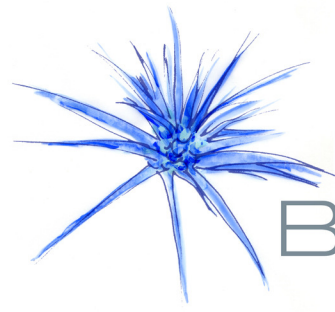


Appendix 2: Map of the grassland portion of Buffalo Stadium grassland reserve (black) in the context of the southern part of the Upper Campaspe Plains showing - Newer Volcanic (Orange) and active alluvium (Green).



Appendix 3: Close up of the grassland section (Black) showing a 1946 aerial photograph sourced from TROVE (see Appendix 4 for the explanation of the other elements). Note the virtual absence of trees and the absence of infrastructure except the two old racing circuits.





Appendix 4: Close up of the grassland section (Black) showing current imagery. The blue lines denote the major drains (artificial); the red boxes indicate the 20 x 20 m quadrats; the "X" shows the location of the permanent peg (numbers show unique code); and the orange polygons show condition categories (see text for explanation).



Appendix 5: Select images of vegetation and species in the grassland at Buffalo Stadium (Dec, 2017)



Picture 1: *Drosera pygmaea* Tiny Sundew – an interesting interstitial species that has apparently not been recorded in the region but was found to be quite common in 2017



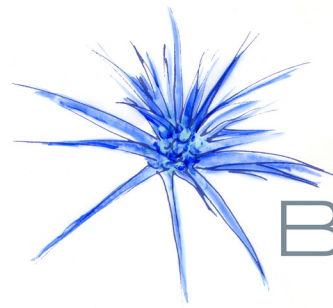
Picture 2: *Thysanotus tuberosus* subsp. *tuberosus* Common Fringe-lily – another interesting geophyte that has apparently only been recorded rarely in the region



Picture 3: Q 2702 – Example of weedy grassland quadrat showing higher cover of Sweet Vernal grass and invasion of woody species

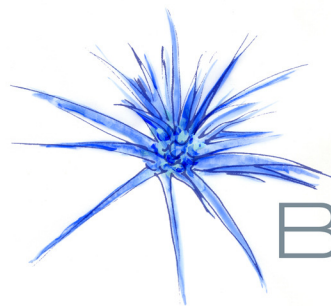


Picture 4: Q 2703 - Example of higher quality grassland quadrat showing lower cover of Sweet Vernal grass; These areas also were slight low-lying and subject to season water logging possibly due to historic scraping by machines

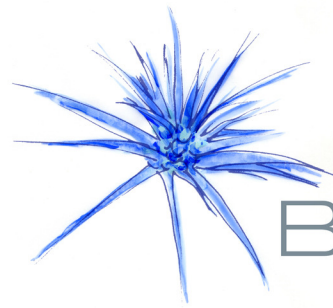


Appendix 6: Buffalo Stadium combined species incorporating the list from past assessments (which includes non-grassland habitats); Note that the Atlas Ecology report compiled their species list from previous survey efforts (i.e. from 1985, 1999 and 2006 and 2006 /7);

