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BUILDING OUR FUTURE

The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park

Submissions and Preferred Infrastructure Report Volume 2: Appendices

Roads and Maritime Services | December, 2017



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Appendix C

Technical Memorandum: Biodiversity

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Date 26 October 2017
From Lukas Clews
Subject **TECHNICAL MEMO – Biodiversity**

1 Project description

Roads and Maritime Services (Roads and Maritime) propose to upgrade 16 km of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park (the project).

The project generally comprises the following key features:

- A six-lane divided road between Mersey Road, Bringelly and Bradley Street, Glenmore Park (two general traffic lanes and a kerbside bus lane in each direction). A wide central median would allow for an additional travel lane in each direction in the future, if required
- An eight-lane divided road between Bradley Street, Glenmore Park and just south of Glenmore Parkway, Glenmore Park (three general traffic lanes and a kerbside bus lane in each direction separated by a central median)
- About eight kilometres of new road between Mersey Road, Bringelly and just south of the existing Elizabeth Drive, Luddenham to realign the section of The Northern Road that currently runs through the Western Sydney Airport site
- About eight kilometres of upgraded and widened road between the existing Elizabeth Drive, Luddenham and just south of Glenmore Parkway, Glenmore Park
- Access to the Luddenham town centre from north of the realigned The Northern Road and the existing The Northern Road
- Twin bridges over Adams Road, Luddenham
- Four new traffic light intersections and new traffic lights at existing intersections
- Local road changes and upgrades to current access arrangements for businesses and private properties
- A new shared path for pedestrians and cyclists on the western side of The Northern Road and footpaths on the eastern side of The Northern Road where required.

A detailed description of the project, including design refinements since exhibition of the EIS is provided in Chapter 5 of the Submissions and Preferred Infrastructure Report for the project.

2 Purpose and background

The Environmental Impact Statement (EIS) for the project was publicly displayed for information and comment between 21 June and 2 August 2017. The EIS considered a range of environmental, social and planning issues and nominated a number of measures to mitigate or manage these potential impacts.

In accordance with section 115Z(6) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), Roads and Maritime is required to prepare a Submissions and Preferred Infrastructure Report to respond to any issues or questions raised by stakeholders and the community received during the EIS exhibition. The Submissions and Preferred Infrastructure Report also describes any refinements to the project's design and outlines revised environmental management measures identified in response to any changes and the submissions received. The Submissions and Preferred Infrastructure Report, including this Memorandum, will also inform the Final EIS to be prepared for the project in accordance with Part 8 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), to be finalised based on the submissions received during exhibition.

The purpose of this Memorandum is to provide additional information to the Biodiversity Assessment Report (BAR) that was prepared for the project (Appendix I of the EIS), taking into consideration design refinements made during the detailed design phase (refer to Section 3) and issues raised by stakeholders and the community during the EIS exhibition (refer to Section 4).

This Memorandum should be read in conjunction with the EIS, Submissions and Preferred Infrastructure Report and any subsequent post-determination documentation. Details on design refinements are explained in the following sections.

3 Environmental assessment of design refinements

There have been a number of design refinements during detailed design of the project, as outlined in Chapter 5 of the Submissions and Preferred Infrastructure Report. These design refinements have resulted in changes to the construction and operational footprints which have affected the calculated direct impacts of the project as assessed within the Biodiversity Assessment Report (BAR) and subsequently presented within the environmental impact statement (EIS).

This section provides a revised assessment of the impacts under the Framework for Biodiversity Assessment (FBA) including recalculation of landscape values, impacts to native vegetation (including threatened ecological communities), impacts to threatened species, and impacts to Matters of National Environmental Significance (MNES), including impacts to the environment of commonwealth land.

The structure and methodology of this assessment is therefore similar to that presented within the BAR, with a focus on biodiversity values and impacts that have changed as a result of the design refinements since exhibition of the EIS.

3.1 Landscape values

As the project is a road upgrade, it is a linear shaped development and landscape value must be assessed according to Appendix 5 of the FBA (Assessing landscape value for linear shaped developments, or multiple fragmentation impacts). Alteration to the proposed construction footprint has resulted in the need for recalculation of landscape value components applicable to linear shaped developments including:

- Percent extent of native vegetation cover in the landscape
- Area to perimeter ratio.

The connectivity value and patch size calculations remain valid with the design change and no recalculation was required.

The revised percent extent of native vegetation cover in the landscape and area to perimeter ratio calculations were undertaken using ESRI ArcGIS software. To undertake the revised assessment of landscape values, a 550 metre buffer was established from the outside edge of the revised construction footprint. While this is a linear road project there are some detached construction compounds which made using a buffer from the centreline problematic. This increased the size of the landscape assessment from the BAR which assessed from the centreline.

3.1.1 Percent native vegetation cover

Once the native vegetation cover was digitised, the extent of native vegetation in the landscape before and after the development was recalculated based on the revised construction footprint (see Table 3.1). The 550 metre landscape buffer is 2,659.65 hectares in size. Current percent native vegetation cover is estimated at 12.26 per cent (score 2.5 as outlined in Table 16 of Appendix 5 of the FBA). After the development, percent native vegetation cover is estimated at 11.13 per cent (rounded to 11 per cent - score 2.5 as outlined in Table 16 of Appendix 5 of the FBA). The score for percent native vegetation cover is 0 as no change in category is predicted. The score in the BAR prepared for the EIS was calculated at 1.25.

Table 3.1 : Percent native vegetation cover in the landscape before and after development

Assessment buffer	Before development		After development		Score for % native vegetation cover in the development footprint buffer
	Native vegetation cover (ha)	Cover (%) (score 2.5)	Native vegetation cover (ha)	Cover (%) (score 2.5)	
2,659.65 ha (550m from the edge of the construction footprint)	326.51	12.26 (score 2.5)	284.83	11.13 (score 2.5)	0

3.1.2 Area to perimeter ratio

For a major project that is a linear shaped development or multiple fragmentation development, the change in area to perimeter ratio of patches impacted must be assessed. This has been recalculated based on the revised construction footprint.

The total area (square metres) and perimeter (metres) of vegetation patches impacted by the development within the 550 metre buffer is outlined in Table 3.2. The area to perimeter ratio before the development is 24 (previously 22) and after development is 21. The proportional change in area to perimeter ratio as calculated by the credit calculator is 12.5 (previously 4.5) and the score for the proportional change in area to perimeter ratio is 2 according to Table 19 in Appendix 5 of the FBA (see Table 3.2).

This is a change from the EIS design assessed in the BAR in which a score of 1 was calculated, however this is still a relatively small change in area to perimeter ratio and is expected as the vegetation currently has a high area to perimeter ratio (due to many small fragments of vegetation in the landscape) which will not be increased significantly by the project.

Table 3.2 : Area to perimeter ratio of vegetation patches before and after development

Before development			After development			Proportional change	Score
Vegetation area (m ²)	Vegetation perimeter (m)	Area to perimeter ratio (whole number)	Vegetation area (m ²)	Vegetation perimeter (m)	Area to perimeter ratio (whole number)		
462,329.27	19,653.96	24	342,393.32	16,340.50	21	12.5	2

3.1.3 Landscape value score

A summary of the recalculated landscape value assessment is provided here. As noted above, the connectivity value and patch size calculations remain valid with the design change therefore no recalculation was required for these.

The landscape component scores are as follows:

- Percent native vegetation cover = 0 (previously 1.25)
- Connectivity value class = 2.5 (no change from original assessment)
- Area / perimeter ratio score = 2 (previously 1)
- Average patch size score = 12.5 (no change from original assessment).

The landscape value score as determined by the BioBanking credit calculator is 17, similar to that previously assessed in the BAR in which the landscape value score was calculated as 17.25.

3.2 Removal of native vegetation

The revised potential loss of vegetation and habitat associated with the project is summarised in Table 3.3. The construction footprint would impact on up to about 40.79 hectares of native vegetation (see Table 3.3). This is a decrease of 3.50 hectares when compared to the EIS design assessed in the BAR (the original impact to all Vegetation Zones was 44.29 hectares).

These impacts have been quantified based on the development footprint after detailed design and take into consideration potential temporary disturbance during construction including compound sites and upgrading of drainage. This calculation also takes into account the clearing required within the Department of Defence land to provide vehicle access along the Defence Establishment Orchard Hills (DEOH) site inside of the new fence line proposed in some parts of the project, which was not assessed in the BAR.

Based on the detailed design, the overall impact to the critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community has reduced by 2.96 hectares. The impact to the River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions endangered ecological community has been reduced by 0.43 hectares.

Table 3.3 : Impacts to native vegetation from the detailed design footprint

Vegetation zone	PCT	Condition	Status (TSC Act)	Original impact (ha)	Area to be impacted by detailed design (ha)	Change
1	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate/ Good	CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion	6.67	5.38	1.29 ha reduction
2	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate/ Good	EEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	2.53	2.43	0.1 ha reduction
3	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Moderate/ Good	CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion	4.92	4.92	No change

Vegetation zone	PCT	Condition	Status (TSC Act)	Original impact (ha)	Area to be impacted by detailed design (ha)	Change
4*	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate/Good_Poor	CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion	4.68	4.30	0.38 ha reduction
5	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Moderate/Good_Poor	CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion	3.21	3.11	0.1 ha reduction
6	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate/Good_Poor	EEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	1.76	1.43	0.33 ha reduction
7	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Moderate/Good_High	CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion	1.25	1.37	0.12 ha increase
8	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Moderate/Good_Derived grassland	CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion	12.01	10.81	1.2 ha reduction
9	<i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate/Good_Other	-	6.17	6.05	0.12 ha reduction
10	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Moderate/Good_Medium	CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion	1.09	0.98	0.11 ha reduction
Totals				44.29	40.79	3.50 ha reduction

Notes: * = The impacts to Vegetation Zone 4 have been included in Table 3.3 above to provide an overview of all impacts to native vegetation. Due to the manual override of the 'Number of Trees with Hollows' and 'Fallen Logs' for HN 528, Vegetation Zone 4 now has a site score of 29.17 and requires an offset to be calculated.

3.3 Removal of threatened fauna species habitat and habitat features

Of the known habitat for the Cumberland Plain Land Snail within the study area (i.e. vegetation in moderate to good condition including where live snails or shells were found during the field survey as part of the original assessment), the development footprint is predicted to impact on about 12.40 hectares. This is a decrease of 0.60 hectares from the original assessment in the BAR which identified 13 hectares of potential habitat.

The development footprint is predicted to impact on 24.10 hectares of potential habitat for the Regent Honeyeater. This is a decrease of 2.15 hectares from the original assessment in the BAR which identified 26.25 hectares of potential habitat.

The potential impacts to identified species credit fauna species is summarised in Table 3.4. Overall, based on detailed design, the project would have less impact on threatened fauna species habitat and habitat features than that the EIS design assessed in the BAR.

Table 3.4 : Summary of threatened fauna species impacts from the detailed design footprint

Threatened species	Ecosystem or species credit species	Status		Original habitat impact (ha)	Habitat to be impacted by detailed design (ha)	Change
		TSC Act	EPBC Act			
Cumberland Plain Land Snail	Species credit species	Endangered	Not listed	13	12.40	0.60 ha avoided
Regent Honeyeater	Species credit species	Critically endangered	Critically endangered	26.25	24.10	2.15 ha avoided

3.4 Removal of threatened plants

There would be an impact to the following threatened plant species and endangered population:

- *Pultenaea parviflora* (Endangered – TSC Act)
- *Marsdenia viridiflora* subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas (Endangered population – TSC Act).

The predicted impact to *Pultenaea parviflora* and the *Marsdenia viridiflora* subsp. *viridiflora* endangered population are outlined below in Table 3.5.

An additional targeted survey to those undertaken for the BAR were conducted for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* (and other threatened plants) around the Vineyard Road extension on the 7th August 2017. This was to account for the footprint changes at this location. Additionally, as stated in the BAR, this area was not able to be accessed during the fieldwork undertaken for the original assessment therefore additional survey was required at this location following detailed design.

In total an additional area of habitat of approximately 4.7 hectares was surveyed by an experienced botanist following the methods described in the *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage, 2016). Traverses of this habitat were undertaken over a three-hour period for a distance of 3.131 kilometres (3,131 metres) (see Figure 3.1). The survey located a further six *Pultenaea parviflora* plants (two of which were in the design footprint, and four outside of the footprint). No additional *Marsdenia viridiflora* subsp. *viridiflora* were recorded.

The original construction footprint based on the EIS design contained (and therefore would have removed) all known individuals and habitat for the *Marsdenia viridiflora* subsp. *viridiflora* endangered population in the study area. The detailed design has resulted in the avoidance of four *Marsdenia viridiflora* subsp. *viridiflora* plants in the area of the DEOH fence between Kings Hill Road and Longview Road (see Figure 3.2). There is no requirement to impact on the location of these plants and exclusion zones would be established around the plants during construction in accordance with standard Roads and Maritime procedure. This reduces the overall impact to 31 individuals (see Table 3.5).

The original construction footprint would have removed the four known *Pultenaea parviflora* plants within the EIS design footprint as well as the two additional plants recorded in the Vineyard Road extension during the August 2017 survey (six *Pultenaea parviflora* plants in total). The August 2017 survey of the Vineyard Road extension recorded six additional *Pultenaea parviflora* plants of which four are outside of the construction footprint so have been avoided. The impact assessed in the EIS was to four *Pultenaea parviflora* plants because the extent of habitat along Vineyard Road extension was unable to be surveyed at the time. The overall impact to *Pultenaea parviflora* is now estimated at six plants (see Table 3.5).

Table 3.5 : Summary of threatened plant species impacts from the detailed design footprint

Threatened species	Ecosystem or species credit species	Status		Original habitat impact	Individuals to be impacted by detailed design	Change
		TSC Act	EPBC Act			
<i>Pultenaea parviflora</i>	Species credit species	Endangered	Vulnerable	4 individuals	6 individuals	2 additional plants to be impacted 4 plants avoided
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> – endangered population	Species credit species	Endangered population	Not listed	35 individuals	31 individuals	4 individuals avoided



Figure 3-1 | Additional targeted survey for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* undertaken in the Vineyard Road extension

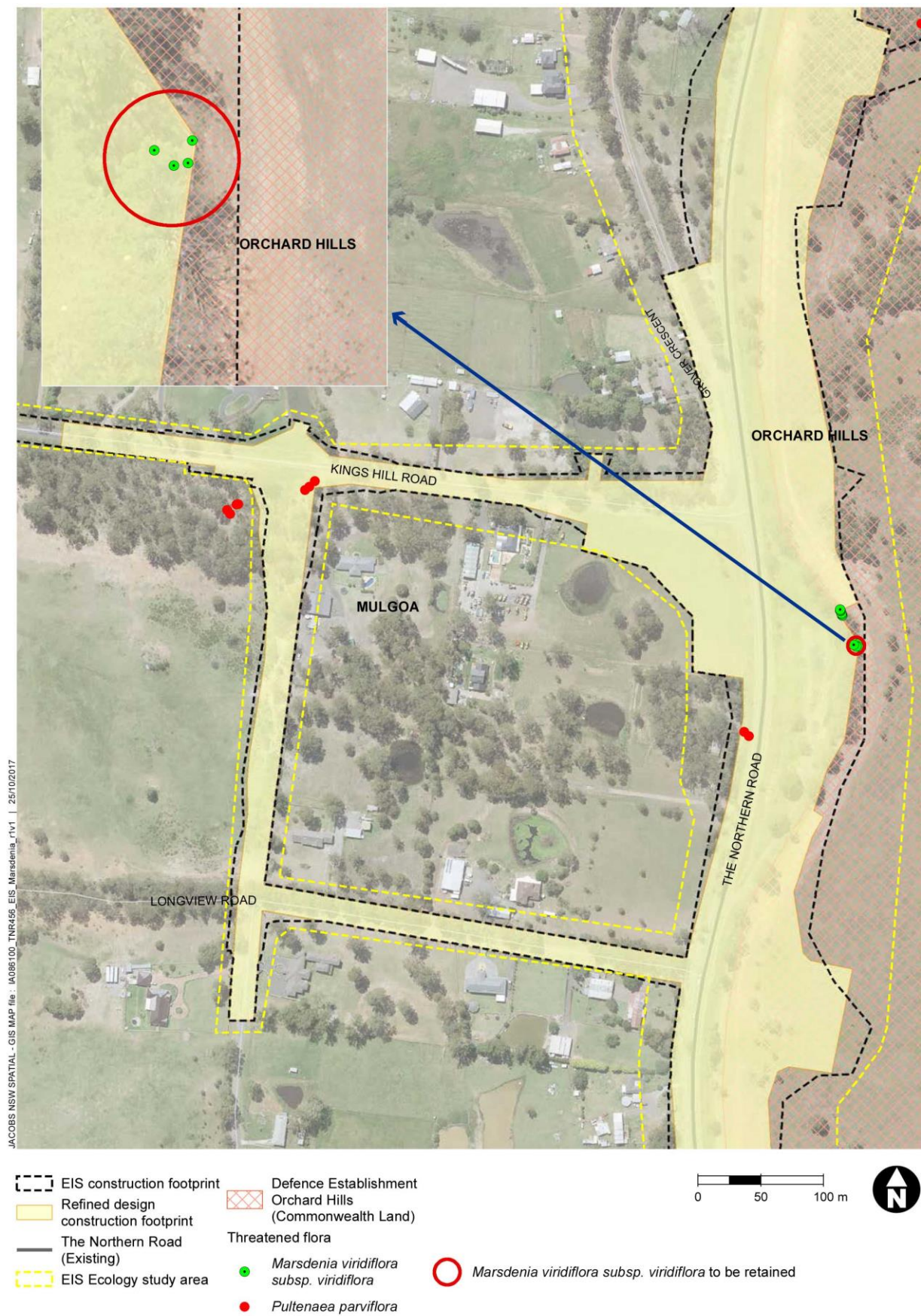


Figure 3-2 | *Marsdenia viridiflora subsp. Viridiflora* to be retained

3.5 Impacts to Matters of National Environmental Significance

3.5.1 Listed ecological communities

The original calculations in the BAR of the extent of direct clearing required to the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community represented a worst case scenario based on the EIS construction footprint. This impact has been reduced at the detailed design phase.

Based on the EIS construction footprint, the project would result in the direct clearing of about 16.37 hectares of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. After detailed design, this impact has been reduced by 1.29 hectares to 15.08 hectares (refer to Table 3.6).

Table 3.6 : Summary of impacts to the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest condition category	Original impact (ha)	Detailed design impact (ha)	Change
Category A (core)	10.69	9.99	0.70 ha reduction
Category C	1.47	1.50	0.03 ha increase
Category C Derived Native Grassland	4.21	3.59	0.62 ha reduction
Total	16.37	15.08	1.29 ha reduction

3.5.2 Listed threatened flora species

The EIS construction footprint would have removed all known *Pultenaea parviflora* plants. The overall impact to *Pultenaea parviflora* is now removal of six plants since the additional plants were found along the Vineyard Road extension. The August 2017 survey of the Vineyard Road extension recorded six additional *Pultenaea parviflora* plants of which four are outside of the construction footprint so would be avoided.

3.5.3 Listed threatened terrestrial fauna species

The original construction footprint was identified as having impacts to habitat for the following threatened species that are listed as threatened under the EPBC Act:

- Grey-headed Flying-fox
- Regent Honeyeater
- Swift Parrot
- Large-eared Pied Bat.

Based on the EIS construction footprint, habitat for these four species was expected to be reduced in extent by about 26.25 hectares due to clearing requirements. Based on detailed design, the extent of this impact would be reduced by 2.15 hectares with a total of 24.10 hectares of foraging habitat expected to be impacted by the project. No breeding habitat would be affected.

3.6 The environment on Commonwealth land (including the Orchard Hills Cumberland Plain Woodland)

An update of the potential impacts to the environment of Commonwealth land as a result of construction and operation of the project is provided in this section as it relates to biodiversity. This includes the DEOH land, and land that has been acquired by the Commonwealth for the purposes of developing the Western Sydney Airport at Badgerys Creek. There would be a decrease in clearing of remnant native vegetation by approximately 0.88 ha (see Table 3.7). This includes a decrease in clearing of the Critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community by 0.8 hectares (see Table 3.7).

Table 3.7 : Revised impacts to vegetation on Commonwealth land

Feature	Original impact	Revised impact after detailed design	Difference
Remnant native vegetation (excluding man-made dams)	13.34 ha	12.46 ha	0.88 ha decrease
Critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community	10.07 ha	9.27 ha	0.80 ha decrease

3.7 Offsetting required

The results of the revised assessment undertaken within the BioBanking credit calculator are presented here. The required ecosystem credits are outlined in Table 3.8.

Table 3.9 outlines the required species credits. The revised credit calculations take into account the amendments to the landscape assessment, altered areas of impact, avoidance of some threatened species impacts, amendment of some benchmark data in the BioBanking credit calculator, and reassignment of the Derived Native Grassland to HN 529. Due to the manual override of the 'Number of Trees with Hollows' and 'Fallen Logs' benchmark values for HN 528 (see section 4.12) this has affected the number of credits generated by the credit calculator (a key change is that Vegetation Zone 4 now has a site score of 29.17 and requires an offset to be calculated). Reassignment of Derived Native Grassland to HN 529 as advised by the OEH (see Section 4.11) has resulted in an altered offset requirement for HN 529 as the Derived Native Grassland PCT is no longer used in the assessment.

Table 3.8 : Ecosystem credits summary

PC type code	Plant community type (PCT)	Original area (ha)	Original credits created	Area (ha)	Credits created
HN526	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	4.29	178.00	3.86	160.54
HN528	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	11.35	307.00	9.68	346.77
HN529	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	10.47	409.66	21.19*	684.68*
HN630	Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	6.17	142.00	6.05	139.00
HN627	Derived grasslands on shale hills of the Cumberland Plain (50-300m asl)	12.01	223.39	-	-
Total		44.29	1,260	40.79	1,331

Notes: * = Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion now includes the impact and credit requirement for Derived grasslands on shale hills of the Cumberland Plain (50-300m asl).

Table 3.9 : Species credits summary

Scientific name	Common name	TS offset multiplier	Original credit requirement	Species credits required
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	1.3	169	161
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	4.0	1,400	1,240
<i>Pultenaea parviflora</i>	Pultenaea parviflora	1.5	60	90
<i>Anthochaera phrygia</i>	Regent Honeyeater	7.7	2,021	1,856

4 Response to issues raised by stakeholders and the community

A number of issues raised by stakeholders and the community during the EIS exhibition related to biodiversity and are addressed in this section of the Memorandum. Where similar issues have been raised in different submissions, only one response has been provided.

The issues raised and the response to these issues forms the basis of this section of the memorandum and would be used to inform the Submissions and Preferred Infrastructure Report for the project.

4.1 General objection to the project

Submission number(s)

7, 12, 25

Issue description

A number of respondents were generally opposed to the project.

The NSW Biodiversity Offsets Policy for Major Projects (BOPMP) provides a standard method for assessing impacts of major projects on biodiversity and determines offsetting requirements. In the State Significant Infrastructure (SSI) application process, the Environmental Impact Statement (EIS) must address the Secretary's Environmental Assessment Requirements (SEARs) requested by Department of Planning and Environment (DPE) and apply the Framework for Biodiversity Assessment (FBA). The FBA adopts the BOPMP and provides an assessment methodology to identify terrestrial biodiversity values, assess impacts and quantify and describe biodiversity offsets required for unavoidable impacts.

This Biodiversity Assessment Report (BAR) was completed in accordance with the requirements specified by the SEARs issued on 28 July 2015, the amended SEARs issued on 9 March 2016 and Commonwealth EIS Guidelines issued on 24 August 2016. Additional assessment in the form of this Memorandum has also been undertaken in accordance with these requirements to assess some of the changes to biodiversity values and impacts as a result of design refinements as outlined in Section 3.

Despite avoidance and mitigation, residual impacts from the clearing of native vegetation and fauna habitat features is acknowledged in the EIS. These impacts have been quantified using the BioBanking Credit Calculator, and will form the basis of offsets for the project. There would be impacts to the following matters which need to be offset via biodiversity credits:

- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (including derived native grasslands)
- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion
- *Pultenaea parviflora*
- *Marsdenia viridiflora* subsp. *viridiflora* - endangered population
- Cumberland Plain Land Snail
- Regent Honeyeater.

Cumberland Plain Woodland is listed as a critically endangered ecological community (CEEC) under the *NSW Threatened Species Conservation Act, 1995* (TSC Act). The project may significantly reduce the viability of this CEEC within the locality and therefore it is considered a matter for further consideration under the FBA. While not recorded during the surveys, there is also likely to be impacts to potential habitat for the critically endangered Regent Honeyeater. As such, this species is also considered a matter for further consideration.

The project is likely to result in a range of impacts to biodiversity which are not covered under the FBA including impacts to the aquatic environment, changes to hydrology, habitat fragmentation, edge effects, injury and mortality of fauna (including indirect impacts associated with vehicle strike), invasion and establishment of weeds, potential for invasion and spread of pathogens and disease, noise, vibration, dust, light and contaminant pollution, and a range of cumulative impacts to vegetation and associated species within the Cumberland Plain region.

Some of the higher quality patches of Cumberland Plain Woodland meet the description of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest CEEC listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The plant species *Pultenaea parviflora* is also listed as vulnerable under the EPBC Act. Other Matters of National Environmental Significance that may be impacted by the project include habitat for the listed Regent Honeyeater, Swift Parrot, Grey-headed Flying-fox and Large-eared Pied Bat. As such, the project has been identified as a controlled action under the EPBC Act due to predicted significant impacts to listed threatened species and ecological communities and Commonwealth land. The controlled action is considered by the Department of the Environment and Energy (DoEE), likely to have a significant impact on the following EPBC Act listed threatened species and ecological communities:

- Critically endangered – Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Cumberland Plain Woodlands)
- Critically endangered – *Lathamus discolor* (Swift Parrot)
- Critically endangered – *Anthochaera phrygia* (Regent Honeyeater)
- Vulnerable – *Pultenaea parviflora*
- Vulnerable – *Pteropus poliocephalus* (Grey-headed Flying-fox).

A Biodiversity Offset Strategy (BOS) has been prepared for the project. The project offsets will aim to provide 'like for like' offsets for all biodiversity values, with this being the minimum requirement for those matters listed under the EPBC Act. The final offset requirement for the Project would be determined during development of the offset package.

