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Biodiversity Management Plan

Crookwell Hospital

Lot 2 // DP 1160080, Crookwell, NSW, 2583

Prepared for Cardno Pty Ltd

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Glossary and abbreviations

Abbreviation	Description
*	Denotes exotic species
BC Act	NSW *Biodiversity Conservation Act 2016*
BMP	Biodiversity Management Plan
DA	Development Application
DPI	Department of Primary Industries
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
ha	Hectares
LGA	Local Government Area
MZ	Management Zone
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
TEC	Threatened Ecological Community
TSC Act	NSW *Threatened Species Conservation Act 1995*
TSGGW	Tablelands Snow Gum Grassy Woodland
ULSC	Upper Lachlan Shire Council
WEM	Woodlands Environmental Management
WoNS	Weeds of National Significance

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1. Introduction

1.1 Background

In 2012, the Greater Area Health Service submitted a planning proposal to rezone Lot 2, DP 1160080, Crookwell from SP2 Infrastructure (Health Services Facility) to R5 Large Lot Residential to enable future development of the site and reflect the intention of the subdivision of the land. This planning proposal included an environmental assessment report by Woodlands Environmental Management (WEM 2016).

The site contains an endangered ecological community (EEC) listed under the New South Wales *Biodiversity Conservation Act 2016* (BC Act) (formerly the *Threatened Species Conservation Act 1995* (TSC Act)), namely *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions*, referred to as Tablelands Snow Gum Grassy Woodland (TSGGW), as well as *Eucalyptus aggregata* (Black Gum), which is listed as a vulnerable species under the BC Act.

Upper Lachlan Shire Council (ULSC) provided the Office of Environment and Heritage (OEH) with an opportunity to comment on the proposal. OEH subsequently provided advice regarding biodiversity in a letter to ULSC dated 19 June 2017 recommending that Lot 2 is rezoned to E3 - Environmental Management as this permits a house with development consent.

In addition, OEH considered that the most appropriate mechanism for avoiding long term impacts from the planning proposal would be through in perpetuity protection of the EEC and threatened species habitat with a section 88B instrument under the *Conveyancing Act 1919* placed on the title.

OEH indicated that the s88B instrument should have a Biodiversity Management Plan (BMP), details of which were provided in their letter.

1.2 Purpose and scope

The purpose of this BMP is to describe the ecological management strategies to offset the impacts of a single dwelling on the site and to protect and manage the conservation values in perpetuity so as to avoid long term impacts.

This BMP addresses the recommendations provided by OEH in their letter dated 19 June 2017 and should be read in conjunction with the Planning Proposal and WEM (2016).

1.3 Objectives

The objectives of this BMP are to:

- protect Tablelands Snow Gum Grassy Woodland
- control feral animals to reduce adverse impacts to conservation values
- manage stock to reduce grazing pressure
- encourage regeneration
- protect habitat provided by live and dead trees and any fallen timber
- control weeds
- maintain connections to other patches of vegetation.

2. Biodiversity

2.1 Threatened ecological communities

One threatened ecological community (TEC), namely Tablelands Snow Gum Grassy Woodland (TSGGW), occurs on the site (WEM 2016). This community is located in the centre, east and north of the site. The south west corner and the north east corner of the site contains disturbed land dominated by exotic vegetation (WEM 2016).

TSGGW is dominated by *Eucalyptus pauciflora* (Snow Gum) with *E. radiata* (Narrow-leaved Peppermint), *E. aggregata* (Black Gum) and *E. stellulata* (Black Sallee). The midstorey is dominated by exotic species such as *Crataegus monogyna** (Hawthorn) and *Cytisus scoparius** (Broom). The ground layer is dominated by exotic species such as *Conzya bonariensis** (Fleabane), *Acetosella vulgaris** (Sorrel), *Dactylis glomerata** (Cocksfoot), *Echium plantagineum** (Paterson's Curse), *Hypochaeris radicata** (Catsear), *Paspalum dilatatum** (Paspalum) and *Rubus fruticosus* spp. agg.* (Blackberry). Native species have a low cover and abundance and include *Themeda triandra* (syn. *australis*)(Kangaroo Grass) and *Poa* spp. (Tussock Grasses) (WEM 2016).