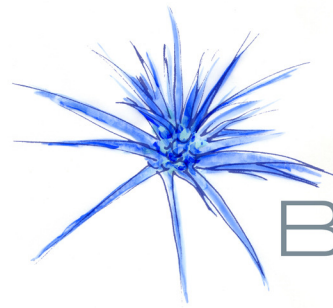
SCIENTIFIC NAME	COMMON NAME	Origin	EPBC	FFG	VROTS	Atlas Ecol.	#1	#2	#3	#4	#5	#6	#7	#8
							2691	2692	2701	2702	2703	2704	2705	2706
Acetosella vulgaris	Sheep Sorrel	*				-								
Agrostis capillaris	Brown-top Bent	*				-	2	2	+	1	2	1	1	
Aira elegantissima	Delicate Hair-grass	*				-	1	1	1		1			
Aira spp.	Hair Grass	*				-								
Anagallis minima	Chaffweed	*				-		1			1			
Anthoxanthum odoratum	Sweet Vernal-grass	*				-	5	3	3	5	4	3	5	5
Arbutus unedo	Strawberry Tree	*				-								
Briza maxima	Large Quaking-grass	*				-								
Briza minor	Lesser Quaking-grass	*				-	2	1	1	2	2	1	2	
Centaurium erythraea	Common Centaury	*				-	1	+	2	2	1	1	2	2
Chamaemelum nobile	Common Chamomile	*				-								
Cicendia filiformis	Slender Cicendia	*				-		1	1		1	1		
Cirsium vulgare	Spear Thistle	*				-	+							
Crataegus monogyna	Hawthorn	*				-	+	+		+			+	
Cynodon dactylon var. dactylon	Couch	*				-								
Cyperus rotundifolius	Nut Grass/Drain Sedge	*				-								
Cyperus tenellus	Tiny Flat-sedge	*				-								
Cytisus scoparius	English Broom	*				Restricted	1							
Dactylus glomeratus	Cocksfoot	*				-								
Daucus carota	Carrot	*				-								
Erica lusitanica	Spanish Heath	*				-		1		1		+	+	3
Festuca arundinacea	Tall Fescue	*				-	+							
Holcus lanatus	Yorkshire Fog	*				-	1			1	+	+		+
Hypochaeris glabra	Smooth Cat's-ear	*				-	1	1	+	1	1	1	1	+
Hypochaeris radicata	Flatweed	*				-	+	+	+	1	1	1	1	1
Isolepis levynsiana	Tiny Flat-sedge	*				-		1	1		1	1		+
Juncus articulata	Jointed Rush	*				-								
Juncus capitatus	Capitate Rush	*				-	1	1			1		1	
Leontodon saxatilis subsp. saxatilis (L. taraxacoides subsp. taraxacoides)	Hairy Hawkbit	*				-		+	+		2	2		1
Lotus corniculatus	Bird's-foot Trefoil	*				-								
Lysimachia arvensis	Pimpernel	*				-								
Matricaria matricarioides	Rounded Chamomile	*				-		1			2			
Paspalum dilatatum	Paspalum	*				-								1
Paspalum distichum	Water Couch	*				-								
Phalaris aquatica	Toowoomba Canary-grass	*				-								
Pinus radiata	Radiata Pine	*				-								
Plantago lanceolata	Ribwort	*				-	2	1		2			+	1
Populus spp.	Poplar sp	*				-								
Prunus spp.	Prunus	*				-					+	+	+	
Romulea rosea	Onion Grass	*				-	1	1	1		1	1		+
Romulea rosea var. australis	Common Onion-grass	*				-								
Rubus fruticosus spp. agg.	Blackberry	*				-	+				+		+	+
Rumex conglomeratus	Clustered Dock	*				-								
Rumex crispus	Curled Dock	*				-								
Sisyrinchium iridifolium	Striped Rush-leaf	*				-								
Sonchus asper s.l.	Rough Sow-thistle	*				-								+
Sonchus oleraceus	Common Sow-thistle	*				-								
Tragopogon porrifolius	Salsify	*				-								
Trifolium campestre var. campestre	Hop Clover	*				-		1						
Trifolium dubium	Suckling Clover	*				-	1	+						
Trifolium glomeratum	Cluster Clover	*				-	1							
Trifolium spp.	Clover	*				-								
Trifolium subterraneum	Subterranean Clover	*				-	+							