4.2 Offsetting

Submission number(s)

27

Issue description

The respondents raised the following issues:

- Concern regarding the offsetting of Conservation Lands located on the DEOH site
- Requests that Roads and Maritime provide the respondent transparency of the offset process
- Concern regarding the ineffectiveness of BioBanking to offset the losses of critically endangered vegetation communities in Western Sydney
- There are insufficient offsets available to supply the offset needs for current development
- Requests that Roads and Maritime procure land to be managed for conservation

The BOS outlines the offsets required for unavoidable (residual) biodiversity impacts associated with the project and demonstrates that appropriate offsets are available and can be delivered for the project. Roads and Maritime are currently working in consultation with OEH to determine the quantum of offsets or supplementary measures that are required for the project. The preferred approach to securing offsets for the project is to purchase credits from the market. Where credits are unavailable for purchase on the market, Roads and Maritime would work with public and private landholders to enter a BioBanking Agreement on their land and then buy the credits issued.

Supplementary measures at a landscape scale are also being investigated in conjunction with the OEH. The final offset requirement for the Project would be determined during development of the offset package in consultation with the OEH. Following discussions with Roads and Maritime, DoEE and OEH, it was decided that an additional supplementary measures package would be developed in consultation with OEH and DoEE with a focus on landscape scale measures within the local area. The package may include measures such as weed eradication programs within Cumberland Plain Woodland.

Refer also to Section 4.22 regarding additional offsets for impact to Cumberland Plain Woodland and Section 4.23 regarding measures to secure offsets.

4.3 Dewatering and backfilling of dams and relocation of aquatic species

Submission number(s)

1, 3, 4, 5, 16, 19, 38

Issue description

The respondents raised the following issues:

- Concern regarding impacts to fauna, such as turtles, in dams near the project
- Request that the project include measures to protect and manage fauna, including capture and relocation of fauna by an appropriately qualified person prior to farm dam dewatering
- Non-native fish species should not be relocated.

The construction and operation of the project has the potential to impact aquatic ecosystems due to changes in water quality, hydrology, habitat loss and instream barriers. Many of the watercourses in the study area are artificial dams, situated in minor gullies which are either first or second order streams, and as such are not considered key fish habitat. Threatened species are unlikely to be present within these dams, however there is a possibility that native and invasive fish species have colonised these dams as well as freshwater turtles and eels. Should dams or creeks be dewatered during the construction of the project, then aquatic fauna will need to be relocated in to a similar aquatic environment to which it was found by trained aquatic ecologists under a Fisheries Permit issued by DPI.

The dewatering of farm dams would be undertaken in accordance with the relevant procedures to be outlined in the construction environmental management plan (CEMP) and relevant sub plans (e.g. the flora and fauna management plan, the soil and water management plan). This would include the management and re-location of Eastern long neck turtles and other aquatic species. All fish and aquatic fauna works will require a Fisheries Permit issued by the NSW Department of Primary Industries (DPI) under Section 37 of the FM Act. Any native fish or aquatic fauna (including turtles) present would be relocated into a similar aquatic environment to which it was found by trained aquatic ecologists.

The selection of relocation sites would be conducted in consultation with DPI Fisheries upon permit application, and will consider permanence of water, any upstream disturbances, habitat, water quality conditions. Fish and other aquatic fauna should be relocated into a waterway with similar water quality and habitat characteristics to minimise stress. Where possible the relocation site would be within the same sub-catchment to avoid the inadvertent dispersal of fauna into unsuitable habitat.

During relocation, fish would be relocated into aerated transportation tubs. Tubs would be located in the shade during capture and transportation to avoid sudden changes in temperature. Frogs, turtles, fish and eels would be treated in a similar manner, however different fauna should not be transported within the same tub to prevent injury or consumption of smaller fauna. Turtles and frogs should be damp, but not submerged in water. Fish and other aquatic fauna would be transported to the recipient site as quickly as practical. Any invasive species would be euthanised in accordance with animal care and ethics permits requirements. Accurate records of species released or euthanised (in the case of exotic species) would be recorded and provided to NSW DPI upon completion.

The EIS includes an existing mitigation measure for the development of a farm dam dewatering plan (SWC-1), this measure would be revised as follows and incorporated into the revised environmental management measures for the project (refer to Section 5):

A farm dam dewatering plan would be prepared which includes:

- A map showing locations of farm dams to be dewatered and the selected relocation sites
- Fisheries Permit and Animal Care and Ethics requirements
- Methodology for the capture, storage, relocation, release of fish and other aquatic fauna
- Euthanisation procedure (as required)
- Location of any offsite discharge points and measures to manage encounters of poor water quality.

4.4 Wildlife corridors and habitat connectivity

4.4.1 Impacts to wildlife corridors and habitat connectivity

Submission number(s)

7, 11, 17, 18, 25, 27, 29

Issue description

The respondents also raised the following issues:

- Concern regarding the impact of the project on wildlife corridors and habitat connectivity
- The EIS does not accurately assess existing wildlife permeability along The Northern Road
- Construction of the bike track to Mulgoa Nature Reserve would impact wildlife connectivity
- No bike trails should be installed through or across the Surveyors Creek Corridor
- The importance of the Glenmore Park Biodiversity Corridor is not fully assessed in the EIS
- Concern regarding impacts of the project on the Flame Robin, Rose Robin and Eastern Grey Kangaroos
- Specific assessment should be made of potential barriers to the annual migration of the Flame Robin and Scarlet Robin over The Northern Road, especially to known habitat in DEOH

Due to the linear nature of the project, it will result in fragmentation of habitats. Habitat fragmentation is considered an important impact of the project and fragmentation impacts and the impact of barriers are discussed in the EIS. The EIS acknowledges fully that there would be localised fragmentation of local wildlife corridors between the existing Northern Road and Willowdene Avenue where some intact habitat patches would be broken apart. The hard barrier introduced by the project would restrict fauna movement. The widening of the existing Northern Road in the north of the study area would further exacerbate the existing barrier effects of this roadway where it bisects Regional Corridor 17 as identified in the OEH BIOMAP.

The EIS acknowledges the existing habitat connectivity within the landscape. Connectivity value has been assessed in accordance with Appendix 5 of the FBA. The connecting links have been identified and a connectivity value score was assigned. The EIS indicates that the project will impact on local area biodiversity links (as defined under the FBA). Several local area biodiversity links have been identified (see Figure 2.3 of the Biodiversity Assessment Report). The EIS acknowledges that the existing Northern Road is a single carriage (two lanes) road and is therefore not considered a barrier of a size that would sever a connecting link. As such, the connecting links identified in the EIS cross the existing Northern Road. The existing Northern Road does however contribute to a considerable reduction in local connectivity when compared to areas without existing roadways (the links are not severed but are highly modified). The Northern Road is a heavily used roadway and significant barrier effects are currently present. The fence along the edge of the Defence Establishment Orchard Hills does increase the barrier effect provided by the existing Northern Road in this area. In this location, dispersal of fauna is currently limited but is not entirely prevented.

The EIS acknowledges that habitat connectivity would be altered during and after construction. There may be declines in population density and/or species richness within the remaining vegetation patches as a result of the project. There may also be an alteration to community composition, altered species interactions, and altered or ecosystem functioning in the locality due to the action. Due to the importance of connectivity, dispersal opportunities and habitat quality, for species at a local scale the project is considered likely to be detrimental to the dispersal of relatively sedentary species such as mammals, frogs, and reptiles. Local division of some wildlife populations, isolation of key habitat resources, loss of genetic interchange, and loss of population viability may result from the fragmentation caused by the project.

The impacts of altered connectivity on fauna species, including Eastern Grey Kangaroos and east-west obligatory migrant species such as the Flame Robin and Scarlet Robin, have been assessed according to the assessment process outlined in the FBA. The Flame Robin and Scarlet Robin are Ecosystem Credit species and direct impacts to these species, along with common species including the Eastern Grey Kangaroo, have been assessed in conjunction with general biodiversity values as they have been assessed as being at least moderately likely to be present in the habitats that would be impacted. Suitable habitat for these species is present and this is identified in the Biodiversity Assessment Report. As with other fauna species, east-west obligatory migrant species such as the Flame Robin and Scarlet Robin would be detrimentally impacted by habitat fragmentation, as would macropods such as the Eastern Grey Kangaroo.

It is noted that the scope of the project does not include any separated bike trails that would impact on the corridor, the proposed shared path is immediately adjacent to the road corridor along the length of the upgrade. There are no plans for bike baths beyond this shared path.

4.4.2 Connectivity measures

Submission number(s)

11, 12, 17, 18, 21, 25, 27, 29, 38

Issue description

A number of respondents suggested additional fauna crossings, underpasses and other connectivity measures be included in the design.

Other issues raised include:

- Further consideration of the u-turn facility in Kings Hill Road and whether this has potential to reduce the fragmentation of a potential west-east biodiversity corridor
- The height of the proposed fauna underpass (1.5 metres) is not suitable for Eastern Grey Kangaroos
- Services should be routed to avoid interfering with Surveyors Creek Corridor and its future restoration on both eastern and western (DEOH) sides
- Insufficient consultation regarding a suitable solution for the safe movement of fauna in the vicinity of the Defence Establishment Orchard Hills.

The proposed design at Kings Hill Road includes a roundabout which would provide a u-turn facility for motorists. The proposed design in this area also includes a link road between Kings Hill Road and Longview Road. The intersection of Longview Road and The Northern Road would be left-in and left-out only and therefore the link road is required to ensure motorists travelling south on the Northern Road can access Longview Road. The connectivity value of the vegetation and the impact of the proposed design on fragmentation of this area has been assessed in BAR.

Connectivity measures are being considered during detailed design in accordance with the Wildlife Connectivity Guidelines for Road Projects (currently in preparation). In particular, maintenance of current connectivity and potential future connectivity has been considered in culvert design, lighting and fencing.

Connectivity between the Mulgoa Nature Reserve and the DEOH via Regional Corridor 17 (Surveyors Creek Corridor) would be planned for in the future with construction of a fauna crossing to allow for future connectivity to the DEOH land. The proposed fauna crossing is a 2.4-metre-tall dry passage underpass (see Figure 4.1). This would be suitable for larger species such as the Eastern Grey Kangaroo based on monitoring results from Pacific Highway projects. The culvert would lead from the Surveyors Creek corridor under the road and will exit at the new DEOH fencing within the road reserve. For DEOH security reasons and traffic safety, the underpass would be blocked onto DEOH land until the DEOH fencing is removed in the future. This is to prevent the public from gaining unauthorised access to the DEOH land through the underpass and to prevent animals from exiting the culvert onto the roadway. Fauna exclusion fencing would be provided either side of the crossing in accordance with Roads and Maritime standards.

Fauna passage would also be provided at Badgery's Creek with the construction of a fauna friendly drainage culvert of similar internal dimensions to the Surveyors Creek / DEOH culvert (see Figure 4.2).

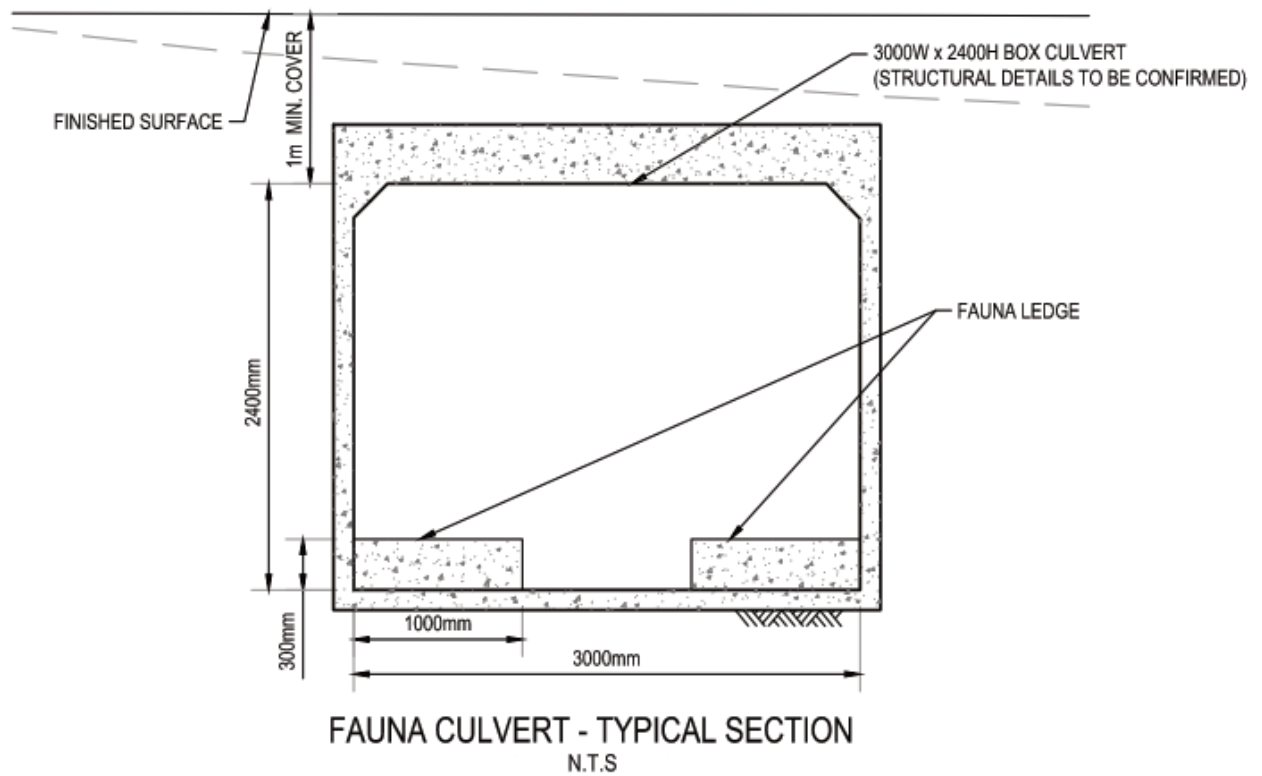


Figure 4.1 : Cross section of the proposed culvert at Surveyors Creek

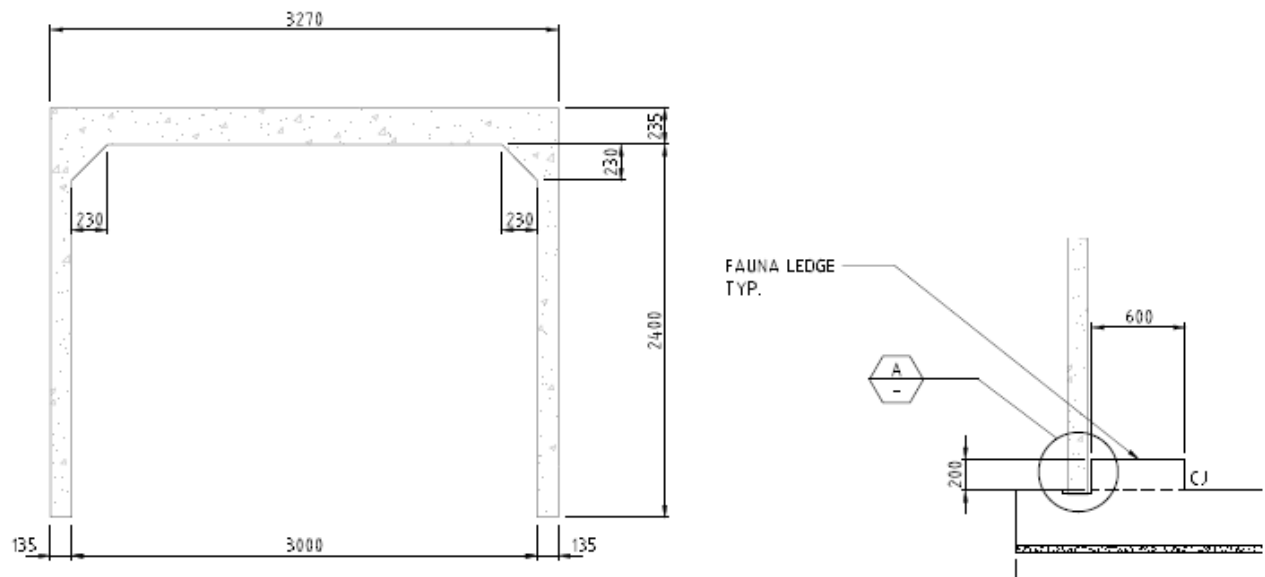


Figure 4.2 : Cross section of the proposed culvert at Badgery's Creek

4.4.3 Fencing of DEOH land

Submission number(s)

11

Issue description

Physical barriers more than two metres high should not be located along the DEOH boundary.

There is a particular fencing specification required for the DEOH boundary. A Class 2 chain link perimeter fence is required to be installed to delineate the base boundary, as it is adjacent to a public road. This fence would be a galvanised, rail-less chain wire security fence and gates 2.4 metres high, topped with at least three strands of barbed (or similar) wire to a total height of 3 metres (see Figure 4.3). The mesh size of the fence would be approximately 50mm x 50mm. The fence would be kept clear of trees and other vegetation to a distance of 5 metres. This fence will continue the current level of fragmentation in the landscape until it is removed in the future.

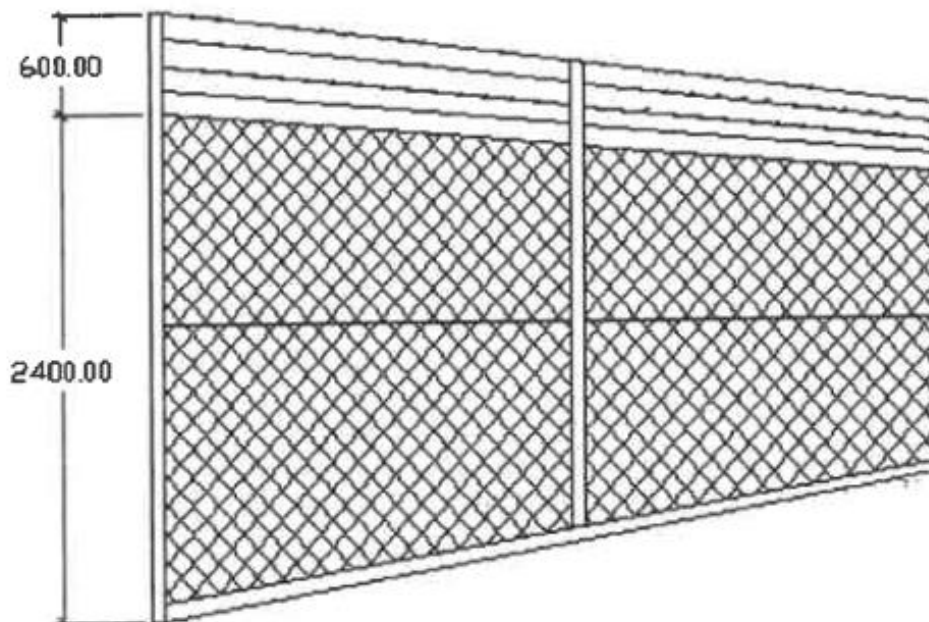


Figure 4.3 : Example of the perimeter fence along the DEOH boundary, with chainmesh and barbed wire

4.5 Large remnant trees

4.5.1 Impacts to large remnant trees

Submission number(s)

11, 12, 16, 17, 18, 21, 25, 29

Issue description

The respondents raised the following issues:

- Concern regarding impacts to large remnant trees, including hollow-bearing trees
- Concern regarding impacts to important trees, particularly *Eucalyptus molucanna*
- Requests that the project retain as many mature trees as possible, in particular two old-growth remnant trees or example near the Orchard Hills roundabout
- Loss of habitat has not been adequately assessed or quantified in the EIS. The EIS must identify the number of tree hollows that will be impacted. Noted that several habitat trees are located within the road shoulder or median strip and can be retained rather than removed.

The EIS recognises the loss of hollow-bearing trees as a long term impact that will affect local fauna populations. The number of hollow-bearing trees was counted at each plot/transect location within the study area and this data forms a component of the assessment of ecosystem composition and function under the FBA. The impact to hollow-bearing trees is offset as part of the ecosystem credit requirement for the project.

Some large remnant hollow-bearing trees, including the trees located near the truck inspection bay at Orchard Hills would be removed by the project. The safe retention of these trees within the median is not a viable option due to road safety, line of sight and other engineering purposes. Additionally, the wide central median has been included in the design to allow for future road capacity upgrades, therefore these trees would likely be subject to removal in the future, regardless of whether or not they could be retained in the current design.

4.5.2 Large tree removal process

Submission number(s)

16

Issue description

Concern regarding impacts to fauna during the tree removal process.

The EIS includes a mitigation measure for a two staged clearing process (B-3), which the contractor would be required to incorporate into the flora and fauna management plan (FFMP) to be developed for the project and implemented during construction. This has been updated to include additional detail and would be included as part of the revised environmental management measures for the project (refer to Section 5 of this Memorandum):

A staged habitat removal process is to be used when hollow-bearing trees are to be removed as follows:

- Make contact with vets and wildlife carers before works start to ensure they are willing to assist treating injured animals if necessary.
- An experienced and licensed wildlife carer and/or ecologist will be present on site during all habitat removal activities to capture and relocate fauna that may be encountered.

- Progressive habitat removal will take place around habitat identified and marked during the pre-clearing process. Remove non-hollow-bearing trees, undergrowth, feed-trees, regrowth and grass. Do not fell trees towards exclusion zones.
- Identified habitat (e.g. hollow-bearing trees) will be left for at least 24 hours after removing non-habitat vegetation to allow fauna to escape. A licensed wildlife carer and/or ecologist will check hollow-bearing trees are not being used by fauna before felling. If necessary, fauna may need to be trapped and relocated to pre-determined habitat identified for fauna release.
- Fell habitat trees as carefully as possible to avoid injury to any fauna still remaining in trees. Use equipment that would allow the habitat trees to be lowered to the ground with minimal impact (e.g. claw extension). Do not fell trees towards exclusion zones.
- An experienced and licensed wildlife carer and/or ecologist will inspect habitat once it is removed e.g. after a tree is felled. Animals that emerge should be captured, inspected for injury then relocated to pre-determined habitat identified for fauna release.
- All hollows have the potential to support fauna and will be placed in adjacent habitat until the following day for further inspection by a licensed wildlife carer and/or ecologist to verify no fauna is present. If possible, the hollows could be permanently relocated in adjacent areas. Inspect woody debris for fauna immediately before chipping to avoid injury or death to fauna that may be present.
- The project manager and/or environment manager should ensure that the outcomes of the clearing process are recorded. Reporting is usually the responsibility of an ecologist or environment officer. Reports are to be submitted to relevant personnel e.g. environment manager or Roads and Maritime regional environmental staff.
- Consider the seasonal impact of clearing on species identified in the environmental assessment or pre-clearing process or that are known to occur in the area.

4.6 Impacts due to landscaping and lighting

4.6.1 Landscaping

Submission number(s)

11, 17, 18

Issue description

The respondents raised the following issues:

- The Orchard Hills stretch of road should be kept rural in character. Landscaping should be avoided along the Defence Establishment Orchard Hills boundary and Cumberland Plain Woodland verges should be retained
- The use of local native flora species for roadside plantings will create habitat, help retain local character, and reduce roadside maintenance
- The width of the existing Surveyors Creek Corridor on both western and eastern sides should be capped with suitable Cumberland Plain Woodland substrate via soil translocation following earthworks
- The Surveyors Creek Corridor and median strip and verges for chains adjoining the Defence Establishment Orchard Hills bushland should not be landscaped. The sites should be restored to BAM/FBA-criteria functional Cumberland Plain Woodland.

An urban design and landscape concept has been developed for the project as documented in the EIS, based on the project objectives and principles, to achieve an integrated design for the project. It incorporates the urban and landscape design concept plans for the project and a landscape planting concept including recommended species. As identified in the EIS, this would be adopted and further developed during detailed design and implemented as part of the Urban Design Landscape Plan

(UDLP) for the project which is currently ongoing. This plan would be developed in consultation with Council.

The EIS includes a mitigation measure for the re-establishment of native vegetation (B-6), which the contractor would be required to incorporate into the flora and fauna management plan (FFMP) to be developed for the project and implemented during construction. This has been updated to include additional detail and would be included as part of the revised environmental management measures for the project (refer to Section 5 of this Memorandum):

Native vegetation would be re-established in disturbed areas and along the roadway using the following procedure:

- Ecologists and landscape architects will work together on the preparation of revegetation plans and specifications that clearly identify the locations of areas to be revegetated.
- Allocate sufficient time for the collection of seed to be used in revegetation.
- Carry out all seed collection in accordance with RTA Seed Collection QA Specification R176 and the Florabank Guidelines and Model Code of Practice.
- Use experienced and licensed seed collectors to carry out seed collection.
- Where possible, procured plants should be grown from local provenance seed.
- Consideration should be given to a range of characteristics such as species, height and drought tolerance when procuring native plants.
- Planting operations should be in accordance with RTA Landscape Planting QA Specification R179.
- Use only plants that have been certified disease free for revegetation works.
- Collect local native topsoils and leaf litter and store for use in revegetation works.
- Soils in areas to be revegetated should match surrounding soil conditions as closely as possible unless adjacent areas are weedy or contaminated.
- Ensure areas to be revegetated have an appropriate level of natural drainage.
- Avoid compaction of soils in areas identified for revegetation. Where compaction has occurred, the soil should be loosened.
- When planting consider seasonal risks of frost, drought, flooding and sun exposure to avoid damaging plants and to encourage growth.
- Ensure plant spacing and diversity follows the landscaping plan for the project, reflects local conditions and is dense enough to ensure plants achieve a timely coverage of the ground.
- Consider appropriate shade and drainage conditions when planting. Provide mulching around plants for dry or potentially weedy sites to help retain moisture and suppress weeds.
- Inspection, monitoring and maintenance of revegetated areas should be conducted in accordance with the landscape management plan. Outline the roles and responsibilities in landscape management and revegetation plans including the schedule for monitoring and maintenance activities.

4.6.2 Lighting

Submission number(s)

11, 17, 18, 27

Issue description

The respondents raised the following issues:

- Concern regarding the impacts of light pollution on fauna
- Reduced street lighting would minimise impacts to native fauna
- Request for lighting to be limited to larger traffic intersections to reduce impacts to fauna, such as threatened bat and owl populations, as well as other nocturnal species
- Lighting should be excluded from the width of the Surveyors Creek Corridor on both eastern and western sides, and along the length of Cumberland Plain Woodland on the DEOH site.