The disturbed land is dominated by exotic species including pasture grasses and woody weeds (WEM 2016).

2.2 Threatened species

2.2.1 Threatened flora

WEM (2016) identified nine semi-mature to mature *E. aggregata* within the site as well as some regeneration of this species. This species is located in the centre and north west of the site (WEM 2016).

2.3 Weeds

Three priority weeds listed under the NSW *Biosecurity Act 2015* (formerly *Noxious Weeds Act 1993*) for the Upper Lachlan Shire Council LGA have been recorded study area (**Table 2.1**) (WEM 2016). These species are also listed as Weeds of National Significance (WoNS).

Table 2.1: Priority weeds and Weeds of National Significance.

Common name	Scientific name	WoNS	Duty
Scotch Broom	*Cytisus scoparius*	Y	**Prohibition on dealings** *Must not be imported into the State or sold* **Regional Recommended Measure** Core infestation area: whole region except exclusion zone of : Bega council *Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment.*

Common name	Scientific name	WoNS	Duty
Blackberry	*Rubus fruticosus* spp. agg.	Y	**Prohibition on dealings** *Must not be imported into the State or sold*
Fireweed	*Senecio madagascariensis**	Y	**Prohibition on dealings** *Must not be imported into the State or sold* **Regional Recommended Measure** Exclusion zone: whole region except the core infestation area of Wollongong, Kiama, Shellharbour, Eurobodalla, Shoalhaven, Bega Valley and Wingecaribee councils *Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

2.4 Site resilience

Given the previous uses of the site for horse grazing and the prevalence of woody and herbaceous weeds, the EEC is considered to have medium to low capacity for regeneration to occur. The EEC will require some intervention for regeneration to be successful, including primary and secondary weed removal, some revegetation and ongoing maintenance works. Revegetation should aim to increase native plant species richness and the cover of native midstorey and canopy species.

A management zone has been drawn around the EEC and has included some disturbed land to decrease the edge to perimeter ratio and for practical ease of management. These disturbed patches of disturbed land will require extra weed control and regeneration effort.

In general, the disturbed land, which is not part of the EEC, is dominated by exotic pasture grasses and has been heavily degraded from past and current land use, including vegetation clearing, soil modification and grazing, and is considered to have no to low capacity for regeneration to occur. The disturbed land should be managed as grazing land. However, weeds should still be managed to lower the risk of spread into the EEC.

3. Biodiversity management

Biodiversity management works outlined below should be implemented for the site. Weed management should begin prior to any proposed works under a development application. A suitably qualified and experienced bush regeneration contractor should be engaged to carry out biodiversity management works.

The site has been divided into two indicative management zones (MZs), based on the conservation values of the site and the different management actions required to protect and manage those conservation values. Final boundaries of the management zones should be identified during the development application stage, when a development footprint has been finalised.

This section describes the biodiversity management zones and then the management measures.

3.1 Biodiversity Management Zones

3.1.1 Management Zone 1 – Protection of EEC

This zone covers 1.83 ha and encompasses the TSGGW and where *E. aggregata* occurs within the site (**Figure 3.1**). This is the largest MZ and its aim is to protect and manage conservation values.

The following management measures will be undertaken in this zone:

- demarcate boundaries
- feral animal management
- weed management
- prohibition of firewood collection
- regeneration of TSGGW
- connectivity of TSGGW created
- protection of *E. aggregata*

3.1.2 Management Zone 2 – Management of cleared land

This zone covers 1.09 ha and encompasses the cleared land and land dominated by exotic species (**Figure 3.1**). This zone is smaller than MZ1 and directly adjacent to MZ1. Its aim is to control stock and other threatening processes and, therefore, provide an ecological buffer to MZ1.