<i>Ulex europaeus</i>	Gorse	*	Regionally controlled	1	2				
<i>Vicia hirsuta</i>	Tiny Vetch (Hairy Vetch)	*	-						
<i>Vicia sativa</i>	Common Vetch	*		1	+				
<i>Vulpia muralis</i>	Wall Fescue	*				+			
<i>Acacia dealbata</i>	Silver Wattle		Local	1	1	2	+	+	+
<i>Acacia melanoxylon</i>	Blackwood		Local	1	+		+	+	+
<i>Acaena echinata</i>	Sheep's Burr		Local	1		1	+	+	2
<i>Acaena novae-zelandiae</i>	Bidgee Widgee		Local						
<i>Allitia cardiocarpa</i>	Swamp Daisy		Regional						
<i>Amphibromus archeri</i>	Pointed Swamp Wallaby-grass		Regional						
<i>Anthosachne scabra</i>	Common Wheat-grass		Local						
<i>Aphelia gracilis</i>	Slender Aphelia		Regional	1					
<i>Aphelia pumilio</i>	Dwarf Aphelia		Regional	1					
<i>Arthropodium minus</i>	Small Vanilla-lily			+					
<i>Arthropodium strictum</i> s.l.	Chocolate Lily		Local	+		+		+	+
<i>Asperula conferta</i>	Common Woodruff		Regional	1					
<i>Asperula conferta</i>	Common Woodruff								
<i>Asperula scoparia</i> subsp. <i>scoparia</i>	Prickly Woodruff		Regional						
<i>Astroloma humifusum</i>	Cranberry Heath		Local	+	+				2
<i>Austrostipa</i> spp.	Spear Grass		Local						
<i>Bossiaea prostrata</i>	Creeping Bossiaea		Local	2	3	+	2	2	2
<i>Brachyscome decipiens</i>	Field Daisy		Regional	+					
<i>Brunonia australis</i>	Blue Pincushion		Local						
<i>Bulbine bulbosa</i>	Bulbine Lily		Regional	1	1	+	2	1	1
<i>Burchardia umbellata</i>	Milkmaids		Local	2	1	1	1	1	+
<i>Caesia calliantha</i>	Blue Grass-lily		Regional						
<i>Callitriche stagnalis</i>	Common Water-starwort		Regional						
<i>Carex breviculmis</i>	Common Grass-sedge		Regional	1	1	1	1	+	1
<i>Carex inversa</i>	Knob Sedge		Regional						
<i>Centella cordifolia</i>	Centella						+		
<i>Centrolepis aristata</i>	Pointed Centrolepis		Regional	1	1		1	+	
<i>Centrolepis strigosa</i> subsp. <i>strigosa</i>	Hairy Centrolepis		Regional						
<i>Coronidium scorpioides</i>	Button Everlasting		Local						
<i>Coronidium gunnianum</i> (<i>Coronidium scorpioides</i> aff. <i>rutidolepis</i>)	Pale Swamp Everlasting	v	Regional						
<i>Crassula helmsii</i>	Swamp Crassula		Regional						
<i>Cymbonotus preissianus</i>	Austral Bear's-ear		Local						
<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea		Local	+	+				1
<i>Deyeuxia quadriseta</i>	Reed Bent-grass		Regional						
<i>Dianella amoena</i>	Matted Flax-lily	E L e		1					
<i>Dianella revoluta</i> var. <i>revoluta</i> s.l. (<i>D. admixta</i>)	Black-anther Flax-lily		Local			+			
<i>Dichondra repens</i>	Kidney-weed		Local						
<i>Dillwynia cinerascens</i> s.l.	Grey Parrot-pea		Local	1	2	3	1	2	2
<i>Diuris chryseopsis</i>	Golden Moths		Regional		+				
<i>Drosera glanduligera</i>	Scarlet Sundew		Regional	1	1	1	+	1	1
<i>Drosera hookeri</i> (<i>D. peltata</i> subsp. <i>auriculata</i>)	Tall Sundew			+	1			+	+
<i>Drosera pygmaea</i>	Tiny Sundew				+	+		1	1
<i>Eleocharis acuta</i>	Common Spike-sedge		Regional						
<i>Eleocharis sphacelata</i>	Tall Spike-sedge		Regional						
<i>Epilobium billardierianum</i>	Variable Willow-herb		Local						
<i>Epilobium hirtigerum</i>	Hairy Willow-herb		Regional						
<i>Eragrostis brownii</i>	Common Love-grass		Regional						
<i>Eragrostis parviflora</i>	Weeping Love-grass				+			2	+
<i>Eryngium vesiculosum</i>	Prickfoot		Regional						
<i>Eucalyptus dives</i>	Broad-leaf Peppermint								+
<i>Eucalyptus radiata</i>	Narrow-leaf Peppermint		Local						
<i>Eucalyptus viminalis</i>	Manna Gum		Local						
<i>Euchiton collinus</i> s.l.	Clustered/Creeping Cudweed			1	+				
<i>Geranium retrorsum</i>	Grassland Crane's-bill		Regional						
<i>Gonocarpus humilis</i>	Shade Raspwort						+	+	
<i>Gonocarpus tetragynus</i>	Common Raspwort		Local	2	1	3	2	2	2