The EIS acknowledges that night works would be required during construction which would involve the use of temporary lighting. Additionally, street lighting would be provided along the full length of the project to light the carriageway and shared path as required to support the safe operation of the road and paths. Street lighting would be designed to ensure relevant guidelines are adhered to including on light spill. As such, the immediate area surrounding the project activities, and the roadside during operation, would be subject to artificial lighting. This would essentially create permanent 'daylight' conditions in the area around the lights. Ecological light pollution may potentially affect nocturnal fauna by temporarily interrupting their life cycle. Due to the frequency and sustained nature of the lighting, it is unlikely that animals would habituate to the light disturbance and a long-term impact in the area of lighting is likely. Despite efforts to minimise the impacts of lighting, localised impacts from light spill would remain and this has been identified and assessed as a residual impact in the BAR/EIS for the project.

4.7 Impacts to Cumberland Plain Woodland

Submission number(s)

12, 21, 25

Issue description

The respondents raised the following issues:

- Concern regarding the impacts of the project on Cumberland Plain Woodland
- Concern regarding the impacts of the project on Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest.

The EIS identified the potential impacts to Cumberland Plain Woodland and this community is identified as a Matter for Further Consideration in the Biodiversity Assessment Report as the project is considered likely to significantly reduce the viability of Cumberland Plain Woodland.

Based on the original construction footprint, the project would result in the direct clearing of about 33.83 hectares of the TSC Act listed critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community. After detailed design, this impact has reduced by 2.96 hectares to about 30.87 hectares.

Based on the original construction footprint, the project would result in the direct clearing of about 16.37 hectares of the EPBC Act listed critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. After detailed design, this impact has been reduced by 1.29 hectares to 15.08 hectares.

4.8 Details of proposed mitigation measures

Submission number(s)

29

Issue description

- Penrith City Council requested further detail on some of the mitigation measures outlined in the EIS
- Three additional mitigation measures regarding seeding and reuse of topsoil were identified
- Three additional mitigation measures regarding hollows, re-use of large woody debris and installation of suitable habitat boxes were identified.

Further details of the mitigation measures for the project as outlined in the EIS are provided in Table 4.1. Additional mitigation measures proposed for the project are outlined in Section 5.

Table 4.1 : Description of mitigation measures

Impact	Proposed mitigation measure	Description of actions
Removal of native vegetation	Native vegetation removal will be minimised through detailed design.	Native vegetation removal has been reduced by 3.50 hectares during detailed design.
	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	<p>The pre-clearing process involves:</p> <ul style="list-style-type: none"> Review the environmental assessment and associated documentation for the project to identify known locations of biodiversity features such as threatened flora and fauna (and their habitat), threatened populations and communities that need to be considered during the pre-clearing process. Identify nearby habitat that would be suitable for the release of fauna that may be encountered during the pre-clearing process or habitat removal. Consult with an ecologist to determine suitable habitat. Mark the pre-determined habitat identified for fauna release on a map. The project manager and/or environment manager will develop an unexpected threatened species finds procedure for projects and maintenance works. This should be part of the Construction Environmental Management Plan (CEMP), flora and fauna management sub-plan or Environmental Work Method Statement (EWMS). Follow the unexpected threatened species finds procedure if additional threatened species or communities are identified that have not been considered in the environmental assessment. The project manager and/or environment manager will incorporate biodiversity management measures identified during the pre-clearing process into the project CEMP and/or designs. The project manager and/or environment manager should engage an ecologist to undertake the following procedure in the weeks before clearing begins: <ul style="list-style-type: none"> Confirm the locations of biodiversity features identified in the environmental assessment. Identify any fauna that have the potential to be disturbed, injured or killed as a result of clearing activities (eg nesting birds). Check for the presence of threatened flora and fauna species that were identified in the environmental assessment as likely to occur. This check should be: <ul style="list-style-type: none"> Conducted by licensed ecologists experienced in fauna handling and the identification of local flora and fauna species. If possible, under taken during optimal weather conditions, season and time of day/night for identifying targeted flora and fauna species. If not already available, record the details for all hollow-bearing trees, trees containing threatened fauna and threatened flora, including (where applicable): <ul style="list-style-type: none"> GPS location. Species. Type of habitat feature (eg nest, bushrock). Size of hollow (eg small, medium, large). Type of hollows (eg branch, limb, trunk). Mark habitat features to be protected during construction. Use suitable methods (eg flagging tape) to mark: <ul style="list-style-type: none"> All hollow-bearing trees or habitat features. Any trees found to contain threatened fauna. The location of any threatened flora. Confirm the location of pre-determined habitat identified for the release of any fauna encountered on site. Submit any updated maps/plans, pre-determined habitat for the release of fauna, habitat features and recommended clearing procedures to the project manager and/or environment manager (or equivalent). The following procedure should be followed 24 hours before clearing: <ul style="list-style-type: none"> Licensed wildlife carers and/or ecologists should capture and/or remove fauna that have the potential to be disturbed, injured or killed as a result of clearing activities. Relocate captured fauna into pre-determined habitat identified for fauna release. The project manager and/or environment manager should inform clearing contractors of any changes to the sequence of clearing if required. Carry out staged habitat removal as outlined in <i>Guide 4: Clearing of vegetation and removal of bushrock</i> where fauna habitat features (such as hollow-bearing trees, habitat trees and bushrock) have been identified and marked.

Impact	Proposed mitigation measure	Description of actions
	<p>Exclusion zones will be established to mark clearing limits according to <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).</p>	<p>An exclusion zone is a designated 'no-go' area that is clearly identified and appropriately fenced to prevent damage to native vegetation and fauna habitats and prevent the distribution of pests, weeds and disease. Exclusion zones will be used to define approved clearing limits for the project. Exclusion zones will be implemented as follows:</p> <ul style="list-style-type: none"> • Review background documents such as environmental assessments and accompanying flora and fauna reports, conditions of approval, project or CEMP, project or contract specifications and updated maps/plans that were developed as part of the pre-clearing process. • Select appropriate exclusion fence type based on the risk of the excluded area being intruded upon, the area to be fenced, and the risk of fauna being trapped, injured or isolated. • Mark exclusion zones on a suitable plan. Plans should: <ul style="list-style-type: none"> a. Be based on up to date plans for the project. b. Include construction chainages or similar distance markers used in construction. c. Be clearly labelled. d. State what is being excluded. e. Be displayed in prominent places in the site shed. f. outline any procedures that must be followed for access into exclusion zones. • Mark out exclusion zones with temporary markings such as pegs or paint. • Ensure that any trees to be felled to establish exclusion zones are felled so as to fall away from the exclusion zone. • Place exclusion zone fencing outside tree protection zones. • Erect signs to inform personnel of the purpose of exclusion zone fencing. • Store materials or equipment outside exclusion zones. • Avoid stockpiling materials and equipment and parking vehicles and machinery within the dripline of any tree. • Ensure all exclusion zones are regularly inspected and repairs to fencing are made where required. • Carry out regular assessments of the adequacy and location of exclusion zones by including this as an auditable item in the project audit schedule. • Maintain exclusion fencing until the risk to disturbance within the excluded zone has been eliminated through other means. Removal of fencing should be under taken in consultation with environmental staff. • Communicate the importance of exclusion zones, and any changes to the zones, to all site staff and visitors (eg in toolbox talks and inductions). • Ensure that any breaches of the exclusion zone are reported through the RTA's environmental incident reporting procedure.

Impact	Proposed mitigation measure	Description of actions
	Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	<p>The pre-clearing process should be completed before any clearing begins (see <i>Guide 1: Pre-clearing process</i>). After pre-clearing has been undertaken, vegetation removal will follow this procedure:</p> <ul style="list-style-type: none"> • Develop a clearing and grubbing plan with reference to the Biodiversity Guidelines and communicate the requirements of the plan to site staff regularly. • document the selection of suitable work methods in a clearing and grubbing plan. • Ensure clearing of vegetation and/or removal of bushrock does not go beyond the approved clearing limits for the project. • Follow the unexpected threatened species finds procedure if a threatened species is encountered that has not previously been identified and assessed in the environmental assessment. • Carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation. • Retain stumps in riparian zones and aquatic habitats to reduce the potential for bank erosion. • Separate woody vegetation to identify suitable items for secondary re-use (see <i>Guide 5: Re-use of woody debris and bushrock</i>) or exotic (non-native) vegetation. keep stockpiles of cleared vegetation under two metres high in accordance with the Roads and Maritime Stockpile Site Management Guideline. • Non-woody vegetation (typically grasses and groundcover species) should be incorporated into the stripping of topsoil to retain any organic materials and nutrients within the topsoil layer. • The staged habitat removal process is to be used when identified habitat (eg hollow-bearing trees, habitat trees or bushrock) is to be removed: <ul style="list-style-type: none"> a. Make contact with vets and wildlife carers before works start to ensure they are willing to assist treating injured animals if necessary. b. An experienced and licensed wildlife carer and/or ecologist will be present on site during all habitat removal activities to capture and relocate fauna that may be encountered. c. Progressive habitat removal will take place around habitat identified and marked during the pre-clearing process. Remove non-hollow-bearing trees, undergrowth, feed-trees, regrowth and grass. do not fell trees towards exclusion zones. d. Identified habitat (eg hollow-bearing trees) will be left for at least 24 hours after removing non-habitat vegetation to allow fauna to escape. A licensed wildlife carer and/or ecologist will check hollow-bearing trees are not being used by fauna before felling. If necessary, fauna may need to be trapped and relocated to pre-determined habitat identified for fauna release. e. Fell habitat trees as carefully as possible to avoid injury to any fauna still remaining in trees. Use equipment that would allow the habitat trees to be lowered to the ground with minimal impact (eg claw extension). do not fell trees towards exclusion zones. f. An experienced and licensed wildlife carer and/or ecologist will inspect habitat once it is removed eg after a tree is felled. Animals that emerge should be captured, inspected for injury then relocated to pre-determined habitat identified for fauna release. g. All hollows have the potential to support fauna and will be placed in adjacent habitat until the following day for further inspection by a licensed wildlife carer and/or ecologist to verify no fauna is present. If possible, the hollows could be permanently relocated in adjacent areas in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i>. Inspect woody debris for fauna immediately before chipping to avoid injury or death to fauna that may be present. • The project manager and/or environment manager should ensure that the outcomes of the clearing process are recorded. Reporting is usually the responsibility of an ecologist or environment officer. Reports are to be submitted to relevant personnel eg environment manager or RTA regional environmental staff. • Consider the seasonal impact of clearing on species identified in the environmental assessment or pre-clearing process or that are known to occur in the area. • Under take bushrock removal in a way that minimises damage to the bushrock, avoids excessive soil disturbance and avoids climatic seasons when species are utilising this resource. • Record the outcomes of the clearing process. • The Australian Standard AS 4373 Pruning of amenity trees should be followed for all pruning works.

Impact	Proposed mitigation measure	Description of actions
	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	<p>An urban design and landscape concept has been developed for the project as documented in the EIS, based on the project objectives and principles, to achieve an integrated design for the project. It incorporates the urban and landscape design concept plans for the project and a landscape planting concept including recommended species. As identified in the EIS, this would be adopted and further developed during detailed design and implemented as part of the Urban Design Landscape Plan (UDLP) for the project which is currently ongoing. This plan would be developed in consultation with Council.</p> <p>Native vegetation will be re-established using the following procedure:</p> <ul style="list-style-type: none"> • Retain native vegetation by minimising the road construction footprint where possible rather than clearing and revegetating the area. • Ecologists and landscape architects will work together on the preparation of revegetation plans and specifications that clearly identify the locations of areas to be revegetated. • Allocate sufficient time for the collection of seed to be used in revegetation. • Carry out all seed collection in accordance with RTA Seed Collection QA Specification R176 and the Florabank Guidelines and Model Code of Practice. • Use experienced and licensed seed collectors to carry out seed collection. • Where possible, procured plants should be grown from local provenance seed. • Consideration should be given to a range of characteristics such as species, height and drought tolerance when procuring native plants. • Planting operations should be in accordance with RTA Landscape Planting QA Specification R179. • Use only plants that have been certified disease free for revegetation works (refer to Guide 7: Pathogen management). • Collect local native topsoils and leaf litter and store for use in revegetation works. • Soils in areas to be revegetated should match surrounding soil conditions as closely as possible unless adjacent areas are weedy or contaminated. • Ensure areas to be revegetated have an appropriate level of natural drainage. • Avoid compaction of soils in areas identified for revegetation. Where compaction has occurred, the soil should be loosened. • There are several seeding techniques that deal with moisture requirements in different ways. For further details refer to Construction Quality Technical Direction 007, Quality Alert 7 – Hydroseeding, hydromulching and other slope stabilisation methods. • When planting consider seasonal risks of frost, drought, flooding and sun exposure to avoid damaging plants and to encourage growth. • Ensure plant spacing and diversity follows the landscaping plan for the project, reflects local conditions and is dense enough to ensure plants achieve a timely coverage of the ground. • Consider appropriate shade and drainage conditions when planting. Provide mulching around plants for dry or potentially weedy sites to help retain moisture and suppress weeds. • Inspection, monitoring and maintenance of revegetated areas should be conducted in accordance with the landscape management plan. Outline the roles and responsibilities in landscape management and revegetation plans including the schedule for monitoring and maintenance activities.

Impact	Proposed mitigation measure	Description of actions
	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified on the project.	<p>The procedure is as follows:</p> <ul style="list-style-type: none"> Threatened flora or fauna species unexpectedly encountered Stop work Notify the environment manager Environmental manager would arrange for an ecologist to conduct an assessment of significance of the likely impact, develop management options and notify OEH, DPI and DoEE as appropriate If a significant impact is not likely to occur, recommence work and maintain regular inspections If a significant impact is likely to occur: <ul style="list-style-type: none"> Consult with OEH, DPI and DoEE as appropriate Obtain approvals, licenses or permits as required Recommence works once advice is sought and necessary approvals, licences and permits are obtained Include species in subsequent inductions, toolbox talks and update the CEMP.
Removal of threatened species habitat and habitat features	Habitat removal will be minimised through detailed design.	<p>Removal of habitat for threatened species has been minimised during detailed design.</p> <p>Impacts to habitat of the Cumberland Plain Land Snail have been reduced by 0.96 ha.</p> <p>Impacts to habitat of species including Grey-headed Flying-fox, Regent Honeyeater, Swift Parrot and Large-eared Pied Bat has been reduced by 2.15 ha.</p>
	Habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	<p>The pre-clearing process should be completed before any clearing begins (see <i>Guide 1: Pre-clearing process</i>). After pre-clearing has been undertaken, vegetation removal will follow this procedure:</p> <ul style="list-style-type: none"> Develop a clearing and grubbing plan with reference to the Biodiversity Guidelines and communicate the requirements of the plan to site staff regularly. document the selection of suitable work methods in a clearing and grubbing plan. Ensure clearing of vegetation and/or removal of bushrock does not go beyond the approved clearing limits for the project. Follow the unexpected threatened species finds procedure if a threatened species is encountered that has not previously been identified and assessed in the environmental assessment. Carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation. Retain stumps in riparian zones and aquatic habitats to reduce the potential for bank erosion. Separate woody vegetation to identify suitable items for secondary re-use (see Guide 5: Re-use of woody debris and bushrock) or exotic (non-native) vegetation. keep stockpiles of cleared vegetation under two metres high in accordance with the Roads and Maritime Stockpile Site Management Guideline. Non-woody vegetation (typically grasses and groundcover species) should be incorporated into the stripping of topsoil to retain any organic materials and nutrients within the topsoil layer. The staged habitat removal process is to be used when identified habitat (eg hollow-bearing trees, habitat trees or bushrock) is to be removed: <ul style="list-style-type: none"> Make contact with vets and wildlife carers before works start to ensure they are willing to assist treating injured animals if necessary. An experienced and licensed wildlife carer and/or ecologist will be present on site during all habitat removal activities to capture and relocate fauna that may be encountered. Progressive habitat removal will take place around habitat identified and marked during the pre-clearing process. Remove non-hollow-bearing trees, undergrowth, feed-trees, regrowth and grass. do not fell trees towards exclusion zones. Identified habitat (eg hollow-bearing trees) will be left for at least 24 hours after removing non-habitat vegetation to allow fauna to escape. A licensed wildlife carer and/or ecologist will check hollow-bearing trees are not being used by fauna before felling. If necessary, fauna may need to be trapped and relocated to pre-determined habitat identified for fauna release. Fell habitat trees as carefully as possible to avoid injury to any fauna still remaining in trees. Use equipment that would allow the habitat trees to be lowered to the ground with minimal impact (eg claw extension). do not fell trees towards exclusion zones. An experienced and licensed wildlife carer and/or ecologist will inspect habitat once it is removed eg after a tree is felled. Animals that emerge should be

Impact	Proposed mitigation measure	Description of actions
		<p>captured, inspected for injury then relocated to pre-determined habitat identified for fauna release.</p> <p>g. All hollows have the potential to support fauna and will be placed in adjacent habitat until the following day for further inspection by a licensed wildlife carer and/or ecologist to verify no fauna is present. If possible, the hollows could be permanently relocated in adjacent areas in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i>. Inspect woody debris for fauna immediately before chipping to avoid injury or death to fauna that may be present.</p> <p>h. The project manager and/or environment manager should ensure that the outcomes of the clearing process are recorded. Reporting is usually the responsibility of an ecologist or environment officer. Reports are to be submitted to relevant personnel eg environment manager or RTA regional environmental staff.</p> <ul style="list-style-type: none"> Consider the seasonal impact of clearing on species identified in the environmental assessment or pre-clearing process or that are known to occur in the area. Under take bushrock removal in a way that minimises damage to the bushrock, avoids excessive soil disturbance and avoids climatic seasons when species are utilising this resource. Record the outcomes of the clearing process. The Australian Standard AS 4373 Pruning of amenity trees should be followed for all pruning works.
	Habitat will be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011)	<p>An urban design and landscape concept has been developed for the project as documented in the EIS, based on the project objectives and principles, to achieve an integrated design for the project. It incorporates the urban and landscape design concept plans for the project and a landscape planting concept including recommended species. As identified in the EIS, this would be adopted and further developed during detailed design and implemented as part of the Urban Design Landscape Plan (UDLP) for the project which is currently ongoing. This plan would be developed in consultation with Council.</p> <p>The following will be undertaken to maximise the re-use of woody debris and bushrock to minimise loss and/or damage to native flora and fauna habitats:</p> <ul style="list-style-type: none"> Contract specifications should state that woody debris and bushrock is to be re-used on site (eg for habitat improvement) where possible. Engage an ecologist to provide advice on the re-use of woody debris and bushrock to ensure it does not have a negative impact on the receiving environment. Separate weeds from native vegetation. Do not extend the amount of clearing and grubbing to make up for mulch shortfalls. Carry out removal, stockpiling, transportation and relocation of woody debris and/or bushrock in a manner that minimises disturbance to native vegetation (including the canopy, shrubs, dead trees, fallen timber and groundcover species) or bushrock. Avoid the spread of any weeds or pathogens that may be in the soil when relocating woody debris and bushrock from stockpiles. Engage an ecologist to provide advice on positioning woody debris and bushrock in designated relocation areas Keep topsoil disturbance to a minimum. When relocating woody debris, place it evenly across the site. Manage stockpiles in accordance with the Roads and Maritime Stockpile Site Management Guideline, Environmental Protection (Management System) QA Specification G36 and Vegetation QA Specification R178. Prepare a mulch tannin management plan for the project where tannins are likely to be generated. <p>To minimise the impact of hollow loss, supplementary fauna habitat in the form of artificial hollows (nest boxes) will be installed as follows:</p> <ul style="list-style-type: none"> Where nest boxes are required, an ecologist will be engaged to develop a nest box strategy. Consult with an ecologist to assist in the implementation of the nest box strategy including installation and monitoring of nest boxes. An ecologist should certify that the nest boxes are designed and built to suit the target species in accordance with the nest box strategy. The entrance size of nest boxes should be no bigger than that required for the target species. The nest box lid should overhang the front and sides of the nest box by at least 25 millimetres to prevent water damage. For monitoring and maintenance purposes, consider using a hinged lid. do not use metal lids or plates on the roof of the nest box lid. Paint the outside of the nest box with non-toxic, dark-coloured, outdoor, water-based acrylic paint. Avoid toxic substances. To assist with drainage, drill three small holes in the base of the nest box. Non-toxic woodchips, wood shavings or sawdust could be placed into possum, glider and bird nest boxes to provide extra insulation in cold climates.

Impact	Proposed mitigation measure	Description of actions
		<ul style="list-style-type: none"> An ecologist should be on site during the installation of nest boxes. The preferred method of attaching nest boxes to trees is the Habisure® system. Bolting nest boxes to trees is not recommended. The density and quantity of each nest box type should reflect the proportion of tree hollow types being removed, the proportion of tree hollow types to be retained in adjacent habitat, the availability of adjacent food resources and the assemblage of hollow-dependant fauna known or likely to occur in the project locality. The location of nest boxes should be as close as possible to the original hollow-bearing tree, consider the type of bark preferred by the target species, be in close proximity to food or other resources, not be installed on trees with existing hollows or where there is a high density of Common Mynas (<i>Acridotheres tristis</i>). Orientate nest boxes between northwest and east and so they are not facing lights from adjacent development. Install approximately 70 per cent of nest boxes up to one month before the start of any clearing. The remainder of nest boxes would be installed before completion of the project. Record the nest box identification number, nest box type, GPS location, species and diameter at breast height of the host tree, nest box height and orientation. Under take ongoing monitoring and maintenance of nest boxes in accordance with the nest box management strategy for the project. If a nest box needs to be removed from the site for repair, then an alternative nest box should be installed in the same location upon removal of the damaged nest box.
	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified on the project.	<p>The procedure is as follows:</p> <ul style="list-style-type: none"> Threatened flora or fauna species unexpectedly encountered Stop work Notify the environment manager Environmental manager would arrange for an ecologist to conduct an assessment of significance of the likely impact, develop management options and notify OEH, DPI and DoEE as appropriate If a significant impact is not likely to occur, recommence work and maintain regular inspections If a significant impact is likely to occur: <ul style="list-style-type: none"> Consult with OEH, DPI and DoEE as appropriate Obtain approvals, licenses or permits as required Recommence works once advice is sought and necessary approvals, licences and permits are obtained Include species in subsequent inductions, toolbox talks and update the CEMP.
Removal of threatened plants	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process</i> of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (NSW Roads and Traffic Authority, 2011).	<p>The pre-clearing process involves:</p> <ul style="list-style-type: none"> Review the environmental assessment and associated documentation for the project to identify known locations of biodiversity features such as threatened flora and fauna (and their habitat), threatened populations and communities that need to be considered during the pre-clearing process. Identify nearby habitat that would be suitable for the release of fauna that may be encountered during the pre-clearing process or habitat removal. Consult with an ecologist to determine suitable habitat. Mark the pre-determined habitat identified for fauna release on a map. The project manager and/or environment manager will develop an unexpected threatened species finds procedure for projects and maintenance works. This should be part of the CEMP, flora and fauna management sub-plan or EWMS. Follow the unexpected threatened species finds procedure if additional threatened species or communities are identified that have not been considered in the environmental assessment. The project manager and/or environment manager will incorporate biodiversity management measures identified during the pre-clearing process into the project CEMP and/or designs. The project manager and/or environment manager should engage an ecologist to undertake the following procedure in the weeks before clearing begins: <ul style="list-style-type: none"> Confirm the locations of biodiversity features identified in the environmental assessment. Identify any fauna that have the potential to be disturbed, injured or killed as a result of clearing activities (eg nesting birds). Check for the presence of threatened flora and fauna species that were identified in the environmental assessment as likely to occur. This check should be: <ul style="list-style-type: none"> Conducted by licensed ecologists experienced in fauna handling and the identification of local flora and fauna species

Impact	Proposed mitigation measure	Description of actions
		<ul style="list-style-type: none"> ii. If possible, undertaken during optimal weather conditions, season and time of day/night for identifying targeted flora and fauna species. d. If not already available, record the details for all hollow-bearing trees, trees containing threatened fauna and threatened flora, including (where applicable): <ul style="list-style-type: none"> i. GPS location ii. Species iii. Type of habitat feature (eg nest, bushrock) iv. Size of hollow (eg small, medium, large) v. Type of hollows (eg branch, limb, trunk). e. Mark habitat features to be protected during construction. Use suitable methods (eg flagging tape) to mark: <ul style="list-style-type: none"> i. All hollow-bearing trees or habitat features. ii. Any trees found to contain threatened fauna. iii. The location of any threatened flora. f. Confirm the location of pre-determined habitat identified for the release of any fauna encountered on site. g. Submit any updated maps/plans, pre-determined habitat for the release of fauna, habitat features and recommended clearing procedures to the project manager and/or environment manager (or equivalent). • The following procedure should be followed 24 hours before clearing: <ul style="list-style-type: none"> a. Licensed wildlife carers and/or ecologists should capture and/or remove fauna that have the potential to be disturbed, injured or killed as a result of clearing activities. b. Relocate captured fauna into pre-determined habitat identified for fauna release. c. The project manager and/or environment manager should inform clearing contractors of any changes to the sequence of clearing if required. d. Carry out staged habitat removal as outlined in <i>Guide 4: Clearing of vegetation and removal of bushrock</i> where fauna habitat features (such as hollow-bearing trees, habitat trees and bushrock) have been identified and marked.
	<p>The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified on the project.</p>	<p>The procedure is as follows:</p> <ul style="list-style-type: none"> • Threatened flora or fauna species unexpectedly encountered • Stop work • Notify the environment manager • Environmental manager would arrange for an ecologist to conduct an assessment of significance of the likely impact, develop management options and notify OEH, DPI and DoEE as appropriate • If a significant impact is not likely to occur, recommence work and maintain regular inspections • If a significant impact is likely to occur: <ul style="list-style-type: none"> a. Consult with OEH, DPI and DoEE as appropriate b. Obtain approvals, licenses or permits as required c. Recommence works once advice is sought and necessary approvals, licences and permits are obtained • Include species in subsequent inductions, toolbox talks and update the CEMP.