The following management measures will be undertaken in this zone:

- demarcate boundaries
- feral animal management
- weed management
- prohibition of firewood collection

Figure 3.1: Management Zones

3.2 Boundaries

This management action will demarcate management zones. Fences will installed to clearly identify the management zones within the site, the site boundary, and to prevent stock from entering MZ1.

A stock fence will be erected around the TSGGW (MZ1) which will prevent horses, sheep or cattle from entering MZ1. Fences will be wildlife friendly fences as defined in the Upper Lachlan Rural Living Handbook (ULSC 2008).

3.3 Feral animal management

Feral animal management will occur in both zones. This will consist of controlling rabbits, hares, foxes, pigs and goats when required. Control of feral animals will use humane methods and will not cause disturbance to the soil layer or native vegetation in MZ1 (i.e. warren ripping for rabbits is not permitted in MZ1).

Control of feral animals should be undertaken with consideration of the draft regional strategic pest management plans that are being produced by the NSW Department of Primary Industries (DPI) and in consultation with the Local Land Services for the Central Tablelands.

Control options (DPI 2018) for feral animals are shown in **Table 3.1**.

Table 3.1: Control options for feral animals

Feral animal	Control option
Rabbits and hares	Baiting with 1080 or pindone, biological controls, fumigation, ripping of rabbit warrens, poisons and fumigants.
Foxes	Poison with 1080, shooting, trapping
Pigs	Fencing, 1080 poisoning, ground shooting, trapping
Goats	Fencing, shooting, trapping

3.4 Weed management

Weed management will be carried out using primary and secondary weed control followed by ongoing maintenance. Weed control will include mechanical removal techniques, herbicide application and natural shading techniques. Disturbance of the soil during the weed management process should be minimised at all times (Buchanan 2000, Bradley 2002). Weed control objectives and treatment techniques in accordance with weed type.

Primary Weed Control

Primary weed control is the initial removal of weed species. Mechanical removal techniques relevant to the weed being removed (Buchanan 2000, Bradley 2002) should be used for all woody weeds and herbaceous plants. Herbicide application, should be utilised to reduce the cover of exotic vines, herbaceous weeds and grasses.

Secondary Weed Control

Secondary weed control involves follow-up weed control to remove seedlings that have emerged after primary control and treatment of any existing plants that reshoot. Any new weed infestation areas identified must also be treated.

Maintenance

Maintenance is the long-term management of a site to prevent weeds from becoming re-established after primary and secondary work. Substantial effort should be focussed on reducing the weed seed bank, eradicating problematic weeds and supporting the growth of native vegetation. Areas with a higher proportion of native species should be the focus of intensive maintenance works, which will include fine hand weeding. A structured maintenance regime following primary and secondary work will reduce the time taken for the site to reach a reasonable level of stability.

Weed Disposal

All seeding herbaceous/grass material and tubers should be bagged, removed from site and disposed of at a licenced green waste facility. Woody weeds should be removed offsite. However, in some instances small piles of woody weeds may utilised as fauna habitat, so long as they do not provide sources of propagules or encourage the further spread or establishment of other weeds.

3.4.1 Management Zone 1

Primary works should include mechanical removal of *Crataegus monogyna* (Hawthorn) and *Pinus radiata* (Monterey Pine) and spot spraying of common herbaceous weeds such as *Senecio madagascariensis* (Fireweed) and *E. plantagineum* (Paterson's Curse) as well as less common weeds such as *Onopordum acanthium* (Scotch Thistle).

Primary works for *Rubus fruticosus* spp. agg. (Blackberry) should include control with herbicides according to the Blackberry Control Manual (DPIWMU 2009). Primary works for *Cytisus scoparius* (Scotch Broom) should include hand grubbing, as it is a woody weed and not common and so this should be feasible from a cost perspective.

Given the location and nature of the site, there is potential for *Nassella trichotoma* (Serrated Tussock) to occur, which is a WoNS. Surveys should be undertaken in appropriate seasons and primary control methods should include chipping for isolated plants and herbicide application for larger clumps.