Haloragis heterophylla	Varied Raspwort	Local	+	+		1	+	+
Hardenbergia violacea	Purple Coral-pea	Local						
Hemarthria uncinata var. uncinata	Mat Grass	Regional	2	1	+	1	2	2
Hovea heterophylla	Common Hovea	Local		1	1			
Hypericum gramineum	Small St John's Wort	Local	1	1	1	1	1	1
Hypoxis hygrometrica	Golden Weather-grass	Regional						
Isolepis cernua var. platycarpa	Club-sedge	Regional						
Isolepis fluitans	Floating Club-sedge	Regional		1		1		
Isolepis hookeriana	Grassy Club-sedge	Regional		+				
Isotoma fluviatilis subsp. australis	Swamp Isotome	Regional						
Juncus amabilis	Hollow Rush	Regional						
Juncus bufonius	Toad Rush	Regional					+	
Juncus holoschoenus	Joint-leaf Rush	Regional	+	+			+	
Juncus sarophorus	Broom Rush	Regional						
Juncus subsecundus	Finger Rush			+				
Lachnagrostis filiformis	Common Blown-grass	Local						
Lagenophora stipitata	Common Bottle-daisy	Local	1					
Leptorhynchus squamatus	Scaly Buttons	Local			+		+	
Linum marginale	Native Flax	Regional						
Lomandra filiformis	Wattle Mat-rush	Local	2	1				
Lomandra filiformis subsp. filiformis	Wattle Mat-rush				+	1		+
Luzula meridionalis	Common Woodrush	Regional		+				
Lythrum hyssopifolia	Small Loosestrife	Regional						
Microlaena stipoides var. stipoides	Weeping Grass	Local	1	2	2	2	2	+
Microseris walteri (Microseris sp. 3)	Yam Daisy	Regional						1
Microtis spp.	Onion Orchid			+				
Microtis unifolia	Common Onion-orchid	Regional		1	1	+	1	1
Montia australasica	White Purslane	Regional						
Montia fontana	Water-blinks	Regional						
Myriophyllum crispatum	Upright Milfoil	Regional						
Opercularia ovata	Broad-leaf Stinkweed	Local			2	1	1	
Oxalis perennans	Grassland Wood-sorrel	Local	+			+		+
Pauridia glabella var. glabella (Hypoxis glabella)	Yellow Star	Regional						
Pauridia vaginata var. vaginata (Hypoxis vaginata var. vaginata)	Yellow Star	Regional	+	1			+	
Pentapogon quadrifidus var. quadrifidus	Five-awned Spear-grass	Regional		1	+	+	1	+
Pimelea humilis	Common Rice-flower	Local	1	1	1	1	1	+
Plantago gaudichaudii	Narrow Plantain	Regional						
Plantago varia	Variable Plantain	Local	1	1				
Poa morrisii	Soft Tussock-grass		3	1		2		1
Poa rodwayi	Velvet Tussock-grass	Regional						
Poa sieberiana	Grey Tussock-grass	Local						
Poa sieberiana var. sieberiana	Grey Tussock-grass					1		1
Portulaca oleracea	Common Purslane	Regional						
Potamogeton ochreateus	Blunt Pondweed	Regional						
Ranunculus glabrifolius	Shining Buttercup	Regional						
Ranunculus lappaceus	Australian Buttercup	Regional	2	2		1		1
Rytidosperma caespitosum	Common Wallaby-grass						2	+
Rytidosperma erianthum	Hill Wallaby-grass	Regional					+	
Rytidosperma fulvum	Copper-awned Wallaby-grass				1		+	
Rytidosperma indutum	Shiny Wallaby-grass					+		
Rytidosperma laeve	Smooth Wallaby-grass	Regional		1	+	+	2	1
Rytidosperma pallidum	Silvertop Wallaby-grass	Local		+	+	+		
Rytidosperma penicillatum	Weeping Wallaby-grass							
Rytidosperma pilosum	Velvet Wallaby-grass	Regional			+	1	+	+
Rytidosperma semiannulare	Wetland Wallaby-grass	Regional					3	
Schoenus apogon	Common Bog-sedge	Local	1	2		+	4	2
Schoenus tesquorum	Soft Bog-sedge	Regional	1	1			+	
Senecio glomeratus	Annual Fireweed	Local		+				
Senecio quadridentatus	Cotton Fireweed	Local						
Senecio squarrosus s.l.	Leafy Fireweed	Regional	+	+	+	+	+	+
Solenogyne dominii	Smooth Solenogyne	Regional			+		+	+
Solenogyne gunnii	Hairy Solenogyne	Regional						+