Impact	Proposed mitigation measure	Description of actions
Aquatic impacts	Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (Department of Primary Industries, 2013).	<p>This procedure is applicable to all construction and maintenance sites where works are in an aquatic habitat or within the riparian zone (50 metres from the highest bank of a waterway or the edge of a wetland).</p> <ul style="list-style-type: none"> Avoid activities in aquatic habitats and riparian zones as much as practicable. The sensitivity of aquatic habitats and riparian zones and the measures in place to protect them should be regularly communicated to all staff eg during inductions and toolbox talks. Protect aquatic habitats and riparian zones where works are not required with exclusion zones. Exclusion fencing should be used outside sensitive areas. The location of aquatic habitat features within or adjacent to the footprint should be clearly identified on environmental management plans. Access the waterway so that riparian vegetation removal is minimised and restricted to the minimum amount of bank length required for the construction activity. Keep vehicles and machinery away from the banks of a waterway where possible. Refuelling of vehicles and plant, and chemical storage and decanting should not take place within 50 metres of aquatic habitats. Avoid clearing within the riparian zone during periods when flooding is likely to occur. Ensure that any clearing under taken does not allow the vegetation/trees to fall into the waterway. Retain the roots of trees on the bank of a waterway in order to maintain bank stability. Consult with department of Primary industries (DPI) (Fisheries) before clearing to identify any trees proposed to be removed that could potentially be used for re-snagging of a waterway. Only the minimum number of snags should be disturbed. DPI (Fisheries) must be consulted before works commence where snags require lopping, realignment, relocation and/or removal. During rehabilitation, stabilise the banks of the waterway through revegetation and/or armouring according to available landscape plans. Protect banks from stock and/or human access using appropriate fencing during the rehabilitation and maintenance period of the work site. Remove all temporary works, flow diversion barriers and sediment control barriers within aquatic habitats as soon as practicable and in a manner that does not promote future channel erosion.
Removal of woody debris	All large woody debris or snags will be relocated instream.	<p>The process involves:</p> <ul style="list-style-type: none"> Consult with department of Primary industries (DPI) (Fisheries) before clearing to identify any trees proposed to be removed that could potentially be used for re-snagging of a waterway. Only the minimum number of snags should be disturbed. DPI (Fisheries) must be consulted before works commence where snags require lopping, realignment, relocation and/or removal.
Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	<p>A flood culvert PXD2 is proposed at the key connectivity point at Surveyors Creek.</p> <p>Scour protection measures or energy dissipation measures will be used along the bed and banks upstream and downstream of any bridge crossing or culvert where high velocities of surface water runoff cannot be minimised by design or by energy dissipaters. This may include flow velocity management measures to minimise erosion and scour in watercourses, or collection and management of runoff waters.</p>
Fragmentation of identified biodiversity links and habitat corridors	Connectivity measures will be implemented in accordance with the <i>Wildlife Connectivity Guidelines for Road Projects</i> (RMS in prep).	<p>Connectivity measures are being considered during detailed design in accordance with the Wildlife Connectivity Guidelines for Road Projects (RMS in prep). In particular, maintenance of current connectivity and potential future connectivity has been considered in culvert design, lighting and fencing.</p> <p>Connectivity between the Mulgoa Nature Reserve, Badgery's Creek and the DEOH via Regional Corridor 17 (Surveyors Creek Corridor) will be planned for in the future with construction of a fauna crossing to allow for future connectivity to the DEOH land. The proposed fauna crossing is a 2.4 metre tall dry passage underpass. This should be suitable for larger species such as the Eastern Grey Kangaroo based on monitoring results from Pacific Highway projects.</p> <p>The culvert will lead from the Surveyors Creek corridor under the road and will exit at the new DEOH fencing. For DEOH security reasons and traffic safety, the underpass will be blocked until the DEOH fencing is removed in the future. This is to prevent the public from gaining unauthorised access to the DEOH land through the underpass and to prevent animals from exiting the culvert onto the roadway.</p>

Impact	Proposed mitigation measure	Description of actions
Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	<p>An exclusion zone is a designated 'no-go' area that is clearly identified and appropriately fenced to prevent damage to native vegetation and fauna habitats and prevent the distribution of pests, weeds and disease. Exclusion zones will be used to define approved clearing limits for the project. Exclusion zones will be implemented as follows:</p> <ul style="list-style-type: none"> Review background documents such as environmental assessments and accompanying flora and fauna reports, conditions of approval, project or CEMP, project or contract specifications and updated maps/plans that were developed as part of the pre-clearing process. Select appropriate exclusion fence type based on the risk of the excluded area being intruded upon, the area to be fenced, and the risk of fauna being trapped, injured or isolated. Mark exclusion zones on a suitable plan. Plans should: <ul style="list-style-type: none"> Be based on up to date plans for the project. Include construction chainages or similar distance markers used in construction. Be clearly labelled. State what is being excluded. Be displayed in prominent places in the site shed. outline any procedures that must be followed for access into exclusion zones. Mark out exclusion zones with temporary markings such as pegs or paint. Ensure that any trees to be felled to establish exclusion zones are felled so as to fall away from the exclusion zone. Place exclusion zone fencing outside tree protection zones. Erect signs to inform personnel of the purpose of exclusion zone fencing. Store materials or equipment outside exclusion zones. Avoid stockpiling materials and equipment and parking vehicles and machinery within the dripline of any tree. Ensure all exclusion zones are regularly inspected and repairs to fencing are made where required. Carry out regular assessments of the adequacy and location of exclusion zones by including this as an auditable item in the project audit schedule. Maintain exclusion fencing until the risk to disturbance within the excluded zone has been eliminated through other means. Removal of fencing should be undertaken in consultation with environmental staff. Communicate the importance of exclusion zones, and any changes to the zones, to all site staff and visitors (eg in toolbox talks and inductions). Ensure that any breaches of the exclusion zone are reported through the RTA's environmental incident reporting procedure.
Injury and mortality of fauna	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	<p>To minimise impacts on fauna as a result of being handled by humans and prevent injury to people handling fauna the following procedures will be implemented:</p> <ul style="list-style-type: none"> Allow fauna to leave an area without intervention as much as possible. Use a licensed fauna ecologist or wildlife carer with specific animal handling experience to carry out any fauna handling. Contact an animal rescue agency/wildlife care group or vet before works start to ensure they are willing and available to be involved in fauna rescue and assist with injured animals. The contact details of the animal rescue agency/wildlife care group or vet should be provided to the site manager, displayed in the site office and included in the CEMP or other relevant management plans for the project. Include the procedures to follow if fauna is found or injured on site in project inductions. Follow the best practice methods outlined below in circumstances where the handling of fauna is completely unavoidable: <ul style="list-style-type: none"> Contact the nominated animal rescue agency/wildlife care group or vet if an animal is injured. Keep the injured animal in a box in a quiet, warm, dark place until transferred. If an injured animal is dangerous, carefully place a box over the top of it if possible, or section off the area and wait for an experienced and licensed fauna ecologist or wildlife carer to arrive. Never deliberately kill a snake as all snakes are protected under the <i>National Parks and Wildlife Act 1974</i> (NSW). If a snake must be handled to remove the risk of harm to the snake or people then handling should only be done by a licensed fauna ecologist or wildlife carer with skills and experience in snake

Impact	Proposed mitigation measure	Description of actions
		<p>handling.</p> <p>d. Follow the Hygiene Protocol for the control of disease in frogs for all frog handling.</p> <p>e. Fish should only be handled by experienced aquatic ecologists.</p> <p>f. Wear gloves when handling mammals (including bats) to protect against bites and scratches. If handling bats, the handler must be vaccinated against the Australian Bat Lyssavirus (ABL) which is a form of rabies.</p> <p>g. Release fauna into pre-determined habitat identified for fauna release.</p> <p>h. Release fauna into similar habitats, as near as possible to their capture location. Release nocturnal fauna at dusk.</p>
Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	<p>To prevent or minimise the spread of weed species on site and during roadside maintenance the following procedure will be followed:</p> <ul style="list-style-type: none"> • Use an ecologist or person trained in weed management and identification to undertake a site weed assessment to identify and describe or map weed infested areas within the site and adjacent areas. • Identify and manage any Weeds of National Significance (WoNS), National Environmental Alert Weeds and/or noxious weeds located within the site or adjacent areas in consultation with the weeds officer at the relevant local council. • Identify surrounding land uses and consult with surrounding landholders where required. • Develop a weed management plan for the site. • The application of herbicide should ensure the safety of users and other people, and minimise risks to the broader environment. • Roads and Maritime has obligations to notify the community of proposed pesticide use (including herbicides) in accordance with the NSW Pesticides Regulation 2009. • Map and mark areas that are infested with weeds as an exclusion zone with fencing and signage to limit access by personnel and vehicles. • Use mechanical weed control methods such as slashing or mowing, as well as a range of herbicides to avoid the development of herbicide resistance (eg glyphosate resistance). • Mow/slash areas infested with weeds before they seed. This may reduce the propagation of new plants. • Program works from least to most weed infested areas. • Clean machinery, vehicles and footwear before moving to a new location. • Securely cover loads of weed-contaminated material to prevent weed plant material falling or blowing off vehicles. • Dispose of weed-contaminated soil at an appropriate waste management facility. • Remove weeds immediately onto suitable trucks and dispose of without stockpiling. • Separate weeds from native vegetation where native vegetation is to be used for mulch. do not use weeds for mulch. • Send samples of topsoil being imported onto site to a national Association of Testing Authorities (nATA) approved soil laboratory to ensure it contains no weed seeds or propagules (vegetative parts of plants such as buds or offshoots that can grow into new individuals). • Minimise soil disturbance within weed infested areas. Topsoil recovered from areas of low weed infestation can be re-used onsite with treatment but should be stockpiled separately. • All weed plant material and topsoil containing weed plant material should be disposed of to an appropriate waste management facility.
Invasion and spread of pests	Pest species will be managed within the project site according to the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	Roads and Maritime will work with the Greater Sydney Local Land Services to determine if the site is suitable for pre-clearing pest control.

Impact	Proposed mitigation measure	Description of actions
Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with <i>Guide 7: Pathogen management</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (NSW Roads and Traffic Authority, 2011).	<p>Where pathogens are known or suspected to occur on or adjacent to projects and during maintenance works the following procedure will be implemented:</p> <ul style="list-style-type: none"> • Pathogen management is ongoing throughout the period in which works are being carried out. • Check the department of Primary industries (DPI) website (www.industry.nsw.gov.au) for the most up-to-date hygiene protocols for each pathogen and for the most recent locations of contamination. • Ensure the risk of spreading pathogens and the mitigation measures required on site are regularly communicated to staff and contractors eg during inductions and toolbox talks. • Advice from DPI or the Office of Environment and Heritage (OEH) regarding the most practical hygiene management measures may be required if pathogens are present. • Programming of works should move from uninfected areas to infected areas. • Ensure vehicles and footwear are free of soil before entering or exiting the site (ie directed to wash down area before entering or exiting the site). • Provide vehicle and boot wash down facilities. • Testing from a national Association of Testing Authorities (nATA) approved laboratory may be required to confirm the presence of pathogens in the soil and/or water. • Set up exclusion zones with fencing and signage to restrict access into contaminated areas. • Restrict vehicles to designated tracks, trails and parking areas.
Noise, light and vibration	Shading and artificial light impacts will be minimised through detailed design.	<p>Street lighting would be provided along the full length of the project to light the carriageway and shared path, and is required to support the safe functioning of the road and paths.</p> <p>Street lighting would be designed to ensure relevant guidelines are adhered to.</p> <p>Where installed, nest boxes will be orientated so they are not facing lights from adjacent development.</p> <p>Some localised impacts from noise and light spill will remain.</p>

4.9 Impacts to threatened species in the extension of Vineyard Road

Submission number(s)

27

Issue description

The respondent raised the following issues:

- Concern regarding the impact if the Vineyard Road extension on an east-west terrestrial corridor, which has been identified to contain threatened plants including *Pultenaea parviflora* and *Marsdenia viridiflora*
- Request that further detail on the timing of 'ground truthing' in the area is provided
- Loss of identified threatened plants must be offset by the permanent conservation of a nearby population.

An additional targeted survey for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* was undertaken in an expanded study area around the Vineyard Road extension on the 7th August 2017. This area was not able to be accessed during the fieldwork undertaken for the original assessment. An area of habitat of approximately 4.7 hectares was surveyed by an experienced botanist following the methods described in the *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage, 2016). Traverses of this habitat were undertaken over a three-hour period for a distance of 3.131 kilometres (3,131 metres) (see Figure 3.1). The survey located a further six *Pultenaea parviflora* plants (two of which were in the development footprint, and four outside of the footprint). No additional *Marsdenia viridiflora* subsp. *viridiflora* plants were recorded during the survey.

This data has been used in the amended assessment of impacts and calculation of offset requirement for the project (refer to Section 3).

Offsetting is also discussed in Section 4.2.

4.10 Impacts to the *Marsdenia viridiflora* subsp. *Viridiflora* endangered population

Submission number(s)

29

Issue description

Further justification is needed regarding the impact of the project on *Marsdenia viridiflora* subsp. *viridiflora* in the context of "red flag" status.

The *Marsdenia viridiflora* subsp. *viridiflora* population has been identified in the BAR as a species credit species that cannot withstand further loss which has informed the assessment. The BAR has been undertaken in accordance with the FBA, and a BOS has been developed for the project. The BOS does not refer to the 'Red Flag' status of any species. 'Red Flag' areas are a concept from the BioBanking Assessment Methodology and do not apply to Major Projects assessed under the FBA.

4.11 Updating the Plant Community Type (PCT) selection and benchmarks for the assessment of Vegetation Zone 8 plot data

Submission number(s)

35

Issue description

OEH requests information supporting the view that PCT 850 is the likely original PCT. Following this, OEH can advise on the next steps with respect to PCT selection and benchmarks for the assessment of Vegetation Zone 8 plot data.

Vegetation Zone 8 was originally described in the BAR and entered into the Credit Calculator as Plant Community Type (PCT) 806 (HN627) 'Derived grasslands on shale hills of the Cumberland Plain (50-300m asl)'. This vegetation is derived native grassland that has resulted from the removal of the original tree canopy and shrub layer. In some parts the shrub layer is regenerating although no tree canopy remains. This native grassland vegetation is considered most likely derived from a former cover of PCT 850 (HN529) 'Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion' given the landscape position, location adjacent to PCT 850, and species composition of the ground layer.

In accordance with the FBA, an assessor must only identify PCTs on the development site that are described in the VIS Classification Database as derived or secondary vegetation communities where the assessor cannot determine the original PCT (FBA, s.5.2.1.11). As such Vegetation Zone 8 has been reassigned to PCT 850, as reflected in the revised assessment included in this Memorandum (refer to Section 3).

4.12 Updating benchmarks for 'Number of Trees with Hollows' and 'Fallen Logs' for HN528 and HN529

Submission number(s)

35

Issue description

The respondent raised the following issues:

- Benchmarks for HN528 and HN529 should be 1 and 50 m for 'Number of Trees with Hollows' and 'Fallen Logs' respectively. These benchmarks should be updated manually in the Credit Calculator with a note made in the BAR. It should be noted these updates are based on OEH advice and do not constitute the use of 'More Appropriate Local Data'.

For HN528 and HN529, the benchmark data for the site attributes 'Number of Trees with Hollows' and 'Fallen Logs' do not have any values assigned to them in the credit calculator. The OEH have advised that these value should be 1 and 50 m for 'Number of Trees with Hollows' and 'Fallen Logs' respectively.

These benchmarks have been manually updated in the credit calculator and the data has been used in the revised assessment included in this Memorandum (refer to Section 3 of this Memorandum).

4.13 Correcting inconsistencies with plot/transect data entered in the Credit Calculator when compared to the values provided in Appendix A of the BAR

Submission number(s)

35

Issue description

The respondent raised the following issues:

- There are inconsistencies between the plot/transect data in the Credit Calculator and Appendix A of the BAR.
- OEH recommends a copy of all raw field data sheets be provided to OEH for review and to determine whether the values in Appendix A (or the Credit Calculator) are correct.

There were some inconsistencies identified with the plot/transect data entered in the Credit Calculator when compared to the values provided in Appendix A of the BAR. All data entered into the Credit Calculator has been checked and amended as necessary.

All data entered into the credit calculator has been checked for consistency with the field sheets. A copy of all raw field data sheets is provided with this memorandum (refer to Appendix A).

4.14 Removing reference to Plot 31 from the BAR as it was not used in the assessment

Submission number(s)

35

Issue description

OEH recommends that the Credit Calculator be corrected to include Plot 31 or 'Grey Box- Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion - Moderate/Good' or reference be removed from the BAR.

Plot 31 was an original Rapid Biodiversity Assessment plot undertaken on the roadside along Willowdene Avenue. This plot was not used in the revised assessment as presented in this Memorandum as it was located outside of the revised construction footprint and landscape assessment area.

4.15 Updating the legend of Figure 3.1 in the BAR to remove errors

Submission number(s)

35

Issue description

OEH recommends updating the legend of Figure 3.1 in the BAR to remove errors.

The legend of Figure 3.1 (Vegetation survey locations) in the BAR incorrectly refers to HN528 as being in 'low' condition. There also seems to be some duplication of PCT names in the legend of Figure 3.1.

The legend of Figure 3.1 has been amended to show the correct classification of HN528 as Moderate/Good_Poor and the duplication with labelling has been removed. Refer to Appendix B.

4.16 Updating Table 6.1 of the BAR to include the area of impact (4.68 ha) for vegetation zone 4 (PCT 849)

Submission number(s)

35

Issue description

OEH recommends that Table 6.1 of the BAR be updated to include the area of impact (4.68 ha) for vegetation zone 4 (PCT 849).

The impacts to Vegetation Zone 4 have been included in Table 3.3 above to provide an overview of all impacts to native vegetation. Due to the manual override of the 'Number of Trees with Hollows' and 'Fallen Logs' for HN 528, Vegetation Zone 4 now has a site score of 29.17 and requires an offset to be calculated.

4.17 Species credit species *Pultenaea pedunculata* (Matted Bush-pea) was predicted by the Credit Calculator for survey but has not been included in the BAR

Submission number(s)

35

Issue description

OEH recommends that *Pultenaea pedunculata* (Matted Bush-pea) be included in the BAR.

Species credit species *Pultenaea pedunculata* (Matted Bush-pea) was predicted by Credit Calculator for survey but has not been included in the BAR.

Pultenaea pedunculata has recently been found in Mulgoa Nature Reserve and there is a record of *Pultenaea pedunculata* from October 2015 approximately 10-11km south of the study area made from Wivenhoe Conservation area at Cobbity. Prior to this record, the nearest record of *Pultenaea pedunculata* was from Prestons from 1998, located about about 16km to the south east of the study area.

The habitat assessment table for the BAR was created in September 2015 before the bulk of the ecological surveys were undertaken from 2/9/2015 to 10/9/2015. The survey was based off the survey matrix generated by the Credit Calculator in September 2015. *Pultenaea pedunculata* was not identified as a species for targeted survey in the original survey matrix so this species was not targeted in the detailed field surveys for the BAR. The Credit Calculator is linked to a threatened species database that is constantly being updated. It is likely that the distribution data for *Pultenaea pedunculata* was edited causing it to appear in the Credit Calculator after the September 2015 surveys had been completed.

Despite its omission from the credit calculator at the time, the targeted surveys for other threatened plants (including *Pultenaea parviflora*) undertaken for the BAR were undertaken from September to February within the flowering period and optimal survey period for *Pultenaea pedunculata*. *Pultenaea pedunculata* was not found on site during the surveys but there is a high likelihood that *Pultenaea pedunculata* would have been encountered during the surveys if the species was present in the habitat at that time.

A summary of the assessment for *Pultenaea pedunculata* is provided in Table 4.2.

Table 4.2 : Habitat assessment for *Pultenaea pedunculata*

Common name (Scientific name)	TSC Act	EPBC Act	Habitat	Minimum survey requirements (Office of Environment and Heritage 2016)	Survey completed
Matted Bush-Pea (<i>Pultenaea pedunculata</i>)	E	-	<p>In the Cumberland Plain the species favours sites in clay or sandy-clay soils (Blacktown Soil Landscape) on Wianamatta Shale-derived soils, usually close to patches of Tertiary Alluvium (Liverpool area) or at or near the Shale-Sandstone interface (Appin). All sites have a lateritic influence with ironstone gravel (nodules) present.</p> <p>Associated habitat includes PCT 849 and PCT 850 which are present on site.</p>	<p>The recommended approach is the parallel field traverse (i.e. parallel Transects) as used by Cropper (1993).</p> <p>As a sub-shrub the maximum distance between transects in open vegetation is 15 m, in dense vegetation is 10 m.</p> <p>In open vegetation, field traverse length is 0.63 km per hectare of potential habitat in open vegetation.</p> <p>With about 60 hectares of potential habitat in the study area, survey time is at least 9.38 hours in open vegetation.</p>	<p>Particular survey effort was expended in the in the vegetation on the Defence Establishment Orchard Hills. Surveys targeted PCT 849 and PCT 850. Derived grasslands were also surveyed. Parallel field traverses undertaken by two observers were used to survey for this species in areas which appeared to provide suitable habitat. Surveys for this species can be undertaken year round. The field surveys were undertaken over a period of 11 days from 2 September 2015 to 4 February 2016 (not inclusive).</p> <p>Floristic plots were undertaken in PCT 849 (14 plots), PCT 850 (16 plots) and PCT 806 (4 plots) which lasted on average 1 hour each with two observers. This equates to 68 person hours of detailed floristic survey in potential habitat. Each floristic plot was accompanied by a traverse throughout the adjacent habitat lasting a minimum of 0.5 hours' duration undertaken by two observers. This resulted in an additional 34 person hours of traverse-based survey in the habitat. In total, 102 person hours were expended on survey within the study area in 2015.</p> <p>The Vineyard Road extension on the 7th August 2017. While this survey was undertaken slightly before the September survey period, most species were flowering earlier than usual in August 2017. This species is known to flower from August to December. This area was not able to be accessed during the fieldwork undertaken for the original assessment. An area of habitat of approximately 4.7 hectares was surveyed. Traverses of this habitat were undertaken over a three-hour period for a distance of 3.131 kilometres (3,131 metres).</p>

4.18 Updating the habitat assessment table for threatened fauna species in Appendix B to include the number of Atlas records

Submission number(s)

35

Issue description

OEH recommends that the habitat assessment table for threatened fauna species in Appendix B be updated to include the number of Atlas records in the 'Number of records' column.

The habitat assessment table for threatened fauna species in the BAR did not include the number of Atlas records in the 'Number of records' column.

This information is now included in Appendix C.

4.19 Updating the BAR to refer to the Grey-headed Flying-fox as an Ecosystem credits species and a Species Credit Species

Submission number(s)

35

Issue description

OEH requested that the BAR and BOS be updated to clarify that the Grey-headed Flying-fox is both an ecosystem and species credit species, no impact to camps (species credits) have been identified and no species credits are required.

The BAR and BOS refer to the Grey-headed Flying-fox as an ecosystem credit species. It is, however, both an ecosystem and species credit species. The Grey-headed Flying-fox is a dual credit species because foraging habitat is broad ranging but breeding camps are localised and, if impacted, must be offset by protecting and enhancing another breeding camp.

As no breeding camps would be impacted by the project and only foraging habitat was present, the Grey-headed Flying-fox was only identified as an ecosystem credit species. No species credits are required for the Grey-headed Flying-fox.

4.20 Revision of the Percentage Vegetation Cover calculations and associated GIS shapefile

Submission number(s)

35

Issue description

The respondents raised the following issues:

- It is unclear why areas of native vegetation identified as moderate to good condition have been excluded from GIS shapefile (CD_TNREISVegetationZonesJacobs_20170110_V03) for native vegetation.
- OEH recommends justification for the exclusion of these areas in accordance with the FBA, or the GIS shapefile be amended and appropriate recalculations be made to address the missing areas in the revised BAR.

The revised percent extent of native vegetation cover in the landscape and area to perimeter ratio calculations were undertaken using ESRI ArcGIS software. To undertake the assessment of landscape values, a 550 metre buffer was established from the outside edge of the construction

footprint as while this is a linear road project there are some detached construction compounds which made using a buffer from the centreline impossible.

Once the native vegetation cover had been digitised, the extent of native vegetation in the landscape before and after the development was recalculated (see Table 4.3). Current percent native vegetation cover is estimated at 12.26 per cent (score 2.5 as outlined in Table 16 of Appendix 5 of the FBA). After the development, percent native vegetation cover is estimated at 11.13 per cent (score 2.5 as outlined in Table 16 of Appendix 5 of the FBA). The score for percent native vegetation cover is 0.

Table 4.3 : Percent native vegetation cover in the landscape before and after development

Assessment buffer	Before development		After development		Score for % native vegetation cover
	Native vegetation cover (ha)	Cover (%)	Native vegetation cover (ha)	Cover (%)	
550m from the edge of the construction footprint	326.51	12.26	296.25	11.13	0

4.21 Avoidance of impacts

Submission number(s)

35

Issue description

OEH recommends that the BAR be updated to include adequate detail regarding the measures taken to avoid impacts to Cumberland Plain Woodland and River-flat Eucalypt Forest as well as areas of habitat for the *Marsdenia viridiflora* subsp. *viridiflora* endangered population, *Pultenaea parviflora*, Regent Honeyeater and Cumberland Plain Land Snail in accordance with the FBA.

The BAR details the measures taken to avoid impacts to Cumberland Plain Woodland and River-flat Eucalypt Forest as well as areas of habitat for the *Marsdenia viridiflora* subsp. *viridiflora* endangered population, *Pultenaea parviflora*, Regent Honeyeater and Cumberland Plain Land Snail.

Section 8.3.1.3 of the FBA states that the proponent must seek to avoid the direct impacts of the Major Project on all biodiversity values at the development site including impacts on:

- endangered ecological communities (EECs) and critically endangered ecological communities (CEECs), and
- PCTs that contain threatened species habitat, and
- areas that contain habitat for vulnerable, endangered or critically endangered threatened species or populations, as determined in accordance with Step 5 in Section 6.5.

Section 7.1 of the BAR outlines the measures that were taken to avoid impacts to EECs, CEECs, PCTs that contain threatened species habitat, and areas that contain habitat for vulnerable, endangered or critically endangered threatened species or populations. Chapter 4 of the EIS describes the alternatives to the project that were considered as part of the project development process and explains how and why the project was selected as the preferred option. Chapter 4 of the EIS also outlines how particular elements of the project have been refined.

All of the *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* records within the study area were made from habitat directly adjacent to the existing Northern Road and Kings Hill Road within Segment 1 that would be subject to road widening. There were no options for avoiding impacts to these species, as the existing road would be widened in this area instead of realigning the road.

Avoiding impacts to these species would require realignment of the existing Northern Road which would have greater impact than the widening.

For Segment 2 of the project, a Rapid Biodiversity Assessment (RBA) was undertaken in the area of the four short listed options under consideration. The aim of the RBA was to make an initial preliminary assessment of significant ecological values potentially affected by the Segment 2 short listed options to inform decision-making for a preferred route and thus inform the concept design and Environmental Assessment. The RBA involved desktop analysis and field surveys and included plot-based vegetation condition assessment, fauna habitat assessment and targeted searches for threatened species. An analysis of the biodiversity data was undertaken with reference to the short listed route options proposed (i.e. east vs west options). The analysis was undertaken within a GIS by overlaying the short listed options onto the vegetation mapping layer that showed TECs and known or potential habitat for threatened species. Potential worst-case impacts were quantified based on a 100-metre-wide corridor and considered impacts to TECs, further fragmentation of woodland, and the direct loss of vegetation / habitat. Impacts to TECs (i.e. Cumberland Plain Woodland and River-flat Eucalypt Forest) were estimated to be greater for the eastern option. The total loss of vegetation and habitat (including habitat for Regent Honeyeater, Cumberland Plain Land Snail) would be greatest with the eastern option. The Western Option was chosen for the project as there were predicted to be lesser impact to TECs and habitats.