Secondary works should include follow up of primary works. Maintenance should be undertaken annually or in accordance with relevant control methods outlined by the DPI. All dead weeds should be bagged and removed from the site and disposed of at a licenced green waste facility.

3.4.2 Management Zone 2

This zone mostly consists of introduced pasture. Primary works should be the same as for Management Zone 1. Addition options for weed management in this zone include grazing.

Surveys for *N. trichotoma* (Serrated Tussock) should be undertaken and controls implemented if it is found to occur on the site in this zone.

3.5 Stock management

This management measure will be undertaken in MZ2, which will also be bounded by fencing. The aim of this measure is to manage stocking rates to avoid destroying pastures, the health of stock and to avoid erosion.

The stocking rates shown below which area recommended by the NSW Department of Primary Industries should be used as a rough guide. The figures assume no supplementary feeding and are subject to the quality and productivity of the pasture (ULSC 2008).

Table 3.2: Planting density table for revegetation works.

Stock	Introduced pasture
Sheep	8 per ha
Cattle	1 per 2 ha
Horses	1 per 2 ha
Alpacas	5 per ha
Goats	8 per ha
Camels	1 per 2 ha

At least 70 percent vegetation cover should be maintained to avoid erosion and degradation. If feed is scarce any trees should be fenced so that stock do not ringbark them.

3.6 Prohibition of firewood collection

The collection of firewood is prohibited in both MZ1 and MZ2. This will ensure the maintenance of habitat for flora and fauna within both zones, which will contribute to the protection of conservation values of the site.

3.7 Regeneration of TSGGW

Natural regeneration will occur in the protected and fenced off areas of TSGGW. However, if the species richness and abundance does not increase over time supplementary planting should be done using locally indigenous species of the community.

Seed collection

Seed collection will be required to ensure indigenous species are available for revegetation works. Species identified for revegetation are outlined in **Appendix A**. All plantings should be of local provenance, collected from nearby patches of vegetation to increase genetic variability. Seed collection zones can extend within a radius of 3 km for groundcover, shrubs and trees and up to 10 km for grasses. The collection site should reflect the natural conditions that existed for the area being regenerated.

Record keeping of seed collection and planting locations is to follow the Flora Bank guidelines (Mortlock 2000) and the bush regeneration contractor is responsible for recording this information. A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works.

Planting densities and species can be identified once the need for supplementary planting is clear.

3.8 Connectivity of TSGGW

The TSGGW should be fenced to ensure that it does not degrade and maintains connection to Crookwell River. Management zones have been identified with this in mind and connections are maintained with bushland and the river to the northwest.

3.9 Protection of Black Gum

MZ1 contains all recorded *E. aggregata* on the site and this zone will be fenced. This will prevent adverse impacts from stock grazing or trampling.

The control and management of weeds within MZ1 will also help protect the life cycle of this species and encourage natural regeneration. Natural regeneration and/or plantings within MZ1 will also be undertaken if necessary, which will help maintain the ecological community in which this species occurs.

3.10 Maintenance

The maintenance phase should commence following one year of primary and secondary works and continue in perpetuity. Regular inspections of site condition should be conducted, including general site monitoring for potential new infestation areas and subsequent weed control of any identified weed species. Inspections and site monitoring must occur every 3 months during winter and autumn and every 1-month during summer and spring. This schedule could be revised depending on performance criteria recorded.

Weed maintenance works will include:

- Regular spot spraying of priority weeds and WoNS in MZ1 and MZ2
- Regular spot spraying of exotic grasses and herbaceous weeds through MZ1 and MZ2
- Treatment of exotic grasses and herbaceous weeds prior to seeding, where possible

If necessary, re-vegetation maintenance works will include:

- Watering during dry periods
- Augmenting past planting areas where attenuation has occurred
- Maintenance and replacement of plant guards, where necessary

4. Performance criteria and monitoring

4.1 Performance criteria

The progress and compliance with the BMP should be monitored and reviewed annually. This process will involve the bush regeneration contractor and land owner. The performance criteria listed in **Table 4.1** are considered to be best practice and are not linked with any specific legislation. The bush regeneration contractor, in consultation with Upper Lachlan Shire Council can adapt these criteria as required in response to the success of regeneration works. Based on the success of the management works, further performance criteria may need to be developed for the maintenance phase.