Appendix 7: Select list of wildflowers and other lifeforms rare or now possibly extinct at the Buffalo Stadium grassland.

SCIENTIFIC NAME	COMMON NAME	EPBC	FFG	VROTS	Atlas Ecol.	This ass'tmt
Allitia cardiocarpa	Swamp Daisy				Regional	Extinct?
Amphibromus archeri	Pointed Swamp Wallaby-grass				Regional	Extinct?
Arthropodium minus	Small Vanilla-lily					2017
Asperula conferta	Common Woodruff				Regional	2017
Asperula scoparia subsp. scoparia	Prickly Woodruff				Regional	Extinct?
Brachyscome decipiens	Field Daisy				Regional	2017
Brunonia australis	Blue Pincushion				Local	Extinct?
Caesia calliantha	Blue Grass-lily				Regional	Extinct?
Centella cordifolia	Centella					2017
Coronidium gunnianum (Coronidium scorpioides aff rutidolepis)	Pale Swamp Everlasting			v	Regional	Extinct?
Coronidium scorpioides	Button Everlasting				Local	Extinct?
Cymbonotus preissianus	Austral Bear's-ear				Local	Extinct?
Dianella amoena	Matted Flax-lily	E	L	e		2017
Dianella revoluta var. revoluta s.l. (D. admixta)	Black-anther Flax-lily				Local	2017
Dichondra repens	Kidney-weed				Local	Extinct?
Diuris chryseopsis	Golden Moths				Regional	2017
Eryngium vesiculosum	Prickfoot				Regional	Extinct?
Eucalyptus dives	Broad-leaf Peppermint					2017
Geranium retrorsum	Grassland Crane's-bill				Regional	Extinct?
Hardenbergia violacea	Purple Coral-pea				Local	Extinct?
Hypoxis hygrometrica	Golden Weather-grass				Regional	Extinct?
Juncus subsecundus	Finger Rush					2017
Lagenophora stipitata	Common Bottle-daisy				Local	2017
Linum marginale	Native Flax				Regional	Extinct?
Microseris walteri (Microseris sp. 3)	Yam Daisy				Regional	Extinct?
Microtis spp.	Onion Orchid					2017
Pauridia glabella var. glabella (Hypoxis glabella)	Yellow Star				Regional	Extinct?
Plantago gaudichaudii	Narrow Plantain				Regional	Extinct?
Ranunculus glabrifolius	Shining Buttercup				Regional	Extinct?
Rytidosperma indutum	Shiny Wallaby-grass					2017
Senecio glomeratus	Annual Fireweed				Local	2017
Solenogyne gunnii	Hairy Solenogyne				Regional	2017
Thelymitra rubra	Salmon Sun-orchid				Regional	2017
Thysanotus tuberosus subsp. tuberosus	Common Fringe-lily					2017
Tricoryne elatior	Yellow Rush-lily				Local	2017
Vittadinia muelleri	Narrow-leaf New Holland Daisy				Regional	Extinct?
Wahlenbergia multicaulis	Branching Bluebell					2017
Wahlenbergia stricta subsp. stricta	Tall Bluebell				Local	2017
Wurmbea dioica	Common Early Nancy				Local	Extinct?