4.21.1 Avoidance with the detailed design

The impact calculations as part of the BAR were based on a worst case scenario involving clearing of all vegetation and habitat within the construction boundary based on the EIS design. The detailed design shows the revised areas where construction will take place and where the final operational footprint would be positioned.

The detailed design has resulted in the following reduction of impact:

- Impact to native vegetation has decreased by 3.50 hectares over the original design.
- Impact to 4 *Marsdenia viridiflora* subsp. *viridiflora* plants along the DEOH fence has been avoided as this area won't be used for construction or operation.
- The impact to *Pultenaea parviflora* has increased to six plants after the additional targeted survey for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* was undertaken in an expanded study area around the Vineyard Road extension on the 7th August 2017. Six *Pultenaea parviflora* plants were found in the area of the Vineyard Road extension of which four would be avoided as they are outside of the construction footprint.
- The impact to habitat for the EPBC Act listed species' Grey-headed Flying-fox, Regent Honeyeater, Swift Parrot and Large-eared Pied Bat has been reduced by 2.15 hectares.
- The impact to the TSC Act listed critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community has reduced by 2.96 hectares.
- The impact to the TSC Act listed River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions endangered ecological community has been reduced by 0.43 hectares
- The impact to the EPBC Act listed critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community has been reduced by 1.29 hectares.

4.22 Additional offsets for impacts to Cumberland Plain Woodland

Submission number(s)

27, 35

Issue description

- A respondent commented on the ineffectiveness of BioBanking as the only vehicle for offsetting losses
- OEH considers the loss of approximately 29.15 ha of moderate/good condition Cumberland Plain Woodland (including 1.25 ha in high condition), and associated indirect impacts resulting from fragmentation, to be unacceptable without the implementation of additional offsets (above those already calculated), supplementary measures or other actions.

Roads and Maritime are currently working in consultation with OEH to address this matter and determine the quantum of offsets or supplementary measures that are required. Supplementary measures at a landscape scale are being investigated in conjunction with the OEH.

Following recent discussions with Roads and Maritime, DoEE and OEH, it was decided that an additional supplementary measures package would be developed in consultation with OEH and DoEE with a focus on landscape scale measures within the local area. The package may include measures such as weed eradication programs within Cumberland Plain Woodland.

4.23 Measures to secure offsets

Submission number(s)

27, 35

Issue description

- Requests that Roads and Maritime procure land to be managed for conservation
- OEH recommends further information be provided detailing the measures that will be taken to secure the required credits for the Regent Honeyeater and *Marsdenia viridiflora* subsp. *viridiflora*.

The BOS identifies that no credits are available to meet the offset requirements for the Regent Honeyeater and *Marsdenia viridiflora* subsp. *viridiflora* - endangered population, but that land may be available (for future creation of credits) via an expression of interest on the BioBanking Public Register.

If credits for Regent Honeyeater and *Marsdenia viridiflora* subsp. *viridiflora* (or any other required credit) are unavailable for purchase on the market, the first step is that Roads and Maritime would work with public and private landholders to enter a BioBanking Agreement on their land and then purchase the credits issued.

4.24 Clearing of vegetation within the DEOH fence line for an access track

Submission number(s)

35

Issue description

OEH is aware that the Department of Defence will need to clear vegetation to provide vehicle access along the inside of the new fenceline in some parts of the project. OEH considers any clearing of vegetation required a consequence of the project should be addressed in the assessment of impacts. It is unclear if this has occurred. If not, an adjustment to the calculations of offset credits will be necessary prior to the approval of the BOS.

The potential loss of vegetation and habitat associated with the project is summarised in Table 3.3. The construction footprint would impact on up to about 40.79 hectares of native vegetation (see Table 3.3). This is a decrease of 3.50 hectares over the original design (the original impact to all Vegetation Zones was 44.29 hectares). These impacts have been quantified based on the development footprint after detailed design and take into consideration potential temporary disturbance during construction including compound sites and upgrading of drainage (refer to Section 3).

This revised design and associated re-calculation also takes into account the clearing that the Department of Defence will need to clear vegetation to provide vehicle access along the inside of the new fence line in some parts of the project.

4.25 Surveys constrained by property access

Submission number(s)

35

Issue description

The respondent noted that threatened species surveys for areas which were constrained by property access would need to be completed (and new calculations performed, if necessary) prior to finalisation of the BOS.

An additional targeted survey for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* was undertaken in an expanded study area around the Vineyard Road extension on the 7th August 2017. This area was not able to be accessed during the fieldwork undertaken for the original assessment. An area of habitat of approximately 4.7 hectares was surveyed by an experienced botanist following the methods described in the *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage, 2016). Traverses of this habitat were undertaken over a three-hour period for a distance of 3.131 kilometres (3,131 metres) (see Figure 3.1).

The survey located a further six *Pultenaea parviflora* plants (two of which were in the development footprint, and four outside of the footprint). No additional *Marsdenia viridiflora* subsp. *viridiflora* were recorded. The additional impact to *Pultenaea parviflora* has been included in the reassessment of impacts.

4.26 Watercourse crossings over key fish habitat

Submission number(s)

38

Issue description

DPI raised the following issues:

- Recommends that the design of any upgraded and/or new culverts incorporates naturalised bases and a combination of elevated "dry" cells to encourage terrestrial movement, and recessed "wet" cells to facilitate fish passage
- Recommends that the EIS include a mitigation measure and condition of approval to outline that all works on waterfront land would be carried out in accordance with the DPI Water Guidelines.

Watercourse crossings over key fish habitat (as mapped by DPI Fisheries) should be designed and constructed to maintain fish passage, in accordance with the DPI Fisheries Policy and guidelines for fish habitat conservation and management.

Five waterway crossings in the study area, including the revised footprint, have been identified as Type 1 – Key Fish Habitats (DPI 2013), as they contain a combination of native aquatic plants and/or woody snags. These watercourses are impacted, intermittently flowing waterways which are also

identified as Class 2 – Moderate Key Fish Habitat (Fairfull and Witheridge, 2003) due to the presence of limited in stream aquatic vegetation.

All watercourse crossings are to be designed in accordance with Policy and Guidelines for Fish Friendly Waterway Crossings and Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge 2003).

4.27 A Vegetation Management Plan should be developed in consultation with DPI Water.

Submission number(s)

38

Issue description

- DPI requested that a Vegetation Management Plan be developed in consultation with DPI Water
- DPI require the identification and mapping of riparian corridors and associated setbacks in accordance with the DPI Water *Guidelines for controlled activities on waterfront land* (2012), and measures for rehabilitation and/or riparian offsets as required.

A new mitigation measure would be added to the revised environmental management measures for the project as follows (refer to Section 5):

A Vegetation Management Plan would be prepared in consultation with DPI Water prior to construction commencing, including details on:

- The riparian corridor widths along the watercourses in proximity to the project (so that these areas can be avoided where possible)
- Riparian areas potentially temporarily or permanently impacted by the project
- The rehabilitation of riparian areas temporarily impacted
- Riparian offsets as required in accordance with DPI guidelines for the riparian areas permanently impacted.

The Vegetation Management Plan will include a scaled map should be provided which identifies:

- The riparian corridor widths in proximity to the project so that these areas can be avoided where possible
- Riparian areas potentially temporarily or permanently impacted by the project
- Rehabilitation and/or riparian offset areas as required. Where the project encroaches on the outer riparian corridor (outer 50% of the vegetated riparian zone) the activity will be offset by connecting an equivalent area to the riparian corridor to ensure the average width of the vegetated riparian zone can be achieved over the length of the watercourse.

4.28 Macroinvertebrate survey monitoring

Submission number(s)

38

Issue description

DPI requested clarification regarding why the EIS does not propose macroinvertebrate survey monitoring along the tributaries of Blaxland Creek on the DEOH lands (Commonwealth land), Badgerys Creek, and Cosgrove Creek.

Site inspections undertaken for the aquatic assessment were visual only, no fish surveys or macroinvertebrate surveys were undertaken. Due to the low likelihood of threatened fish species

being present, limited water availability and limited aquatic habitat, fish and macroinvertebrate surveys were deemed unnecessary at the EIS stage.

4.29 Revegetation of riparian areas

Submission number(s)

11, 29, 38

Issue description

The respondents raised the following issues:

- The Surveyors Creek Corridor should be capped with suitable Cumberland Plain Woodland substrate via soil translocation at the conclusion of earthworks
- The site should be restored to BAM/FBA-criteria functional Cumberland Plain Woodland, preferably through 'Grassy Groundcover' or similar techniques
- Penrith City Council commented that mitigation measures are not identified in detail. Three additional mitigation measures regarding seeding and reuse of topsoil were identified as follows:
 - 1. Use of local provenance seed in all plantings.
 - 2. All areas that are to be grassed are to use direct seeding of native grasses and herbs as per Greening Australia's Grassy Groundcover Restoration.
 - 3. Reuse of topsoil from high quality bushland patches in vegetated fauna crossings and other areas to be revegetated.
- DPI recommends the following:
 - 1. Topsoil (and seedbank) should be removed from native vegetation areas that are to be permanently cleared and relocated and used in the revegetation of riparian areas
 - 2. Native plants should be transplanted from the areas to be permanently cleared to riparian land that is to be revegetated.

An urban design and landscape concept has been developed for the project as documented in the EIS, based on the project objectives and principles, to achieve an integrated design for the project. It incorporates the urban and landscape design concept plans for the project and a landscape planting concept including recommended species. As identified in the EIS, this would be adopted and further developed during detailed design and implemented as part of the Urban Design Landscape Plan (UDLP) for the project which is currently ongoing. There may be scope to include transplanting native species from areas to be cleared into revegetation areas but this would depend on the type of species being removed and the likely success of transplanting.

Plants to be used in revegetation would be sourced from local provenance seed where available and seed collection would be undertaken before clearing. There may be the opportunity for reuse of topsoil from cleared areas depending on the quality of the vegetation to be removed as the topsoil could contain a significant load of seed from exotic species and may not be suitable for reuse. Roads and Maritime would consider reuse of topsoil as part of the Urban Design Landscape Plan (UDLP) for the project.

5 Mitigation measures

Additional mitigation measures have been developed in response to the assessment of design refinements and in response to submissions. These are included in Table 5.1 and would be incorporated into the revised environmental management measures for the project.

Table 5.1: Revised environmental management measures – Biodiversity

Impact	Environmental management measures	Responsibility	Timing
Impacts to riparian corridors	<p>Vegetation Management Plan would be prepared in consultation with DPI Water prior to construction commencing, including details on:</p> <ul style="list-style-type: none"> The riparian corridor widths along the watercourses in proximity to the project (so that these areas can be avoided where possible) Riparian areas potentially temporarily or permanently impacted by the project The rehabilitation of riparian areas temporarily impacted Riparian offsets for the riparian areas permanently impacted. <p>The Vegetation Management Plan would include a scaled map should be provided which identifies:</p> <ul style="list-style-type: none"> The riparian corridor widths in proximity to the project so that these areas can be avoided where possible Riparian areas potentially temporarily or permanently impacted by the project Riparian offset areas. 	Construction contractor	Prior to construction
Revegetation	Roads and Maritime would consider reuse of topsoil as part of the Urban Design Landscape Plan (UDLP) for the project.	Roads and Maritime	Prior to construction
Revegetation	Roads and Maritime would consider transplanting native species from areas to be cleared into revegetation areas, depending on the type of species being removed and the likely success of transplanting. Plants to be used in revegetation would be sourced from local provenance seed where appropriate and available, and associated seed collection would be undertaken prior to clearing.	Roads and Maritime	Prior to construction

Impact	Environmental management measures	Responsibility	Timing
Impacts to <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> and <i>Pultenaea parviflora</i>	<p>Exclusion zones would be established around <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> plants proposed to be retained in the area of the DEOH fence between Kings Hill Road and Longview Road, in accordance with standard Roads and Maritime procedure.</p> <p>Exclusion zones would be established around the four <i>Pultenaea parviflora</i> plants to be retained in the area of the Vineyard Road extension in accordance with Roads and Maritime procedure.</p> <p>Roads and Maritime will investigate options for salvage of genetic material and/or translocation of <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> and <i>Pultenaea parviflora</i> plants that are to be impacted prior to construction.</p>	Construction contractor	Construction

6 Conclusions and recommendations

6.1 Design refinements

There have been a number of design refinements during detailed design of the project, as outlined in Chapter 5 of the Submissions and Preferred Infrastructure Report. These design refinements have resulted in changes to the construction and operational footprints which have affected the calculated impacts of the project as assessed and presented within the Biodiversity Assessment Report (BAR) and subsequently presented within the environmental impact statement (EIS).

This Memorandum has provided a revised assessment of these impacts under the Framework for Biodiversity Assessment (FBA) including recalculation of landscape values, impacts to native vegetation (including threatened ecological communities), impacts to threatened species, and impacts to Matters of National Environmental Significance (MNES).

Overall, the design refinements during detailed design would result in a reduction of impacts to biodiversity and have resulted in further avoidance of impacts to ecological values. Indeed, the direct impact to threatened ecological communities and threatened species would also be reduced from those presented in the BAR assuming the implementation of all relevant revised environmental management measures for the project.

6.2 Issues raised by Stakeholders and the community

A number of submissions were received from stakeholder and the community during the EIS exhibition, including issues related to biodiversity.

The main comments made by community respondents related to:

- Dewatering and backfilling of dams and impacts to biodiversity
- Impacts on wildlife corridors and habitat connectivity
- Impacts to large remnant trees
- Impacts due to landscaping and lighting
- Impacts to Cumberland Plain Woodland
- The details of mitigation measures such as underpasses and staging of works
- Impacts to threatened species with the extension of Vineyard Road.

Government agency submissions were also received from the Office of Environment and Heritage (OEH) and the Department of Primary Industries (DPI) regarding a range of biodiversity related issues.

These have been addressed and responded to within this Memorandum, including further impact assessment and revised environmental management measures where required. These responses would be incorporated into the relevant sections of the Submissions and Preferred Infrastructure Report.

Appendix A – Raw field data sheets

NS26 Mod/Good
JACOBS

BioBanking Field Sheet

Entered ✓
Alluvial - Good

Survey Site Form - BioBanking				Site ID: P12-2		Vegetation zone: CRFF	
Date: 18/11/2015				Surveyor(s): LC			
Waypoint ID: -676				Photo numbers: 2253		2356	
Coordinates: E 0286959 N 6257714				Photo direction: N		E S W	
Mapped Vegetation type: CRFF				Condition: Low		Mod good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): flat		Altitude: 66m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Undecided? <input type="checkbox"/>							
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	.						
T1	15.35m			<i>Eucalyptus tereticornis</i>			
T2	8.10m			<i>Eucalyptus tereticornis</i>			
T3	.						
S1	.			<i>Eucalypt regn.</i>			
S2	.						
G	.			<i>Sida Microcalva (d)</i> <i>Bidens</i>			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %	Native grass tally -		Total (hits/50)	
5m	30	0	0			60%	
10m	30	0	0				
15m	5	0	0				
20m	20	0	0				
25m	10	0	0				
30m	10	0	0				
35m	40	0	0				
40m	30	0	0				
45m	40	0	0			0%	
50m	0	0	0			100%	
Total (sum / 10) = 21.5				Native shrub tally -		Total (hits/50)	
Larger 50 x 20m plot							
Length of woody debris >10cm wide & >0.5m long				0		0%	
Proportion of canopy sp. regeneration				100%		40%	
Number of trees with hollows >5cm				2			

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Site ID: P12-2			Survey type: Quadrat 20m x 20m			
Species	Cover	Abund.	Species	Cover	Abund.	
1 Eucalyptus tecticornia	6	49	41			
2 Sida acuta	4	20	42			
3 Microlaena stipoides	5	20	43			
4 Bidens pilosa	3	20	44	Dam/wetland - out of plot		
5 Arctostaphylos	2	20	45			
6 Oxalis	1	1	46	Typha australis		
7 Cirsium vulgare	1	1	47	Juncus acutus		
8 Platago lanceolata	1	1	48	Cycloperum heterophyllum		
9 Cypripedium	1	1	49	Blackberry		
10 Adiantum reginae	2	20	50	Canyza		
11 Hypochaeris radicata	1	1	51	Triplachya		
12 Scirpus madagascariensis	2	20	52	Fireweed		
13 Anagallis arvensis	2	20	53	Canyza		
14 Erechtos sphaerocarpus	1	1	54	Centella		
15 Cycloperum heterophyllum	2	20	55	Lachnagrostis filiformis		
16 Canyza baccata	1	1	56	Juncus floridatus		
17 Glycyrrhiza	2	20	57	Lilium - small		
18 Eriodictyon	2	20	58	Mimiphyllum		
19 Rumex	1	1	59	Persicaria - purple spotted		
20 Opuntia stricta	1	2	60	Ranunculus muricatus		
21			61	Festuca distichum		
22			62	Persicaria - shield leaf		
23			63	Sagittaria?		
24			64	Rumex		
25			65	Sonchus		
26			66	Epilobium		
27			67	Nymphaea - pink		
28			68	Nardoo		
29			69			
30			70			
31			71			
32			72			
33			73	Hakea sericea at road edge		
34			74			
35			75			
36			76	678 - Angophora subulata - 1m dbh		
37			77			
38			78			
39			79			
40			80			

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree			Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blauquet 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1	<5% - rare		Plot Disturbance	Fire damage:				
2	<5% - common		Clearing (inc. logging):	Storm damage:				
3	5 - 25%		Cultivation (inc. pasture):	Trampling:				
4	25 - 50%		Soil erosion:	Flood damage:				
5	50 - 75%		Firewood collection:	Feral herbivores:				
6	75 - 100%		Stock grazing:	Other:				

Survey Site Form - BioBanking				Site ID: P12 - 1		Vegetation zone: CRFF CRFF - alluvial	
Date	18/11/2015			Surveyor(s): LC			
Waypoint ID	673			Photo numbers	2345	→	2348
Coordinates	E 0286947 N 6257885			Photo direction	N	E	S
Mapped Vegetation type: CRFF CRFF				Condition:	Low	Medium good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): E		Altitude: 64m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass =			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E							
T1	15-25m			Eucalyptus amplitalis Eucalyptus crebra			
T2							
T3	1-8m			Eucalyptus crebra			
S1							
S2							
G				Sida Hypochaeris Eragrostis amabilis Cenchrus Bidens Moth Vine Microdora			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	10	0	0	Native grass tally -			
10m	25	0	0				
15m	20	0	0				
20m	15	0	0				
25m	0	0	0				
30m	5	0	0	Native other (herb, fern, sedge, etc) tally - 1			
35m	40	0	0				
40m	50	0	0				
45m	30	0	0				
50m	40	0	0				
Total (sum / 10) = 23.5%				Native shrub tally -			
Larger 50 x 20m plot				Total (hits/50)			
Length of woody debris >10cm wide & >0.5m long				0%			
Proportion of canopy sp. regeneration				100%			
Number of trees with hollows >5cm				3			
				Exotic tally -			
				Total (hits/50)			
				54%			

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Site ID: P12-1		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1 <i>Eucalyptus amplifolia</i>	3	7	41					
2 <i>Eucalyptus acalypha</i>	5	42	42					
3 <i>Erigeron annuus</i>	3	12	43					
4 <i>Arctostaphylos</i>	2	20+	44					
5 <i>Sida</i>	3	20+	45					
6 <i>Centella asiatica</i>	3	20+	46					
7 <i>Plantago lanceolata</i>	2	20+	47					
8 <i>Microstachya stipoides</i>	4	20+	48					
9 <i>Cymbopogon refractus</i>	1	1	49					
10 <i>Stenotaphrum secundatum</i>	2	20+	50					
11 <i>Bidens pilosa</i>	2	20+	51					
12 <i>Cyperus gracilis</i>	2	20+	52					
13 <i>Cyperus leptophyllus</i>	2	20+	53					
14 <i>Plantago</i>	2	20+	54					
15 <i>Cirsium vulgare</i>	1	2	55					
16 <i>Briza subaetida</i>	2	20+	56					
17 <i>Hypochaeris radicata</i>	2	20+	57					
18 Pine	1	2	58					
19 <i>Juncus urbinatus</i>	1	1	59					
20 <i>Brunonella australis</i>	1	1	60					
21			61					
22			62					
23			63					
24			64					
25			65					
26			66					
27			67	GPS 674 & 675				
28			68	large E. amplifolia	2m dbh			
29			69	E. frutescens				
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	8		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1	<5% - rare	Plot Disturbance		Fire damage:				
2	<5% - common	Clearing (inc. logging):		Storm damage:				
3	5 - 25%	Cultivation (inc. pasture):		Trampling:				
4	25 - 50%	Soil erosion:		Flood damage:				
5	50 - 75%	Firewood collection:		Feral herbivores:				
6	75 - 100%	Stock grazing:		Other:				

HN526 Mod/Wood

BioBanking Field Sheet

Entered ✓

JACOBS

Alluvial - Good

Survey Site Form - BioBanking				Site ID: P12-3		Vegetation zone: CPW	
Date: 18/11/2015				Surveyor(s): LC			
Waypoint ID: 677				Photo numbers: 2375		2378	
Coordinates: E N				Photo direction: N		E S W	
Mapped Vegetation type: CPW				Condition: Low		Mid-good	
Slope: Gentle, Mod, Steep				Aspect (degrees or cardinal): flat		Altitude: 68m	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: erect, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Undecided? <input type="checkbox"/>							
Vegetative Structure (formation) = Open Forest				Ecologically Dominant Layer (EDL) - most biomass = canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	.	.	.				
T1	15-20m			Eucalyptus mellucena (d)			
T2	6-8m			Angophora Halimda			
T3	.						
S1	1-2m			Acacia parramattensis African olive Halimda senilis ?!			
S2	.						
G	.			Microlaena Bidens Sida argentea canopy Ginodora			
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)							
Definitions							
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated							
Estimated cover i = isolated (0.2-2%); v = very sparse (2-50%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)							
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall							
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest							
50m Transect				10 Points - Foliage Projective Cover			
Point	Canopy % (photos)	Midstorey %	Exotic %	Ground cover tally sheet, 50 points along 50m transect			
5m	0	0	0	every 1m record if plant intersects (hits) point			
10m	0	0	0	Native grass tally - 			
15m	50	0	0	Total (hits/50) 40%			
20m	0	0	0	Native other (herb, fern, sedge, etc) tally - 			
25m	0	0	0	Total (hits/50) 10%			
30m	0	0	0	Native shrub tally -			
35m	60	0	0	Total (hits/50) 0%			
40m	30	0	0	Exotic tally - 			
45m	10	0	0	Total (hits/50) 50%			
50m	10	0	0				
Total (sum / 10) = 16							
Larger 50 x 20m plot							
Length of woody debris >10cm wide & >0.5m long				0m			
Proportion of canopy sp. regeneration				100%			
Number of trees with hollows >5cm				1			

JACOBS

Site ID: P12-3			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 <i>Eucalyptus moluccana</i>	3	3	41						
2 <i>Anagallis flavida</i>	1	1	42						
3 <i>Acacia parvifolia</i>	1	1	43						
4 <i>Albizia leucacantha</i>	1	1	44						
5 <i>Pithecellobium dulce</i>	1	1	45						
6 <i>Avicennia nitida</i>	2	20+	46						
7 <i>Microstema stipoides</i>	4	20+	47						
8 <i>Sida rhomboides</i>	2	20+	48						
9 <i>Bidens pilosa</i>	2	20+	49						
10 <i>Bromelia ciliaris</i>	2	20+	50						
11 <i>Anagallis arvensis</i>	2	20+	51						
12 <i>Senecio radicans</i>	2	20+	52						
13 <i>Cirsium vulgare</i>	1	1	53						
14 <i>Albizia leucacantha</i>	2	20+	54						
15 <i>Platago lanceolata</i>	1	1	55						
16 <i>Dichondra repens</i>	3	20+	56						
17 <i>Caryota brevifolia</i>	1	1	57						
18 <i>Cycloperum leptophyllum</i>	1	20+	58						
19 <i>Briza subaristata</i>	1	1	59						
20 <i>Centropus</i>	1	1	60						
21 <i>Hypochaeris radicata</i>	1	1	61						
22 <i>Chelidonium majus</i>	2	20+	62						
23 <i>Cymbopogon nardus</i>	2	5	63						
24 <i>Crucianella curvata</i>	2	20+	64						
25 <i>Richtia stelleri</i>	1	1	65						
26 <i>Phyllanthus / Euphorbia</i>	1	1	66						
27 <i>Briza pinnatifida</i>	1	1	67						
28 <i>Albizia leucacantha</i>	1	1	68						
29 <i>Oralis - hairy</i>	1	1	69						
30 <i>Tiny Waltheria</i>	1	1	70						
31 <i>Vittadinia ?</i>	1	1	71						
32 <i>Cynodon dactylon</i>	1	1	72						
33 <i>Conoclinium gracile</i>	1	1	73						
34 <i>Large Waltheria</i>	1	1	74						
35 <i>Crucianella hederacea</i>	1	1	75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	18		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:					
			Clearing (inc. logging):	Storm damage:					
			Cultivation (inc. pasture):	Trampling:					
			Soil erosion:	Flood damage:					
			Firewood collection:	Feral herbivores:					
			Stock grazing:	Other:					

HN 526 Mod/Good

BioBanking Field Sheet

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Alluvial - Good

JACOBS

Survey Site Form - BioBanking				Site ID: P12-4		Vegetation zone: CRFF	
Date	18/11/2014			Surveyor(s): LC			
Waypoint ID	079			Photo numbers	2382	2385	
Coordinates	E N			Photo direction	N	E	S W
Mapped Vegetation type: CRFF				Condition:		Low	Mod/Good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): flat		Altitude: 71m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	10-15m			<i>E. tereticornis</i> <i>E. cabra</i> <i>A. subulatus</i> <i>E. molluccana</i>			
T2	-						
T3	-			<i>Acacia parramattensis</i>			
S1	1-2m			<i>Bursaria spinosa</i>			
S2	-						
G	-			<i>Dichradia repens</i> <i>Alysicarpus</i>			
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)							
Definitions							
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated							
Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)							
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall							
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest							
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	30	10	0	Native grass tally - 			Total (hits/50)
10m	20	10	0				18%
15m	20	10	0				
20m	40	0	0				
25m	40	10	0				
30m	30	0	0	Native other (herb, fern, sedge, etc) tally - 			Total (hits/50)
35m	30	0	0	 			72% 48%
40m	10	0	0				
45m	5	10	0				
50m	20	0	0				
Total (sum / 10) = 24.5% 5% 0%				Native shrub tally -			Total (hits/50)
Larger 50 x 20m plot							
Length of woody debris >10cm wide & >0.5m long			7m				0%
Proportion of canopy sp. regeneration			100%	Exotic tally - 			Total (hits/50)
Number of trees with hollows >5cm			1				8%

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Site ID: P12-4			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1. <i>Angophora subulata</i>	3	4	41					
2. <i>Eucalyptus turtica</i>	3	20	42					
3. <i>Eucalyptus acuta</i>	2	3	43					
4. <i>Eucalyptus mellucera</i>	1	2	44					
5. <i>Bursaria spinosa</i>	3	20	45					
6. <i>Dichondra repens</i>	4	20	46					
7. <i>Microdora stipoides</i>	3	20	47					
8. <i>Glycine tabacina</i>	2	20	48					
9. <i>Chrysanthemum</i>	1	20	49					
10. <i>Acacia parvifolia</i>	1	1	50					
11. <i>Thymelaea</i>	1	1	51					
12. <i>Cratogeomys</i>	2	20	52					
13. <i>Chlidanthus sieberi</i>	2	20	53					
14. <i>Sarcocolla madagascariensis</i>	1	1	54					
15. <i>Cynobogon stracheyi</i>	1	1	55					
16. <i>Arundinaria coarctata</i>	2	20	56					
17. <i>Opuntia stricta</i>	1	1	57					
18. <i>Taraxacum</i>	1	1	58					
19. <i>Stachys</i>	1	1	59					
20. <i>Euphorbia</i>	1	3	60					
21. <i>Cirsium vulgare</i>	1	1	61					
22			62					
23			63					
24			64					
25			65					
26			66					
27			67					
28			68					
29			69					
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	17		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blauquet 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare			Plot Disturbance:		Fire damage:			
2 <5% - common			Clearing (inc. logging):		Storm damage:			
3 5 - 25%			Cultivation (inc. pasture):		Trampling:			
4 25 - 50%			Soil erosion:		Flood damage:			
5 50 - 75%			Firewood collection:		Feral herbivores:			
6 75 - 100%			Stock grazing:		Other:			

HN 526 Mod/Good - Poor

BioBanking Field Sheet

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site 46.