Table 4.1: Revegetation performance monitoring criteria.

Treatment Zones	Year 1	Year 2	Year 3	Year 4	Year 5
All Zones	Commencement of all tasks outlined in the BMP or evidence of planning for their implementation.				
	A demonstrated increase in native cover and diversity and a demonstrated decrease in exotic species cover and diversity by the end of the 3rd year.				
	A minimum of 90% survival rate of all revegetation.				
	A visible improvement of soil stability.				
	An 80% reduction in *Rubus fruticosus* spp. agg.* cover.	An 80-95% reduction in *Rubus fruticosus* spp. agg.* cover.	*Rubus fruticosus* spp. agg. maintained at <5% cover.	*Rubus fruticosus* spp. agg. maintained at <5% cover.	*Rubus fruticosus* spp. agg. maintained at <5% cover.
	A 50% reduction in herbaceous weeds and exotic grass cover.	A 50-70% reduction in herbaceous weeds and exotic grass cover.	A 70-90% reduction in herbaceous weeds and exotic grass cover.	Herbaceous weeds and exotic grasses maintained at <5% cover.	Herbaceous weeds and exotic grasses maintained at <5% cover.
	An 80% reduction in woody weed cover.	Woody weeds retained at low levels (<5% cover).	Woody weeds retained at low levels (<5% cover).	Woody weeds retained at low levels (<5% cover).	No woody weeds >10 cm in height remaining, with low cover (<5%) and abundance throughout the site.

4.2 Monitoring reports

The bush regeneration contractor and the land owner will monitor the vegetation for changes over time. The objective of the monitoring and reporting program is to record changes to the vegetation as a result of vegetation management works. Monitoring works will require liaison with the land owner, the bush regeneration contractor and Upper Lachlan Shire Council.

Monthly monitoring and reporting must be documented and compiled into an annual report to determine the effectiveness of the works undertaken. Site conditions should be recorded on the work plan template at the beginning and end of on-ground works. This data should be included in the annual report. Monitoring photo points should be established at three permanent reference points.

An example report is detailed in **Table 4.2**, and the report should include:

- Works carried out, including weed species targeted and their location
- An approximation of the time spent on each task
- Any observations, such as the occurrence of new weed species
- Rates of regeneration of native species
- A description of any problems encountered and how they were overcome
- A summary of how the site-specific objectives have been met (or not)
- Herbicide and other chemicals used, including quantity, dilution rate and other relevant information
- Weed control mechanisms used during the period
- Climatic conditions which may have influenced weed germination and growth
- Performance criteria and success
- If required, maps of weed distribution and density.

4.3 Bush regeneration contractors

Suitably qualified and experienced bush regeneration contractors that are members of the Australian Association of Bush Regenerators or fulfil the membership criteria must undertake all vegetation management works. In addition to this, team leaders should hold a Certificate III in Conservation & Land Management or possess equivalent field experience and certification. The contractor should carry out best practice bush regeneration techniques as described by Buchanan (2009).

Table 4.2: Example monitoring report template.

Date			
Name of Contractor:			
Hours worked on site since last monitoring report:			
Site Condition:	Zone		
	Weed cover %		
	Seedling survival %		
	Planting numbers		
	Herbicide used (in Litres)		
	Other		
Describe relevant weed management techniques:			
Describe problems; e.g. weed invasions, damage to planted material, etc.:			
Photographic evidence:			
Planned work before next monitoring report:			

5. References

Bradley, J. (2002) *Bringing back the bush. The Bradley Method of Bush Regeneration*. New Holland Publishers, Sydney.