Alluvial

Mod/Good - Poor

Survey Site Form - BioBanking				Site ID: 200	Vegetation zone:
Date	2/9/2015			Surveyor(s):	Lukas Clews
Waypoint ID	46			Photo numbers	1243 1244 1242
Coordinates	E N			Photo direction	N E S W
Mapped Vegetation type: <u>CPW</u>				Condition:	Low <u>Mod-good</u>
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): <u>W</u>		Altitude: <u>74m</u>	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, Depression, watercourse, escarpment, terrace					
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?					
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill	
Remnant / Old growth (uncleared): Yes / <u>No</u> / Undecided? <u>Young trees</u> <u>grazed.</u>					
Vegetative Structure (formation) = <u>Open forest</u>				Ecologically Dominant Layer (EDL) - most biomass = <u>Canopy</u>	
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance	
E	-				
T1	15-20m			<u>Eucalyptus mellucera</u> <u>Eucalyptus tecticornis</u> <u>E. kintoreana?</u> <u>eugenioides</u>	
T2	-				
T3	-				
S1	-			<u>Bursaria spinosa</u> <u>Araucaria</u>	
S2	-				
G	-			<u>Dichandra</u> <u>repens</u> <u>Gnaphalium</u> <u>microchaeta</u> <u>Solanum</u> <u>paniculatum</u>	
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%) Definitions Dominance d = dominant; c = co-dominant; s = subdominant; a = associated Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%) Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest					
50m Transect				Ground cover tally sheet, 50 points along 50m transect	
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point	
Point	Canopy % (photos)	Midstorey %	Exotic %		
5m	20	20	0	Native grass tally - <u> </u>	Total (hits/50) <u>8%</u>
10m	10	0	0		
15m	5	0	0		
20m	30	0	0		
25m	30	0	0		
30m	20	0	0	Native other (herb, fern, sedge, etc) tally - <u> </u> <u> </u> <u> </u>	Total (hits/50) <u>22%</u>
35m	40	0	0		
40m	50	0	0		
45m	50	0	0		
50m	25.5	2%	0%		
Total (sum / 10) = <u>28.5</u> <u>2.7</u> <u>0%</u>				Native shrub tally -	
Larger 50 x 20m plot				Total (hits/50)	
Length of woody debris >10cm wide & >0.5m long			0	<u>0%</u>	
Proportion of canopy sp. regeneration			100%	Exotic tally - <u> </u> <u> </u> <u> </u> <u> </u>	
Number of trees with hollows >5cm			0	Total (hits/50) <u>36%</u>	

JACOBS

Site ID: 16			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1. <i>Cymbonotus</i>	2	5	41					
2. <i>Solanum pinnatifidum</i>	2	20+	42					
3. <i>Medicago coccinea</i>	2	20+	43					
4. <i>Chenopodium</i>	2	20+	44					
5. <i>Dichandra repens</i>	3	20+	45					
6. <i>Eriodia montana</i>	2	20+	46					
7. <i>Cirsium vulgare</i>	2	20+	47					
8. <i>Eucalyptus moluccana</i>	5	40	48					
9. <i>Eucalyptus tereticornis</i>	2	4	49					
10. <i>Bursera spinosa</i>	2	20	50					
11. <i>Oxalis yellow</i>	2	20+	51					
12. <i>Coryza</i>	2	20+	52					
13. <i>Urtica incisa</i>	2	20+	53					
14. <i>Anagallis arvensis</i>	2	20+	54					
15. <i>Cyperus gracilis</i>	2	20+	55					
16. <i>Pennisetum clandestinum</i>	4	20+	56					
17. <i>Casuarina glauca</i>	1	1	57					
18. <i>Olea avicarpa</i>	2	20+	58					
19. <i>Solanum pinnatifidum</i>	1	1	59					
20. <i>Platago lanceolata</i>	2	20+	60					
21. <i>Alysicarpus talassicus</i>	2	20+	61					
22. <i>Senecio virens</i>	2	20+	62					
23. <i>Lotus</i>	2	20+	63					
24. <i>Sida rhombifolia</i>	2	20+	64					
25. <i>Richardia</i>	2	20+	65					
26. <i>Poa annua</i>	2	20+	66					
27. <i>Lomandra confertifolia</i>	1	3	67					
28. <i>Sonchus oleraceus</i>	1	1	68					
29. <i>Araucaria arborescens</i>	1	1	69					
30. <i>Clerodendron</i>	1	1	70					
31. <i>Brassica</i>	1	1	71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	14		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare			Plot Disturbance			Fire damage:		
2 <5% - common			Clearing (inc. logging):			Storm damage:		
3 5 - 25%			Cultivation (inc. pasture):			Trampling:		
4 25 - 50%			Soil erosion:			Flood damage:		
5 50 - 75%			Firewood collection:			Feral herbivores:		
6 75 - 100%			Stock grazing:			Other:		

JACOBS

Alluvial - Poor

Survey Site Form - BioBanking				Site ID: 39-1		Vegetation zone: CAW / RPEF	
Date: 2/1/2015				Surveyor(s):			
Waypoint ID: 39-1				Photo numbers: 1245			
Coordinates: E N				Photo direction: N		E S W	
Mapped Vegetation type: RPEF / CAW				Condition: Low		Mod: good	
Slope: Gentle Mod. Steep		Aspect (degrees or cardinal): S		Altitude: 91m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided? large trees							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance:			
E							
T1	20-25m			Eucalyptus moluccana Eucalyptus tereticornis Angophora floribunda			
T2							
T3							
S1	2-6m			Aracia melanoxylon Olea europaea			
S2							
G				Pennisetum clandestinum Malva parviflora Flowered Solanum, Vetch, couch			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %			Total (hits/50)	
5m	40	0	0	Native grass tally - 		36%	
10m	40	0	0				
15m	20	0	0				
20m	0	0	0				
25m	0	0	0				
30m	0	0	0	Native other (herb, fern, sedge, etc) tally - 		2%	
35m	0	0	0				
40m	0	0	0				
45m	20	10	0				
50m	20	20	40				
Total (sum / 10) = 15 3 4				Native shrub tally -		0%	
Larger 50 x 20m plot							
Length of woody debris >10cm wide & >0.5m long				0m			
Proportion of canopy sp. regeneration				100%			
Number of trees with hollows >5cm				0			
				Exotic tally - 		62%	

JACOBS

Site ID: 39-1			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 Eucalyptus mellurana -	4	2	41						
2 Eucalyptus tereticornis -	4	2	42						
3 Malva parviflora	3	20+	43						
4 Spodopogon	3	20+	44						
5 Rumex crispus	2	20+	45						
6 Pennisetum clandestinum	5	20+	46						
7 Microstachya stipoides -	3	20+	47						
8 Vicia sativa	2	20+	48						
9 Tetragonia tetragonioides -	2	20+	49						
10 Cirsium vulgare	2	20+	50						
11 Medicago polymorpha	2	20+	51						
12 Solanum elaeagnifolium	1	1	52						
13 Senecio madagascariensis	2	20+	53						
14 Solanum elaeagnifolium	1	1	54						
15 Platoglossum	2	20+	55						
16 Aracia nuda	2	3	56						
17 Lysium ferocissimum	1	1	57						
18 Bidens pilosa	1	1	58						
19 Eriogonum cicutaria	3	20+	59						
20 Taraxacum officinale	1	1	60						
21 Forficula vulgare	1	1	61						
22 Solanum pseudocarpum	1	1	62						
23 Chickweed	2	20+	63						
24 Chloris gayana	2	20+	64						
25 Cyperus sp.	1	1	65						
26 Rumex crispus	2	20+	66						
27 Geranium	1	1	67						
28 Hypochaeris radicata	2	20+	68						
29 Verbena bonariensis	1	1	69						
30 Eragrostis curvula	1	1	70						
31 Aristida sp. vagans -	2	20+	71						
32 Chloris verticillata -	2	20+	72						
33 Themeda triandra -	2	20+	73						
34 Cyperus gracilis -	2	20+	74						
35 Conyza bonariensis	1	1	75						
36 Bromus catharticus	2	20+	76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	11		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale			Leaf & stick litter						
Modified Braun-Blanquet 6 scale			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1	<5% - rare		Plot Disturbance	Fire damage:					
2	<5% - common		Clearing (inc. logging):	Storm damage:					
3	5 - 25%		Cultivation (inc. pasture):	Trampling:					
4	25 - 50%		Soil erosion:	Flood damage:					
5	50 - 75%		Firewood collection:	Feral herbivores:					
6	75 - 100%		Stock grazing:	Other:					

HN 526 Mod/Good-Poor

BioBanking Field Sheet

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Alluvial-Poor

Survey Site Form - BioBanking				Site ID: 39-2		Vegetation zone: Awley CPW	
Date: 2/9/2015				Surveyor(s): Lukas Claus			
Waypoint ID: 39-2				Photo numbers: 1259		1260	
Coordinates: E				Photo direction: N		E	
N				S		W	
Mapped Vegetation type: CPW?				Condition: Low		Mod-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): NW		Altitude: 83m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation): Open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	10-30m			Eucalyptus tereticornis Casuarina glauca			
T2	-						
T3	2-8m			Olca europaea			
S1	-			Bursaria spinosa Dillwynia sieberi			
S2	-						
G	-			Anistda, Theseda, Didymandra clenatis			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover - i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	30	30	30	Native grass tally - 			Total (hits/50) 42%
10m	0	0	100				
15m	0	0	90				
20m	20	10	0				
25m	50	50	10				
30m	30	5	60	Native other (herb, fern, sedge, etc) tally - 			Total (hits/50) 26%
35m	20	10	60				
40m	30	10	70				
45m	60	0	40				
50m	0	0	0				
Total (sum / 10) = 24				Native shrub tally -			Total (hits/50)
Larger 50 x 20m plot							Total (hits/50) 0%
Length of woody debris >10cm wide & >0.5m long 2							
Proportion of canopy sp. regeneration 100%				Exotic tally - 			Total (hits/50)
Number of trees with hollows >5cm 0							10%

JACOBS

Site ID: 39-2			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 Asperula rubra -	2	20+	41						
2 Dillwynia sieberi -	4	20+	42						
3 Aca eucalypta	5	20+	43						
4 Eucalyptus tereticornis -	5	20+	44						
5 Bursaria spinosa -	3	20+	45						
6 Indigofera australis -	1	1	46						
7 Arctostaphylos -	1	1	47	- 3 main vein					
8 Dicranodes repens -	2	20+	48						
9 Theophrasta -	3	20+	49						
10 Clematis -	2	20+	50						
11 Brunoniella australis -	2	20+	51						
12 Verbena	2	20+	52						
13 Glycine tabacina -	2	20+	53						
14 Aristida vagans -	4	20+	54						
15 Senecio madagascariensis	1	1	55						
16 Cirsium vulgare	1	1	56						
17 Desmodium illinoense -	1	1	57						
18 Glycine clandestina -	2	20+	58						
19 Convolvulus arvensis -	1	1	59						
20 Cyperus sp.	1	1	60						
21 Centella asiatica -	1	1	61						
22 Casuarina glauca -	2	6	62						
23 Opiliones adustus -	1	2	63						
24 Ajuga australis -	1	1	64						
25 Lantana	1	1	65						
26 Geranium -	2	20+	66						
27 Cotula	1	1	67						
28 Plectrothrips parviflorus -	1	1	68						
29 Pratia purpurascens -	2	20+	69						
30 Bidens biternata	1	1	70						
31 Echinata erecta	2	20+	71						
32 Taraxacum officinale	1	1	72						
33 Arctostaphylos -	1	1	73						
34 Darcia squarrosa	1	1	74						
35 Eremophila debilis -	1	1	75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	27		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:					
			Clearing (inc. logging):	Storm damage:					
			Cultivation (inc. pasture):	Trampling:					
			Soil erosion:	Flood damage:					
			Firewood collection:	Feral herbivores:					
			Stock grazing:	Other:					

JACOBS

Alluvial - Poor

Survey Site Form - BioBanking				Site ID: 59		Vegetation zone: RFEF	
Date	2/9/2015			Surveyor(s): Lukas deWes			
Waypoint ID	59			Photo numbers			
Coordinates	E N			Photo direction		N E S W	
Mapped Vegetation type: RFEF				Condition:		Low Med-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): SSW		Altitude: 82m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	.						
T1	20-28m			<i>Eucalyptus</i> <i>Eucalyptus nidiuensis</i> <i>Angophora</i>			
T2	.						
T3	.						
S1	1-2m			<i>Bursaria spinosa</i> <i>Alnus excelsa</i>			
S2	.						
G	.			<i>Microkales stipoides</i> <i>Sesuvio madagascariensis</i> <i>Cirsium vulgare</i> <i>Gynodon dactylon</i>			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point		Total (hits/50)	
5m	5	10	0	Native grass tally -		76%	
10m	5	20	0				
15m	5	10	0				
20m	5	20	0				
25m	40	15	0				
30m	30	10	0	Native other (herb, fern, sedge, etc) tally -		Total (hits/50)	
35m	20	10	0			10%	
40m	5	20	0				
45m	10	5	0				
50m	10	0	0				
Total (sum / 10) = 13% 12% 0%				Native shrub tally -		Total (hits/50)	
Larger 50 x 20m plot						4%	
Length of woody debris >10cm wide & >0.5m long				5m			
Proportion of canopy sp. regeneration				100%		Total (hits/50)	
Number of trees with hollows >5cm				0		4%	

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Site ID: 59			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1 Indigofera australis -	2	2	41					
2 chickweed	2	20+	42					
3 Microseris stipoides -	4	20+	43					
4 Oxalis yellow	2	20+	44					
5 Dichondra repens -	2	20+	45					
6 Alysic. deflexa -	2	20+	46					
7 Senecio madagascariensis	2	20+	47					
8 Hypochaeris radicata	2	20+	48					
9 Cirsium vulgare	2	20+	49					
10 Asperula rubra -	2	20+	50					
11 Alysic. tabernaem -	2	20+	51					
12 Plantago lanceolata	2	20+	52					
13 Bursaria spinosa -	4	20+	53					
14 Eucalyptus mollissima -	5	24	54					
15 Eucalyptus tereticornis -	3	3	55					
16 Geranium sp.	3	20+	56					
17 Convolvulus erubescens -	1	2	57					
18 Trifolium repens	2	20+	58					
19 Oxalis yellow	1	20+	59					
20 Brunoniella australis -	2	20+	60					
21 Sida acuminifolia	1	2	61					
22 Anemone sp.	1	1	62					
23 Runtex crispus	1	2	63					
24 Plectrathus parviflor -	1	2	64					
25 Oryz. europaea	3	20+	65					
26 Mediola caroliniana	1	1	66					
27 Hypochaeris radicata	1	20+	67					
28 Colula	1	20+	68					
29 Aristida	3	20+	69					
30 Lotus sp.	1	1	70					
31 Blackberry	2	20+	71					
32 Solanum / spiky apple	1	1	72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	18		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

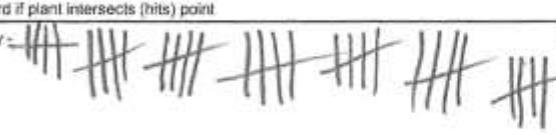

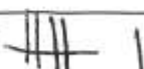
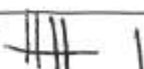
UN526 Mod/wood - Poor

BioBanking Field Sheet

atod ✓

JACOBS

Alluvial - Poor

Survey Site Form - BioBanking				Site ID: 60		Vegetation zone: RFEF	
Date	3/9/2015			Surveyor(s): Lukas Lewis			
Waypoint ID	60			Photo numbers	1276	1277	
Coordinates	E			Photo direction	N	E	S W
Mapped Vegetation type: RFEF				Condition:	Low	Mod-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): S		Altitude: 73m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, silurum, limestone, metamorphics, gravel, ?							
Soil type: sandy loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact topsoil removed, fill			
Remnant / Old growth (uncleared): Yes (No) Undecided?							
Vegetative Structure (formation) = open forest				Ecologically Dominant Layer (EDL) - most biomass = canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	20-25m			Eucalyptus tereticornis (d) Eucalyptus argenteoides			
T2	-						
T3	-						
S1	-			Acacia implexa Acacia parramattensis Bursaria spinosa			
S2	-			Olea europaea			
G	-			Microlaena stipoides Dichandra repens Scaevola albida			
<p>Tree height (clrp) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clnc) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	5	40	0	Native grass tally -  Total (hits/50) 76%			
10m	0	60	0				
15m	30	90	0				
20m	40	25	0				
25m	60	25	0				
30m	30	20	0	Native other (herb, fern, sedge, etc) tally -  Total (hits/50) 10%			
35m	0	0	0				
40m	0	0	0				
45m	5	20	0				
50m	0	50	0				
Total (sum / 10) = 17 33 0				Native shrub tally -  Total (hits/50) 0%			
Larger 50 x 20m plot				Exotic tally -  Total (hits/50) 12%			
Length of woody debris >10cm wide & >0.5m long			0m				
Proportion of canopy sp. regeneration			100%				
Number of trees with hollows >5cm			0				

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Site ID: 60		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus tectronis -	4	3	41					
2 Aracia implexa -	3	8	42					
3 Aracia parvifolia -	2	4	43					
4 Bursaria spinosa -	3	20+	44					
5 Oba argentea	4	20+	45					
6 Aracia sp. ? Scandela	1	5	46 Scandela albida					
7 Sida strobilata	2	20+	47					
8 Succisa pratensis -	2	20+	48					
9 Mikolana stipitata -	6	20+	49					
10 Plantago lanceolata	2	20+	50					
11 Cirsium vulgare	1	1	51					
12 Rubus fruticosus	1	1	52					
13 Dichondra repens -	2	20+	53					
14 Aravia scitron	2	20+	54					
15 Galtonopsis -	1	1	55					
16 Clematis -	2	20+	56					
17 Oplismenus serotinus -	3	20+	57					
18 Oxalis - hairy	2	20+	58					
19 Convolvulus erubescens -	2	20+	59					
20 Hypochaeris radicata	1	1	60					
21 Native blackberry -	1	1	61					
22 Bidens pilosa	1	1	62					
23 Verbena	1	1	63					
24 Galium lat -	2	20+	64					
25 Chick weed	1	1	65					
26 Trifolium repens	1	1	66					
27 Geranium -	2	20+	67					
28 Glycine clandestina -	1	1	68					
29 Vicia sativa	1	1	69					
30 Alysic tobacco -	1	1	70					
31 Hypericum	1	1	71					
32 Lam. arvensis -	1	1	72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	17		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
			Plot Disturbance	Fire damage:				
Clearing (inc. logging):	Storm damage:							
Cultivation (inc. pasture):	Trampling:							
Soil erosion:	Flood damage:							
Firewood collection:	Feral herbivores:							
Stock grazing:	Other:							

HN 528 Mod/Good

Shale Plains
BioBanking Field Sheet

Mod/Good

JACOBS

1655 Northern Rd

Entered ✓

Survey Site Form - BioBanking				Site ID: 528 16		Vegetation zone: RFEF roadside	
Date	3/9/2015			Surveyor(s): Lukas Clews			
Waypoint ID	528 16			Photo numbers		1267	
Coordinates	E N			Photo direction		N E S W	
Mapped Vegetation type: RFEF				Condition:		Low	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): flat		Altitude:		80m	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, fat depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	15-20m			Eucalyptus tecticornis (d) Eucalyptus melluciana (cd)			
T2	-						
T3	-						
S1	1-6m			Olea europaea			
S2	-						
G	-			Anistida chloris gayana Elmharta erecta Hardenbergia Carmelina Kikuyu			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				10 Points - Foliage Projective Cover			
Point	Canopy % (photos)	Midstorey %	Exotic %	Ground cover tally sheet, 50 points along 50m transect			
5m	40	10	30	- every 1m record if plant intersects (hits) point			
10m	40	0	0	Native grass tally -			
15m	20	0	0	Total (hits/50)			
20m	60	0	0	0%			
25m	60	0	0				
30m	40	0	0	Native other (herb, fern, sedge, etc) tally -			
35m	40	0	0	Total (hits/50)			
40m	50	0	0	2%, 28%			
45m	20	0	0				
50m	40	0	0				
Total (sum / 10) = 41				Native shrub tally -			
Larger 50 x 20m plot				Total (hits/50)			
Length of woody debris >10cm wide & >0.5m long				0%			
Proportion of canopy sp. regeneration				100%			
Number of trees with hollows >5cm				0			
				Exotic tally -			
				Total (hits/50)			
				96%			

JACOBS

Narrow Linear plot to get Roadside veg.

Site ID: 529		16		Survey type: Quadrat 20m x 20m		10 x 40m		
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus tereticornis	4	20	41					
2 Eucalyptus moluccana	1	2	42					
3 Olea curatella	5	20+	43					
4 Hardenbergia violacea	2	20+	44					
5 Bidens pilosa	2	20+	45					
6 Eriogonum ciliatum	4	20+	46					
7 Plantago lanceolata	2	20+	47					
8 Dichondra repens	2	20+	48					
9 Rommelina aerea	2	20+	49					
10 Modiola	2	20+	50					
11 Solanum paniculatum	2	20+	51					
12 Eragrostis ciliaris	3	20+	52					
13 Arctostaphylos	2	20+	53					
14 Carrot tops	2	20+	54					
15 Wahlenbergia	1	1	55					
16 Cirsium vulgare	1	1	56					
17 Eriogonum nutans	1	1	57					
18 Pennisetum clandestinum	4	20+	58					
19 Eriogonum hostatum	1	1	59					
20 Sida rhombifolia	2	20+	60					
21 Rumex crispus	1	4	61					
22 Chloris gayana	2	20+	62					
23 Cyperus gracilis	1	1	63					
24 Setaria	2	20+	64					
25 Chickweed	2	20+	65					
26 Verbena bonariensis	1	1	66					
27 Aristida vagans	3	20+	67					
28 Senecio madagascariensis	1	1	68					
29 Senecio albicollis	1	2	69					
30 Aemula nutans	1	2	70					
31 Fumaria muralis	1	1	71					
32 Solanum sp. prickly apple	1	1	72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	12		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale			Leaf & stick litter					
Modified Braun-blanket 6 scale			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1	<5% - rare		Plot Disturbance	Fire damage:				
2	<5% - common		Clearing (inc. logging):	Storm damage:				
3	5 - 25%		Cultivation (inc. pasture):	Trampling:				
4	25 - 50%		Soil erosion:	Flood damage:				
5	50 - 75%		Firewood collection:	Feral herbivores:				
6	75 - 100%		Stock grazing:	Other:				

HN 528 Mod/Good

BioBanking Field Sheet

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JACOBS

Shale Plains - Mod/Good

Survey Site Form - BioBanking				Site ID: <u>Defence 2</u>		Vegetation zone: <u>SHW</u> <u>CPW</u>	
Date	<u>1/10/2015</u>			Surveyor(s): <u>Lukas deuss</u>			
Waypoint ID	<u>658</u>			Photo numbers	<u>2240</u>		<u>2244</u>
Coordinates	E <u>285626</u> N <u>6254457</u>			Photo direction	N		E S W
Mapped Vegetation type: <u>CPW</u>				Condition:	Low <u>Mod/Good</u>		
Slope: <u>Gentle, Mod, Steep</u>		Aspect (degrees or cardinal): <u>NE</u>		Altitude: <u>92m</u>			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): <u>Yes/No/Undecided?</u>							
Vegetative Structure (formation) = <u>Open forest</u>				Ecologically Dominant Layer (EDL) - most biomass = <u>Canopy</u>			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	.						
T1	<u>15-25m</u>			<u>Eucalyptus nollyana</u> <u>Eucalyptus fibrosa</u>			
T2	.						
T3	.						
S1	.			<u>Acacia Calcata</u> <u>Dillwynia sieberi</u> <u>Davallia</u>			
S2	.						
G	.			<u>Chloris gayana</u> <u>Themeda triandrum</u> <u>Eragrostis curvula</u>			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	<u>10</u>	<u>0</u>	<u>0</u>	Native grass tally - <u> </u> <u> </u> <u> </u> <u> </u> <u> </u>			Total (hits/50)
10m	<u>0</u>	<u>20</u>	<u>0</u>	<u> </u> <u> </u> <u>1</u>			<u>72%</u>
15m	<u>0</u>	<u>20</u>	<u>0</u>				
20m	<u>5</u>	<u>30</u>	<u>0</u>				
25m	<u>0</u>	<u>30</u>	<u>0</u>				
30m	<u>0</u>	<u>20</u>	<u>0</u>	Native other (herb, fern, sedge, etc) tally - <u> </u>			Total (hits/50)
35m	<u>0</u>	<u>10</u>	<u>0</u>				<u>4%</u>
40m	<u>0</u>	<u>0</u>	<u>0</u>				
45m	<u>0</u>	<u>40</u>	<u>0</u>				
50m	<u>20</u>	<u>0</u>	<u>0</u>				
Total (sum / 10) = <u>3.5</u> <u>17</u> <u>0</u>				Native shrub tally -			Total (hits/50)
Larger 50 x 20m plot							
Length of woody debris >10cm wide & >0.5m long				<u>0m</u>			<u>0%</u>
Proportion of canopy sp. regeneration				<u>100%</u>			
Number of trees with hollows >5cm				<u>0</u>			
				Exotic tally - <u> </u> <u> </u> <u> </u>			Total (hits/50)
							<u>24%</u>

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Site ID: Defence 2			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus moluccana	3	2	41					
2 Acacia falcata	4	20+	42					
3 Dillwynia sieberi	3	10	43					
4 Eragrostis amabilis	3	20+	44					
5 Nicotiana glauca	4	20+	45					
6 Clusia gayana	3	20+	46					
7 Species madagascariensis	1	4	47					
8 Platago lanceolata	2	20+	48					
9 Dichradia repens	2	20+	49					
10 Chionochloa sieberi	1	2	50					
11 Anadenia hederacea	2	20+	51					
12 Hypericum gramineum	1	1	52					
13 Hadenbergia violacea	1	4	53					
14 Glycine tabacina	1	1	54					
15 Vicia	1	1	55					
16 Briza subaistata	3	20+	56					
17 Centella asiatica	2	20+	57					
18 Bidens pilosa	1	1	58					
19			59					
20			60					
21			61					
22			62					
23 670 - E. fibrosa x 2 - outside plot			63					
24			64					
25			65					
26			66					
27			67					
28			68					
29			69					
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	11		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale: Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN 528 Mod/Good

BioBanking Field Sheet

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JACOBS

Shale Plains - Mod/Good

Survey Site Form - BioBanking				Site ID: <i>Marsdenia 1</i>		Vegetation zone: <i>CPW</i>	
Date: <i>1/16/2015</i>				Surveyor(s): <i>Lukas deWes</i>			
Waypoint ID: <i>656</i>				Photo numbers: <i>2203</i>		→ <i>2229</i>	
Coordinates: E <i>285709</i> N <i>6254892</i>				Photo direction: N		E S W	
Mapped Vegetation type: <i>CPW</i>				Condition: <i>Low</i>		<i>Mod-good</i>	
Slope: <i>Shallow, Mod, Steep</i>				Aspect (degrees or cardinal): <i>Flat</i>		Altitude: <i>93m</i>	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, silurium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	-			<i>Eucalyptus melanocarpa</i>			
T2	-						
T3	-						
S1	-			<i>Acacia parvifolia</i> <i>Acacia falcata</i>			
S2	-						
G	-			<i>Eragrostis amabilis</i> <i>Themeda triandra</i> <i>Chloris gayana</i> <i>Arizida</i>			
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)							
Definitions Dominance d = dominant; c = co-dominant; s = subdominant; a = associated Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)							
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %	Native grass tally -		Total (hits/50)	
5m	20	0	0			22%	
10m	10	5	0				
15m	5	0	0				
20m	10	0	0				
25m	5	0	0				
30m	0	0	0				
35m	40	0	0			10%	
40m	40	0	0				
45m	10	0	0				
50m							
Total (sum / 10) = 14%				Native shrub tally -		Total (hits/50)	
Larger 50 x 20m plot						0%	
Length of woody debris >10cm wide & >0.5m long				0m			
Proportion of canopy sp. regeneration				100%		Total (hits/50)	
Number of trees with hollows >5cm				1		20%	

2232
2234

92%

JACOBS

Site ID: <i>Morsdenia</i> <i>1</i>			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 <i>Eucalyptus melluceana</i>	5	9	41						
2 <i>Morsdenia viridiflora</i>	1	5?	42 <i>aps 657 - E. teet</i>	<i>cornis</i>					
3 <i>Artemisia serotena</i>	1	2	43						
4 <i>Plumula triadica</i>	4	20+	44						
5 <i>Chenopodium gayana</i>	4	20+	45						
6 <i>Eragrostis curvula</i>	4	20+	46						
7 <i>Bidens pilosa</i>	1	1	47						
8 <i>Senecio madagascariensis</i>	2	10	48						
9 <i>Bromajella australis</i>	3	20+	49						
10 <i>Dichandra repens</i>	3	20+	50						
11 <i>Platago bucculata</i>	2	20+	51						
12 <i>Hypochaeris radicata</i>	2	20+	52						
13 <i>Sonchus oleraceus</i>	1	2	53						
14 <i>Dianella ligulifolia</i>	1	1	54						
15 <i>Eleocharis acicularis</i>	1	1	55						
16 <i>Glycine tabacina</i>	2	20+	56						
17 <i>Vittadinia</i> sp.	1	1	57						
18 <i>Anthragidium nulloham</i>	1	1	58						
19 <i>Acacia parramattensis</i>	1	2	59						
20 <i>Succulent salm</i>	1	1	60						
21 <i>Acacia salicaria</i>	1	1	61						
22 <i>Aristida</i> <i>vegan?</i>	1	1	62						
23 <i>Hardenbergia violacea</i>	1	1	63						
24 <i>Erumpitia debilis</i>	1	1	64						
25			65						
26			66						
27			67						
28			68						
29			69						
30			70						
31			71						
32			72						
33			73						
34			74						
35			75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	15		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1 <5% - rare			Plot Disturbance	Fire damage:					
2 <5% - common			Clearing (inc. logging):	Storm damage:					
3 5 - 25%			Cultivation (inc. pasture):	Trampling:					
4 25 - 50%			Soil erosion:	Flood damage:					
5 50 - 75%			Firewood collection:	Feral herbivores:					
6 75 - 100%			Stock grazing:	Other:					

HN528 Mod/Good

BioBanking Field Sheet

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JACOBS

Shale Plains - Mod/Good

Survey Site Form - BioBanking				Site ID: <u>Deface P2</u>		Vegetation zone: <u>CPW</u>	
Date	<u>1/10/2015</u>			Surveyor(s): <u>Lukas Clews</u>			
Waypoint ID	<u>636</u>			Photo numbers	<u>2200</u>	<u>2201</u>	<u>2202</u>
Coordinates	E	<u>283752</u>		Photo direction	N	E	S
	N	<u>625949</u>					W
Mapped Vegetation type: <u>CPW</u>				Condition:		Low	Mod/Good
Slope: <u>Gentle, Mod, Steep</u>		Aspect (degrees or cardinal): <u>HE</u>		Altitude: <u>92m</u>			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, <u>flat</u> , Depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay/organic, gravel, skeletal, ?				Soil disturbance: <u>indist. topsoil removed, fill</u>			
Remnant / Old growth (uncleared): <u>Yes/No / Undecided?</u>				<u>Some larger trees 60-65cm dbh</u>			
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E							
T1	<u>15-20m</u>			<u>Eucalyptus molluccana</u>			
T2							
T3							
S1				<u>Dodonaea viscosa</u> <u>Davallia</u> <u>Alra europaea</u>			
S2							
G				<u>Eragrostis curvula</u> <u>Chloris gayana</u> <u>Arundo</u>			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	<u>40</u>	<u>0</u>	<u>0</u>	Native grass tally - <u> </u> <u> </u> <u> </u>			
10m	<u>40</u>	<u>0</u>	<u>0</u>	Total (hits/50)			
15m	<u>10</u>	<u>0</u>	<u>0</u>	<u>28%</u>			
20m	<u>20</u>	<u>5</u>	<u>0</u>				
25m	<u>30</u>	<u>10</u>	<u>0</u>				
30m	<u>5</u>	<u>0</u>	<u>0</u>	Native other (herb, fern, sedge, etc) tally - <u> </u>			
35m	<u>30</u>	<u>0</u>	<u>0</u>	Total (hits/50)			
40m	<u>10</u>	<u>10</u>	<u>0</u>	<u>8%</u>			
45m	<u>50</u>	<u>25</u>	<u>0</u>				
50m	<u>30</u>	<u>0</u>	<u>0</u>				
Total (sum / 10) =	<u>26.5</u>	<u>5</u>	<u>0</u>	Native shrub tally -			
Larger 50 x 20m plot				Total (hits/50)			
Length of woody debris >10cm wide & >0.5m long				<u>0m</u>			
Proportion of canopy sp. regeneration				<u>100%</u>			
Number of trees with hollows >5cm				<u>2</u>			
				Exotic tally - <u> </u> <u> </u> <u> </u>			
				Total (hits/50)			
				<u>28%</u>			

JACOBS

Site ID: Defence PZ			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1 <i>Eucalyptus molluccana</i>	5	4	41					
2 <i>Eragrostis curvula</i>	5	20+	42					
3 <i>Dactyloctenium aegyptium</i>	1	1	43					
4 <i>Dodonaea viscosa</i>	1	3	44					
5 <i>Olea europaea</i>	1	1	45					
6 <i>Scaevola taccada</i>	2	8	46					
7 <i>Fernandina bladenii</i>	2	20+	47					
8 <i>Chloris gayana</i>	4	20+	48					
9 <i>Platarrhena lanceolata</i>	1	2	49					
10 <i>Aristida vagans</i>	1	4	50					
11 <i>Dichandra repens</i>	2	20+	51					
12 <i>Lachnagrostis filiformis</i>	1	1	52					
13 <i>Arundo donax</i>	1	1	53					
14 <i>Taraxacum officinale</i>	1	2	54					
15 <i>Liatris - yellow</i>	1	1	55					
16 <i>Cyrtosperma</i>	1	4	56					
17 <i>Lolium perenne</i>	1	1	57					
18 <i>Briza sphaerostachya</i>	1	4	58					
19 <i>Lilium - B.</i>	1	5	59					
20 <i>Calochortus</i>	1	1	60					
21 <i>Cynodon dactylon</i>	2	20+	61					
22 <i>Cuscuta spinescens</i>	1	1	62					
23			63					
24			64					
25			65					
26			66					
27			67					
28			68					
29			69					
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	9		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 5 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN528 Mod/Good.

BioBanking Field Sheet

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JACOBS

Shale Plains - Mod / Good

Survey Site Form - BioBanking				Site ID: 2183 NR		Vegetation zone: CPW	
Date	1/10/2015			Surveyor(s):			
Waypoint ID	635			Photo numbers	2182		2183
Coordinates	E 286404 N 6256329			Photo direction	N		E S W
Mapped Vegetation type: CPW				Condition:	Low		Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): Flat		Altitude: 91m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact/topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided? Easement Power Line							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	15-20m			Eucalyptus meluocarpa (d) Eucalyptus tereticornis			
T2	-						
T3	-						
S1	-			Olea europaea Bursaria spinosa			
S2	-			Hardenbergia violacea			
G	-			Plumella triandra Dichondra repens Eragrostis curvula			
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)							
Definitions							
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated							
Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)							
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall							
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %				Total (hits/50)
5m	30	0	0	Native grass tally - IIII IIII IIII IIII			36%
10m	0	0	0				
15m	0	0	0				
20m	0	0	0				
25m	0	0	0				
30m	0	0	0	Native other (herb, fern, sedge, etc) tally - IIII II			16%
35m	0	0	0				
40m	0	0	0				
45m	10	0	0				
50m	60	0	0				
Total (sum / 10) = 10%				Native shrub tally -			Total (hits/50)
Larger 50 x 20m plot							0%
Length of woody debris >10cm wide & >0.5m long				0m			
Proportion of canopy sp. regeneration				100%			
Number of trees with hollows >5cm				2			
				Exotic tally - IIII IIII I			Total (hits/50)
							22%

JACOBS

Site ID: 2183 NR			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 Eucalyptus moluccana	5	36	41						
2 Eucalyptus toeticonis	3	2	42						
3 Bursera sp.	1	1	43						
4 Sida rhombifolia	1	5	44						
5 Senecio madagascariensis	2	20+	45						
6 Eleocharis acicularis	4	20+	46						
7 Theophrasta australis	4	20+	47						
8 Dircaea repens	2	20+	48						
9 Bromelia australis	2	20+	49						
10 Aristida vagans	1	2	50						
11 Sonchus oleraceus	1	1	51						
12 Glycine tabacina	2	20+	52						
13 Platago lanceolata	2	20+	53						
14 Lily	2	20+	54						
15 Chlois gaura	2	20+	55						
16 Lomandra filiformis	1	2	56						
17 Hedyotis corymbosa	1	1	57						
18 Eriodictyon ovatum	1	1	58						
19 Opuntia stricta	1	2	59						
20 Lactuca scariola	1	1	60						
21 Dianella brevifolia	1	4	61						
22 Aca eumera	1	2	62						
23 Taraxacum officinale	1	6	63						
24 Hypochaeris glabra	1	2	64						
25 Cirsium vulgare	1	2	65						
26 Gnaphalium purpureum	1	1	66						
27 Anthopodium millefolium	1	1	67						
28 Araxia scariola	1	1	68						
29 Urtica dioica - large	1	3	69						
30 cyclosporus heterophyllus	1	3	70						
31 Medicago polymorpha	2	20+	71						
32 Anagallis arvensis	2	20+	72						
33 Vicia baccata	1	1	73						
34			74						
35			75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	15		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blauquet 6 scale			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:					
			Clearing (inc. logging):	Storm damage:					
			Cultivation (inc. pasture):	Trampling:					
			Soil erosion:	Flood damage:					
			Firewood collection:	Feral herbivores:					
			Stock grazing:	Other:					

HNS28 Mod/Good

JACOBS

BioBanking Field Sheet

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Shale Plains - Mod/Good

Survey Site Form - BioBanking				Site ID: 2 Bradley		Vegetation zone: CPW	
Date	30/9/2015			Surveyor(s): Lukas Clews			
Waypoint ID	633			Photo numbers	2165	2166	
Coordinates	E	281706		Photo direction	N	E	S W
	N	6257025					
Mapped Vegetation type: CPW				Condition:		Low	Mod-good
Slope: Gentle/Mod, Steep		Aspect (degrees or cardinal): ESE		Altitude: 68m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact , topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	-			Eucalyptus tecticornis Eucalyptus crebra			
T2	-						
T3	-						
S1	-			Bursaria spinosa Lycium ferocissimum Acacia parramattensis			
S2	-						
G	-			Eragrostis curvula Setaria madagascariensis Dichondra repens Microlaena			
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)							
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)							
Definitions							
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated							
Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)							
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall							
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %			Total (hits/50)	
5m	40	10	0	Native grass tally - 		14%	
10m	40	20	0				
15m	5	0	0				
20m	40	10	0				
25m	40	25	0				
30m	20	60	0	Native other (herb, fern, sedge, etc) tally - 		30%	
35m	30	60	0				
40m	60	10	0				
45m	0	0	0				
50m	0	0	0				
Total (sum / 10) = 27.5 19.5 0				Native shrub tally - 		Total (hits/50)	
Larger 50 x 20m plot						6%	
Length of woody debris >10cm wide & >0.5m long				1m			
Proportion of canopy sp. regeneration				00%		Total (hits/50)	
Number of trees with hollows >5cm				1		28%	
				 			

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Site ID: 2 Bradley		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus tereticornis -	4	4	41					
2 Eucalyptus crebra -	4	3	42					
3 Brunellia australis -	2	20+	43					
4 Bursaria spinosa -	3	20+	44					
5 Bothriochloa nana -	3	20+	45					
6 Lycopodium teretifolium	2	3	46					
7 Arctostaphylos	2	20+	47					
8 Dichondra repens -	3	20+	48					
9 Plantago lanceolata	2	20+	49					
10 Senecio nodosus	2	20+	50					
11 Aristida plagiata	2	20+	51					
12 Opilismenus acutus	2	20+	52					
13 Flakubagia violacea -	1	1	53					
14 Sida rhomboides	2	20+	54					
15 Glycine tabacina -	2	20+	55					
16 Lolium perenne	1	1	56					
17 Cyperus gracilis -	2	20+	57					
18 Oxalis hairy	2	20+	58					
19 Briza subaristata	2	20+	59					
20 Acacia parramattensis -	3	3	60					
21 Sonchus oleraceus	1	1	61					
22 Cirsium vulgare	1	1	62					
23 Bromus catharticus	1	1	63					
24 Euphorbia	1	1	64					
25 Chiodanthus sictus	1	3	65					
26 Nahlbergia	1	1	66					
27			67					
28			68					
29			69					
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	14		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale			Leaf & stick litter					
Modified Braun-blauquet 6 scale			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare			Plot Disturbance		Fire damage:			
2 <5% - common			Clearing (inc. logging):		Storm damage:			
3 5 - 25%			Cultivation (inc. pasture):		Trampling:			
4 25 - 50%			Soil erosion:		Flood damage:			
5 50 - 75%			Firewood collection:		Feral herbivores:			
6 75 - 100%			Stock grazing:		Other:			

HWS28 Mod / wood

BioBanking Field Sheet

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JACOBS

Shale Plains - wood

Survey Site Form - BioBanking				Site ID: P2-2		Vegetation zone: CPW	
Date: 18/11/2015				Surveyor(s): LC			
Waypoint ID: 681				Photo numbers: 2398		2400	
Coordinates: E N				Photo direction: N		E S W	
Mapped Vegetation type: CPW				Condition: Low		Mod-good	
Slope: Gentle, Mod, Steep				Aspect (degrees or cardinal): flat		Altitude: 38m	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, silvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact/topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) = Jan forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	10-30m			Eucalyptus moluccana			
T2	-						
T3	-						
S1	-			Acacia olive			
S2	-						
G	-			Bidens Sida Miconia Bruniella Cissampelos vulgare			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %	Native grass tally -		Total (hits/50)	
5m	30	0	0			6%	
10m	40	0	0				
15m	50	0	50				
20m	40	0	20				
25m	40	0	0				
30m	10	0	0	Native other (herb, fern, sedge, etc) tally -		Total (hits/50)	
35m	40	0	0			38%	
40m	20	0	0				
45m	10	0	0				
50m	40	0	0				
Total (sum / 10) = 32% 0% 7%				Native shrub tally -		Total (hits/50)	
Larger 50 x 20m plot							
Length of woody debris >10cm wide & >0.5m long				0		0%	
Proportion of canopy sp. regeneration				100%		Exotic tally -	
Number of trees with hollows >5cm				1		Total (hits/50)	
						58%	

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Site ID: P2-2			Survey type: Quadrat 20m x 20m		
Species	Cover	Abund.	Species	Cover	Abund.
1 Eucalyptus urophylla	6	40	41		
2 Olea curvipes	3	20	42		
3 Sida rhombifolia	3	20	43		
4 Brunellia australis	3	20	44		
5 Bidens pilosa	4	20	45		
6 Alysicarpus debilis	2	20	46		
7 Lycopodium gracile	1	1	47		
8 Dichradia repens	1	20	48		
9 Tinospora vitifolia	2	20	49		
10 Echinopogon aciculatus	1	1	50		
11 Aristida vagans	2	20	51		
12 Odismachus tenuis	2	20	52		
13 Cyperus avicula	1	1	53		
14 Eleocharis acicularis	2	20	54		
15 Phragmites australis	1	1	55		
16 Microstachya stipoides	4	20	56		
17 Centella asiatica	1	1	57		
18 Eriodictyon aegyptiacum	2	20	58		
19 Dichrochloa	1	1	59		
20 Bursera sp.	1	1	60		
21 Lycopodium barbatum	1	1	61		
22 Lycopodium	1	1	62		
23 Cirsium vulgare	1	2	63		
24 Cyperus polystachyus	1	1	64		
25 Asperula rubra	2	20	65		
26 Briza subulata	1	1	66		
27 Dielsiotheca siala	1	1	67		
28 Logania hirta?	1	20	68 Matha saluader		
29 Echinops phaeus	1	1	69		
30			70		
31			71		
32			72		
33			73		
34			74		
35			75		
36			76		
37			77		
38			78		
39			79		
40			80		

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	18		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Pot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HW 528 Mod/Good

BioBanking Field Sheet

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JACOBS

Shale Plains - Good

Survey Site Form - BioBanking			Site ID: P2-3		Vegetation zone: CPW	
Date	18/11/2015		Surveyor(s): LC			
Waypoint ID	683		Photo numbers	2405	→	2408
Coordinates	E		Photo direction	N	E	S
	N					W
Mapped Vegetation type: CPW			Condition:		Low	Mod-goog
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): Flat		Altitude: 90m		
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace						
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?						
Soil type: sand, loam, clay, organic, gravel, skeletal, ?			Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?						
Vegetative Structure (formation) = Open forest			Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance		
E						
T1	15-25m			Eucalyptus moluccana		
T2						
T3						
S1	1-6m			Eucalyptus moluccana		
S2						
G				Microlaena stipoides sida Aristida Eragrostis curvula Moist vine Spear thistle		
Tree height (cino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (cino) from bottom of slope = distance from tree x (top% - bottom%)						
Definitions Dominance d = dominant; c = co-dominant; s = subdominant; a = associated Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)						
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest						
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect		
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point		
5m	10	0	0	Native grass tally - 1 Total (hits/50) 42%		
10m	5	0	0			
15m	0	0	0			
20m	10	0	0			
25m	0	0	0			
30m	0	0	0	Native other (herb, fern, sedge, etc) tally - Total (hits/50) 10%		
35m	0	0	0			
40m	0	0	0			
45m	40	0	0			
50m	50	0	0			
Total (sum / 10) =	11.5	0	0	Native shrub tally - Total (hits/50) 0%		
Larger 50 x 20m plot				Exotic tally - Total (hits/50) 48%		
Length of woody debris >10cm wide & >0.5m long			1m			
Proportion of canopy sp. regeneration			100%			
Number of trees with hollows >5cm				2		

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Site ID: P2-3			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus mollis	6	20	41					
2 Hypochaeris glabra	2	20	42					
3 Pterocarpus cuneata	4	20	43					
4 Microseris stipoides	4	20	44					
5 Hypochaeris radicata	1	1	45					
6 Sida rhombifolia	4	20	46					
7 Bidens pilosa	2	20	47					
8 Cyperus gracilis	1	1	48					
9 Aristida vagans	3	20	49					
10 Themeda	2	20	50					
11 Senecio madagascariensis	1	1	51					
12 Chloanthus strobilatus	2	20	52					
13 Arachis cuneata	2	20	53					
14 Cirsium vulgare	2	20	54					
15 Thym. latifolius	1	1	55					
16 Bursera spinosa	2	6	56					
17 Oxalis corniculata	2	20	57					
18 Euphorbia	1	1	58					
19 Glycine tabacina	2	20	59					
20 Solanum pseudocarpum	1	2	60					
21 Anagallis arvensis	1	1	61					
22 Parsonsia straminea	1	1	62					
23 Malva caroliniana	1	1	63					
24 Cynodon dactylon	3	20	64					
25 Plantago lanceolata	1	2	65					
26 Briza subaristata	1	1	66					
27 Stachys	1	2	67					
28 Chloanthus strobilatus	2	20	68					
29 Verbena limicola	1	1	69					
30 Yellow lupine	1	1	70					
31 Crotalaria aschita	1	1	71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	16		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale 1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
Stock grazing:	Other:							

HN 528 Mod/Good

BioBanking Field Sheet

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JACOBS

Shale Plains - mod/Good

Survey Site Form - BioBanking				Site ID: site 24 2a	Vegetation zone: CPW
Date	20/1/2016			Surveyor(s): Lukas Clews	
Waypoint ID	767			Photo numbers	2312 2313 2314 2315
Coordinates	E 0285921	N 6246596	Photo direction	N	E S W
Mapped Vegetation type: CPW				Condition:	Low Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal):		Altitude:	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace					
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?					
Soil type: sand, loam, clay, organic, gravel, skeletal, ?			Soil disturbance: intact, topsoil removed, fill		
Remnant / Old growth (uncleared): Yes (No / Undecided?)					
Vegetative Structure (formation): Forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy	
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance	
E	.				
T1	20-25m			Eucalyptus tereticornis Eucalyptus moluccana	
T2	.				
T3	.				
S1	1-8m			Olea europaea Bursaria spinescens	
S2	.				
G	0-0.5m			Chloris verticillata Microstegia stipoides Aristida canosus	
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>					
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect	
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point	
5m	30	0	0	Native grass tally -	
10m	30	0	25		
15m	20	15	10		
20m	10	25	0		
25m	15	10	20		
30m	5	20	10	Native other (herb, fern, sedge, etc) tally -	
35m	0	0	0		
40m	0	0	0		
45m	0	0	0		
50m	0	0	0		
Total (sum / 10) = 10 7 6.5				Native shrub tally -	
Larger 50 x 20m plot				Total (hits/50)	
Length of woody debris >10cm wide & >0.5m long				0%	
Proportion of canopy sp. regeneration				100%	
Number of trees with hollows >5cm				10%	

JACOBS

Site ID: site 29-1			Survey type: Quadrat 20m x 20m		
Species	Cover	Abund.	Species	Cover	Abund.
1 E. tereticauris	-	3	41 Pteranthus parv.	-	1
2 E. moluccana	-	3	42 Freziera daniellia	-	1
3 Byrsonia sparsa	-	3	43 Eragrostis curvula	-	2
4 Cleome viscapia	-	4	44 Cyrtus gracilis	-	1
5 Aristida ramosa	-	2	45 Rhynchospora trigyna	-	3
6 Microseris strobilata	-	5	46 Cynoplossium spartale	-	1
7 Paspalum dealatum	-	2	47 Solanum pseudocarp.	-	1
8 Cofusa	-	1			
9 Sida rhombifolia	-	1			
10 Verbena sp.	-	1			
11 Echynopsis	-	1			
12 Plantago lanceolata	-	2			
13 Dichroa repens	-	2			
14 Hypericum sp.	-	2			
15 Cissampelos	-	2			
16 Brunonia australis	-	2			
17 Oxalis per.	-	1			
18 Trifolium repens	-	1			
19 Glycine micro.	-	1			
20 Eriosema debile	-	2			
21 Desmodium viciifolium	-	2			
22 Galium verum	-	2			
23 Phyllanthus	-	1			
24 Senecio madagascari.	-	1			
25 Chloris ventricosa	-	2			
26 Pennisetum simile	-	1			
27 Sporobolus ciliaris	-	1			
28 Bothriochloa nana	-	1			
29 Cirsium vulgare	-	1			
30 Galium gaudichaudii	-	2			
31 Carex laxa	-	1			
32 Plantago (native)	-	1			
33 Wahlenbergia gracilis	-	1			
34 Sigesbeckia orientalis	-	1			
35 Scrofula	-	1			
36 Desmodium brachyotum	-	1			
37 Euphorbia sp.	-	1			
38 Villadenia sp.	-	1			
39 Odanum pinnatifidum	-	1			
40 Plantago major	-	1			