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Mortlock, W. (2000) The Hawkesbury-Nepean Catchment Management Authority (2000) Florabank Guideline 10: Seed collection ranges for revegetation. http://www.florabank.org.au/ Florabank, Yarralumla, ACT [20 August 2001]

New South Wales Department of Primary Industries (DPI 2018). *Pest control*. http://centraltablelands.lls.nsw.gov.au/biosecurity/pest-control

NSW Department of Primary Industries Weed Management Unit (DPIWMU 2009) *Blackberry Control Manual: Management and control options for blackberry* (*Rubus* spp.) in Australia. Department of Primary Industries, Victoria.

Upper Lachlan Shire Council (ULSC 2008). *The Rural Living Handbook. A guide for rural residential landholders*. Upper Lachlan Shire Council

Appendix A: Planting palette

Tablelands Snow Gum Grassy Woodland

As a guide for planting, this appendix shows a planting palette for the vegetation community Tablelands Snow Gum Grassy Woodland, adapted from the Final Determination for this community. However, as this EEC is very widespread, species chosen for plantings should be similar to what is present the closest healthy remnants of the same EEC.

Scientific Name	Common Name
Tree	
Eucalyptus aggregata	Black Gum
Eucalyptus dalrympleana subsp. *dalrympleana*	Mountain Gum
Eucalyptus dives	Broad-leaved Peppermint
Eucalyptus ovata	Swamp Gum
Eucalyptus pauciflora	Snow Gum
Eucalyptus radiata	Narrow-leaved Peppermint
Eucalyptus rubida	Candlebark
Eucalyptus stellulata	Black Sallee
Eucalyptus viminalis	Ribbon Gum
Shrub	
Acacia dealbata	Silver Wattle
Acacia melanoxylon	Blackwood
Hymenanthera dentata (now *Melyctis dentatus*)	Tree Violet
Leptospermum myrtifolium	Myrtle Tea-tree
Melichrus urceolatus	Urn-heath
Grasses, sedges and rushes	
Anthosachne scabra (syn *Elymus scaber*)	Wheatgrass
Aristida ramosa	Purple Wiregrass
Austrostipa bigeniculata	-
Austrostipa blackii	-
Austrostipa densiflora	-
Austrostipa scabra subsp. *falcata*	-
Bothriochloa macra	Red Grass
Carex appressa	Tall Sedge
Carex inversa	-
Chrysocephalum apiculatum	Common Everlasting
Dichelachne crinita	Longhair Plumegrass
Dichelachne micrantha	Shorthair plumegrass
Juncus australis	-
Juncus filicaulis	-
Juncus subsecundus	-

Scientific Name	Common Name
Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush
Microlaena stipoides	Weeping Grass
Poa labillardierei	Tussock
Poa meionectes	-
Poa sieberiana	-
Rytidosperma duttonianum (syn *Austrodanthonia duttoniana*)	-
Rytidosperma laeve (syn *Austrodanthonia laevis*)	-
Rytidosperma penicillatum (syn Austrodanthonia penicillata)	Slender Wallaby Grass
Rytidosperma pilosum (syn *Austrodanthonia pilosa*)	Smooth-flower Wallaby Grass
Schoenus apogon	Common Bog-rush
Themeda triandra (syn *Themeda australis*)	Kangaroo Grass
Groundcover species and vines/scramblers	
Acaena echinata	-
Acaena novae-zelandiae	Bidgee-widgee
Acaena ovina	-
Asperula conferta	Common Woodruff
Asperula scoparia	Prickly Woodruff
Convolvulus angustissimus	-
Desmodium varians	Slender Tick-trefoil
Dichondra repens	Kidney Weed
Epilobium billardiereanum	-
Geranium solanderi	Native Geranium
Gonocarpus tetragynus	-
Haloragis heterophylla	Rough Raspwort
Hydrocotyle laxiflora	Stinking Pennywort
Hypericum gramineum	Small St John's Work
Leptorhynchos squamatus	-
Plantago varia	-
Scleranthus biflorus	Knawel
Solenogyne gunnii	-