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	36		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance:	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN 528 Mod/wood

BioBanking Field Sheet

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JACOBS

Shale Plains - mod / good

Survey Site Form - BioBanking				Site ID: Prop. 27	Vegetation zone: low			
Date	20/1/2016			Surveyor(s):				
Waypoint ID	766 - 27			Photo numbers	2308	2309	2310	2311
Coordinates	E 0286161 N 6246218			Photo direction	N	E	S	W
Mapped Vegetation type:				Condition:		Low		Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal):		Altitude:				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E	-							
T1	20-25m		20%	Eucalyptus tereticornis				
T2	-							
T3	-							
S1	0.5-1.5m		45%	Bursaria spinosa Selam prickly apple				
S2	-							
G	0-20m		90%	Microdora stipoides Dichondra repens				
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover I = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>								
50m Transect				10 Points - Foliage Projective Cover				
Point	Canopy % (photos)	Midstorey %	Exotic %	Ground cover tally sheet, 50 points along 50m transect				
5m	10	0	0	- every 1m record if plant intersects (hits) point				
10m	0	0	0	Native grass tally -				
15m	10	0	0	Total (hits/50) 84%				
20m	30	0	0					
25m	30	0	0					
30m	5	0	0	Native other (herb, fern, sedge, etc) tally -				
35m	0	0	0	Total (hits/50) 22%				
40m	0	0	0					
45m	0	0	0					
50m	0	0	0					
Total (sum / 10) = 8.5%				Native shrub tally - 1				
Larger 50 x 20m plot				Total (hits/50) 2%				
Length of woody debris >10cm wide & >0.5m long				2m				
Proportion of canopy sp. regeneration				100				
Number of trees with hollows >5cm				0				
				Exotic tally -				
				Total (hits/50) 6%				

JACOBS

Site ID: Prop. 27		Survey type: Quadrat 20m x 20m				
Species	Cover	Abund.	Species	Cover	Abund.	
1 Eucalyptus tectronis	3	4	41			
2 Bursaria spinosa	2	30	42			
3 Solanum peltatum	3	40	43			
4 Solanum pseudophyllum	2	20	44			
5 Arctostaphylos	2	20	45			
6 Dichandra repens	3	100	46			
7 Microdora stipitata	5	200	47			
8 Echinops cuneatus	2	20	48			
9 Carex	1	1	49			
10 Phyllanthus	1	2	50			
11 Desmodium illinoense	1	1	51			
12 Oxalis perennans	2	20	52			
13 Brunoniella australis	2	20	53			
14 Calceolaria tabacina	2	20	54			
15 Cirsium vulgare	1	1	55			
16 Eriophorum	1	1	56			
17 Carex invaria	2	2	57			
18 Sporobolus cuneatus	2	20	58			
19 Heliotropium	1	1	59			
20 Aristida appressa	1	2	60			
21 Centaurea cyanea	1	1	61			
22 Australanthus tenuis	1	2	62			
23 Olearia rugosa	1	2	63			
24 Richardia	1	1	64			
25 Asperula caerulea	2	20	65			
26 Medicago	1	2	66			
27 Polypodium munitum	1	2	67			
28 Fragaria virginiana	1	2	68			
29 Chamaecrista nictitans	1	1	69			
30 Senecio madagascariensis	1	1	70			
31 Sida maritima	2	20	71			
32 Cyperus gracilis	1	10	72			
33 Oplismenus aemulus	1	1	73			
34 Phalaris lacustris	1	1	74			
35 Cyclospora leptophylla	1	1	75			
36 Tricoryne clavata	1	1	76			
37 Gomphocarpus physalis	1	1	77			
38 Chelidonium sibiricum	2	20	78			
39			79			
40			80			

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree			Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
			Plot Disturbance					
			Clearing (inc. logging):					
			Cultivation (inc. pasture):					
			Soil erosion:					
			Firewood collection:					
			Stock grazing:					
			Fire damage:					
			Storm damage:					
			Trampling:					
			Flood damage:					
			Feral herbivores:					
			Other:					

Cover abundance scale	
Modified Braun-blanket 6 scale	
1	<5% - rare
2	<5% - common
3	5 - 25%
4	25 - 50%
5	50 - 75%
6	75 - 100%

HN 528 Mod/Good

BioBanking Field Sheet

Shale Plains - Mod/Good

JACOBS

Front Paddock

170-2

Entered ✓

Survey Site Form - BioBanking				Site ID: 107 170-2		Vegetation zone: CPW?	
Date: 3/9/2015				Surveyor(s): Lukas Clews			
Waypoint ID: 107 170-2				Photo numbers: 1299		1300	
Coordinates: E				Photo direction: N		E	
N				S		W	
Mapped Vegetation type: CPW?				Condition: Low		Mod-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): N4		Altitude: 100m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes (No) Undecided?							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	.						
T1	20-30m			Eucalyptus moluccana Eucalyptus tereticornis			
T2	10-15m			Exocarpos cupressiformis Canopy regrowth			
T3	.						
S1	1-2m			Lantana Lycium ferocissimum Bursaria spinosa			
S2	.						
G	.			Microlaena stipoides Ehretia erecta			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions:</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %			Total (hits/50)	
5m	5	0	0	Native grass tally -		88%	
10m	50	0	0				
15m	20	0	0				
20m	30	0	0				
25m	5	10	0				
30m	0	0	0	Native other (herb, fern, sedge, etc) tally -		Total (hits/50)	
35m	50	0	0			0%	
40m	40	0	40				
45m	5	0	0				
50m	10	0	0				
Total (sum / 10) = 21.5				Native shrub tally -		Total (hits/50)	
Larger 50 x 20m plot						0%	
Length of woody debris >10cm wide & >0.5m long				1.2m			
Proportion of canopy sp. regeneration				100%		Total (hits/50)	
Number of trees with hollows >5cm				1		10%	

JACOBS

frat Paddock

Site ID: 701-170-2		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus mellurca	6	22	41					
2 Eucalyptus tachionis	3	3	42					
3 Lantana	3	6	43					
4 Lycium ferissimum	3	4	44					
5 Solanum scaberrimum	2	20+	45					
6 Tamarix	2	20+	46					
7 Chick weed	3	20+	47					
8 Medicago	2	20+	48					
9 Ursula vulgare	2	20+	49					
10 Silene maritima	2	20+	50					
11 Chamaecyparis	2	20+	51					
12 Cotula	2	20+	52					
13 Solanum praevalens	2	20+	53					
14 Lycopodium gracile	2	20+	54					
15 Microseris strobilata	3	20+	55					
16 Ranunculus	1	2	56					
17 Bursaria spinosa	2	4	57					
18 Medicago polymorpha	1	1	58					
19 Oxalis yellow	2	20+	59					
20 Euphorbia acuta	3	20+	60					
21 Ononis laevis	1	1	61					
22 Phytolacca octandra	1	1	62					
23 Ranunculus acris	2	20+	63					
24			64					
25			65					
26			66					
27			67					
28			68					
29			69					
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	6		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare			Plot Disturbance			Fire damage:		
2 <5% - common			Clearing (inc. logging):			Storm damage:		
3 5 - 25%			Cultivation (inc. pasture):			Trampling:		
4 25 - 50%			Soil erosion:			Flood damage:		
5 50 - 75%			Firewood collection:			Feral herbivores:		
6 75 - 100%			Stock grazing:			Other:		

Entered ✓

JACOBS

Shale Plains - poor

Survey Site Form - BioBanking				Site ID: 209	Vegetation zone: CPW - SHEP CPW
Date:	2/9/2015			Surveyor(s): Lukas Claus	
Waypoint ID:	209			Photo numbers:	
Coordinates:	E N	Photo direction:	N	E	S W
Mapped Vegetation type: CPW				Condition:	Low Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): SE		Altitude: 98m	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace					
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?					
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill	
Remnant / Old growth (uncleared): Yes / No / Undecided? old trees					
Vegetative Structure (formation) = Open woodland				Ecologically Dominant Layer (EDL) - most biomass = canopy	
Strata	Height Interval	Median	Est. cover	Dominant Species & Dominance	
E	X	X	X	X	
T1	15-20m			Eucalyptus melanocarpa (d) Eucalyptus tereticornis	
T2	X	X	X	X	
T3	X	X	X	X	
S1	X	X	X	X	
S2	X	X	X	X	
G	.			Panisetum clandestinum Paspalum Scaevola moluccensis	
Tree height (cino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (cino) from bottom of slope = distance from tree x (top% - bottom%)					
Definitions Dominance d = dominant; c = co-dominant; s = subordinate; a = associated Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)					
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest					
50m Transect 10 Points - Foliage Projective Cover				Ground cover tally sheet, 50 points along 50m transect	
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point	
5m	10	0	0	Native grass tally - Total (hits/50)	
10m	10			0	
15m	5				
20m	0				
25m	5				
30m	30			Native other (herb, fern, sedge, etc) tally - Total (hits/50)	
35m	40			0	
40m	30				
45m	5				
50m					
Total (sum / 10) =	13.5	0	0	Native shrub tally - Total (hits/50)	
Larger 50 x 20m plot				0	
Length of woody debris >10cm wide & >0.5m long			1.2m	Total (hits/50)	
Proportion of canopy sp. regeneration			0	Exotic tally - Total (hits/50)	
Number of trees with hollows >5cm			4	96%	

JACOBS

Site ID: 209		Survey type: Quadrat 20m x 20m								
Species	Cover	Abund.	Species	Cover	Abund.					
1 Eucalyptus moluccana	3	2	41							
2 Pennisetum clausenianum	6	20+	42							
3 Senecio madagascariensis	3	20+	43							
4 Cyperus gracilis	2	20+	44							
5 Cotula	2	20+	45							
6 Paspalum	3	20+	46							
7 Trifolium repens	3	20+	47							
8 Chickweed	2	20+	48							
9 Urtica incisa	1	4	49							
10 Scaevola taccada	1	2	50							
11 Poa annua	2	20+	51							
12 Malva parviflora	2	20+	52							
13 large chickweed	2	3	53	just chickweed as before						
14 Plantago lanceolata	1	2	54							
15 Taraxacum officinale	1	1	55							
16 Wire weed	1	1	56							
17			57							
18			58							
19			59							
20			60							
21			61							
22			62							
23			63							
24			64							
25			65							
26			66							
27			67							
28			68							
29			69							
30			70							
31			71							
32			72							
33			73							
34			74							
35			75							
36			76							
37			77							
38			78							
39			79							
40			80							
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5		
Tree	4		Native perennial grass							
Shrub			Native other grass							
Grass (annual)			Native forb & other							
Grass (perennial)			Native shrub (<1m)							
Other (annual)			Exotic grass							
Other (perennial)			Exotic forb & other							
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter							
			Rocks							
			Bare ground							
			Cryptogams							
			Total	100	100	100	100	100		
1	<5% - rare		Plot Disturbance	Fire damage:						
2	<5% - common		Clearing (inc. logging):	Storm damage:						
3	5 - 25%		Cultivation (inc. pasture):	Trampling:						
4	25 - 50%		Soil erosion:	Flood damage:						
5	50 - 75%		Firewood collection:	Feral herbivores:						
6	75 - 100%		Stock grazing:	Other:						

Entered ✓

shale ^{flats} ~~flats~~ - Poor

q. 8!

JACOBS

Site ID: 510 Willowden			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 Eucalyptus torricensis	- 4	5	41						
2 Sida rhomboides	3	23	42						
3 Kikuyu	6	100+	43						
4 Sporobolus creber	- 1	1	44						
5 Solanum prichth apple	4	47	45						
6 Atriplex	- 1	13	46						
7 Cyperus gracilis	- 1	10	47						
8 Crows foot	2	20+	48						
9 Senecio madagascariensis	1	1	49						
10 Lycopodium obscurum	1	2	50						
11 Trifolium repens	1	1	51						
12 Malva parviflora	1	1	52						
13 Paspalum	- 1	2	53						
14 Lepidium africanum	2	10	54						
15 Valeriana officinale	1	1	55						
16 Oxalis perennans	- 2	20+	56						
17 Composita celosoides	1	1	57						
18 Eriodictyon polygamoides	- 2	20+	58						
19 Wire weed	1	1	59						
20 Hairy bit	1	2	60						
21 Eriodictyon trigonum	- 1	10	61						
22 Evagrostis laevis	- 1	2	62						
23 Composita baccata	1	1	63						
24 Schizanthus sp.	1	1	64						
25 Cyperus dactyloides	- 4	100+	65						
26 Dulcis gayana	1	5	66						
27 Dichondra repens	- 1	2	67						
28 Cirsium vulgare	1	1	68						
29			69						
30			70						
31			71						
32			72						
33			73						
34			74						
35			75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	11		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1	<5% - rare	Plot Disturbance		Fire damage:					
2	<5% - common	Clearing (inc. logging):		Storm damage:					
3	5 - 25%	Cultivation (inc. pasture):		Trampling:					
4	25 - 50%	Soil erosion:		Flood damage:					
5	50 - 75%	Firewood collection:		Feral herbivores:					
6	75 - 100%	Stock grazing:		Other:					

HN 528 Mod/Wood - Poor

BioBanking Field Sheet

Entered ✓

JACOBS

Shale Plains - Poor

Survey Site Form - BioBanking				Site ID: 219	Vegetation zone: CPW Hills Plains			
Date				Surveyor(s): Lukas Clevs				
Waypoint ID	219			Photo numbers				
Coordinates	E			Photo direction	N	E	S	W
Mapped Vegetation type: CPW				Condition:		Low		Most good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): SSE		Altitude: 106m				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?				Canopy trees only				
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E	X	X	X	X				
T1	15-25m		20%	Eucalyptus tenticornis Eucalyptus moluccana				
T2	X	X	X	X				
T3	X	X	X	X				
S1	1m			Lycium ferocissimum				
S2	.							
G	.		40%	Penisetum clandestinum Cirsium vulgare Scaevola madagascariensis Dichondra repens				
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>								
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect				
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point				
5m	30	0	0	Native grass tally -				Total (hits/50)
10m	30	0	0					
15m	50	0	0					
20m	50	0	0					
25m	5	0	0					
30m	20	1	0	Native other (herb, fern, sedge, etc) tally -				Total (hits/50)
35m	30	1	10					
40m	40	1	5					
45m	30	1	10					
50m	40	1						
Total (sum / 10) = 32.5 0 2.5				Native shrub tally -				Total (hits/50)
Larger 50 x 20m plot								
Length of woody debris >10cm wide & >0.5m long				42.2				0%
Proportion of canopy sp. regeneration				0%				
Number of trees with hollows >5cm				8				80%

JACOBS

Site ID: 219			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 Eucalyptus tereticornis -	3	3	41						
2 E. moluccana	3	5	42						
3 Lycium ferocissimum	3	30	43						
4 Scaevola taccada - var	4	20+	44						
5 Cirsium vulgare	3	20+	45						
6 Cotula	3	20+	46						
7 Oxalis - smooth yellow	3	20+	47						
8 Solanum nigrum	1	1	48						
9 Pennisetum clandestinum	4	20+	49						
10 Paspalum	2	20+	50						
11 Sida rhombifolia	1	1	51						
12 Daucus - carrot tops	1	1	52						
13 Conyza bonariensis	2	20+	53						
14 Cyperus gracilis -	2	20+	54						
15 Clitoria polygama	1	1	55						
16 Hypochaeris radicata	2	20+	56						
17 Sporobolus parviflorus	2	20+	57						
18 Taraxacum officinale	1	1	58						
19 Sonchus oleraceus	1	1	59						
20 Stinking roger	1	1	60						
21 Tribulus terrestris	2	20+	61						
22 Chick weed	1	1	62						
23 Bromus catharticus	1	1	63						
24 Vicia sativa	1	1	64						
25 Dichondra repens -	2	20+	65						
26			66						
27			67						
28			68						
29			69						
30			70						
31			71						
32			72						
33			73						
34			74						
35			75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	6		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1 <5% - rare			Plot Disturbance			Fire damage:			
2 <5% - common			Clearing (inc. logging):			Storm damage:			
3 5 - 25%			Cultivation (inc. pasture):			Trampling:			
4 25 - 50%			Soil erosion:			Flood damage:			
5 50 - 75%			Firewood collection:			Feral herbivores:			
6 75 - 100%			Stock grazing:			Other:			

HN 529 Mod/Good

Shale Hills - Mod/Good
BioBanking Field Sheet

JACOBS

Sales Park 63

Entered ✓

Survey Site Form - BioBanking				Site ID: Church Block 63 Vegetation zone: CPW			
Date: 2/1/2015				Surveyor(s): Lucas Clews			
Waypoint ID: 529 63		Photo numbers: 1263		1264		1265	
Coordinates: E		Photo direction: N		E		S	
N						W	
Mapped Vegetation type: CPW				Condition: Low		Mod/Good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): S		Altitude: 115m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation): Open Forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	.						
T1	20-25m			Eucalyptus melluocana Eucalyptus tecticornis Eucalyptus uelera			
T2	.						
T3	.						
S1	.			Acacia Bursaria spinosa Indigofera australis			
S2	.						
G	.			Eragrostis curvula Chloris gayana Themeda Aristida Microseris			
<p>Tree height (cino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (cino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions:</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %			Total (hits/50)	
5m	20	0	0	Native grass tally -		60%	
10m	0	0	0				
15m	0	0	0				
20m	20	0	0				
25m	40	0	0				
30m	10	0	0	Native other (herb, fern, sedge, etc) tally -		8%	
35m	30	10	0				
40m	20	20	0				
45m	5	0	0				
50m	5	0	0				
Total (sum / 10) = 15 3 0				Native shrub tally -		Total (hits/50)	
Larger 50 x 20m plot						0%	
Length of woody debris >10cm wide & >0.5m long			56.4				
Proportion of canopy sp. regeneration			100%	Exotic tally -		Total (hits/50)	
Number of trees with hollows >5cm			0			24%	

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Site ID: <i>Sales Park 69</i>			Survey type: Quadrat 20m x 20m		
Species	Cover	Abund.	Species	Cover	Abund.
1. <i>Cleistanthus parviflorus</i>	1	6	41		
2. <i>Themeda triandra</i>	2	20+	42		
3. <i>Dichandra repens</i>	2	20+	43		
4. <i>Sesuvio madagascariensis</i>	2	20+	44		
5. <i>Indigofera australis</i>	2	4	45		
6. <i>Wurmbia dioica</i>	2	20+	46		
7. <i>Chenopodium quinoa</i>	2	20+	47		
8. <i>Bidens pilosa</i>	2	20+	48		
9. <i>Burkea spinosa</i>	3	20+	49		
10. <i>Eragrostis curvula</i>	4	20+	50		
11. <i>Optunia acuminata</i>	2	20+	51		
12. <i>Asparagus asparagoides</i>	2	20+	52		
13. <i>Arundo donax</i>	2	20+	53		
14. <i>Euphorbia hirta</i>	5	10	54		
15. <i>Eleocharis acicularis</i>	2	2	55		
16. <i>Small Lamiaceae</i>	2	20+	56. <i>Mattha schoides</i>		
17. <i>Olea europaea</i>	2	20+	57		
18. <i>Platocodon lanceolatus</i>	1	1	58		
19. <i>Sonchus oleraceus</i>	1	1	59		
20. <i>Cirsium vulgare</i>	1	1	60		
21. <i>Oxalis</i>	1	1	61		
22. <i>Gypsea gracilis</i>	2	20+	62		
23. <i>Ulex - Anthropodium</i>	1	1	63		
24. <i>Glycine tabacina</i>	2	20+	64		
25. <i>Acerium</i>	1	1	65		
26. <i>Chiclaetles cichori</i>	2	20+	66		
27. <i>Waltherburgia communis</i>	1	1	67		
28. <i>Anacardium occidentale</i>	2	20+	68		
29. <i>Diella - Blue green</i>	1	1	69		
30. <i>Setaria</i>	2	20+	70		
31. <i>Father Galium</i>	1	1	71		
32			72		
33			73		
34			74		
35			75		
36			76		
37			77		
38			78		
39			79		
40			80		

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	20		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN 52a Mod/Good

JACOBS

BioBanking Field Sheet

Shale Hills - mod/Good Entered ✓

Survey Site Form - BioBanking				Site ID: 57		Vegetation zone: REF	
Date	2/9/2015			Surveyor(s): Lukas clews			
Waypoint ID	57			Photo numbers	1237		
Coordinates	E 285649 N 6248509			Photo direction	N E S W		
Mapped Vegetation type: REF				Condition:	Low Mod-good		
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): NE		Altitude: 96m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	20-25m			Eucalyptus tereticornis Eucalyptus moluccana Eucalyptus crebra			
T2	-						
T3	-						
S1	4-6m			Acacia parvattasis Solanum sp - Alra europaea			
S2	1m			Burkea Clematis			
G	-			Bromus , sida Scaevola taccada , Burkea spiro Cirsium vulgare , Micadorea			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions:</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet. 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	30	0	0	Native grass tally - ///			
10m	10	0	0	Total (hits/50)			
15m	5	0	0	6%			
20m	10	40	0				
25m	5	0	0				
30m	10	10	10	Native other (herb, fern, sedge, etc) tally -			
35m	20	0	50	Total (hits/50)			
40m	5	0	0	0% 92%			
45m	5	0	0				
50m	10%	5%	6				
Total (sum / 10) = 11				Native shrub tally -			
Larger 50 x 20m plot				Total (hits/50)			
Length of woody debris >10cm wide & >0.5m long 4m				0%			
Proportion of canopy sp. regeneration 100%				Exotic tally - 			
Number of trees with hollows >5cm 1				Total (hits/50)			
				86%			

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Site ID: S7			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 Eucalyptus tecticaria	5	9	41						
2 E. moluccana	4	5	42						
3 Acacia parvifolia	4	20+	43						
4 Bursaria spinosa	4	20+	44						
5 Dichondra repens	2	20+	45						
6 Molida caroliniana	2	20+	46						
7 chick weed	2	20+	47						
8 Microcladia stipoides	3	20+	48						
9 Sida rhombifolia	2	20+	49						
10 Fire weed	2	20+	50						
11 Blackberry	1	2	51						
12 Clematis smooth	2	20+	52						
13 Opilismenus serrulata	3	20+	53						
14 Eriodia hostata	2	20+	54						
15 Plectratus pariflorus	1	2	55						
16 Bidens pilosa	2	20+	56						
17 Glycine clandestina	1	2	57						
18 Olea europaea	3	20+	58						
19 Lycium ferocissimum	2	20+	59						
20 Solanum praeputellum	1	1	60						
21 Lantana	3	20+	61						
22 Trifolium repens	2	20+	62						
23 Dichelachne	1	1	63						
24 cotula	1	1	64						
25 Medicago polymorpha	2	20+	65						
26 Stinking Ragwort	1	1	66						
27 Solanum spiky thistle	2	5	67						
28 Convolvulus suberosus	1	1	68						
29 Eragrostis brownii	1	1	69						
30 Pod annua	2	20+	70						
31			71						
32			72						
33			73						
34			74						
35			75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree			Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blanket 6 scale 1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
			Plot Disturbance	Fire damage:					
			Clearing (inc. logging):	Storm damage:					
			Cultivation (inc. pasture):	Trampling:					
			Soil erosion:	Flood damage:					
			Firewood collection:	Feral herbivores:					
Stock grazing:	Other:								

UN52a Mod/Good

BioBanking Field Sheet

Entered ✓

JACOBS

Shale Hills - Mod/Good

Survey Site Form - BioBanking				Site ID: 40	Vegetation zone: CPW - Cleared understory			
Date	3/9/2015			Surveyor(s):				
Waypoint ID	40			Photo numbers	1284	→	1288	
Coordinates	E			Photo direction	N	E	S	W
	N							
Mapped Vegetation type: CPW				Condition:	Low		Mod-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): SW		Altitude: 78m				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, sandstone, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?				canopy but cleared & grazed understory				
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = canopy				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E								
T1	20-25m			Eucalyptus molluccana (d) Eucalyptus tereticornis (sd) Eucalyptus argenteoides (d)				
T2				Brachyditos populneus (d)				
T3	8m			Clea europaea (d)				
S1								
S2	0.5-1m			Burmia spinosa (d)				
G				Dichandra repens Chloris verticillata Cynoda dactyloides Oplismenus aemulus Echinochloa crusgalli				
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-80% = woodland; 80-100% = open forest; 100% = closed forest</p>								
50m Transect				10 Points - Foliage Projective Cover				
Point	Canopy % (photos)	Midstorey %	Exotic %	Ground cover tally sheet, 50 points along 50m transect				
5m	60	0	0	- every 1m record if plant intersects (hits) point				
10m	30	0	0	Native grass tally - IIII IIII IIII IIII				
15m	40	0	0	Total (hits/50)				
20m	30	0	0	36%				
25m	5	0	0	Native other (herb, fern, sedge, etc) tally - IIII IIII I				
30m	10	0	0	Total (hits/50)				
35m	20	0	0	22% 88%				
40m	40	0	0					
45m	5	0	0					
50m	5	10	0					
Total (sum / 10) = 24.5				Native shrub tally - I				
Larger 50 x 20m plot				Total (hits/50)				
Length of woody debris >10cm wide & >0.5m long				2%				
Proportion of canopy sp. regeneration				100%				
Number of trees with hollows >5cm				Exotic tally - IIII IIII				
				Total (hits/50)				
				28%				

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Site ID: 40		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1 <i>Amaranthus</i>	2	20+	41					
2 <i>Plantago grandifolia</i>	1	1	42					
3 <i>Senecio madagascariensis</i>	2	20+	43					
4 <i>Brassica</i>	1	1	44					
5 <i>Eucalyptus mellucera</i>	5	18	45					
6 <i>Eucalyptus todtiana</i>	1	1	46					
7 <i>Olea europaea</i>	1	1	47					
8 <i>Solanum spiky apple</i>	2	18	48					
9 <i>Cynodon dactylon</i>	3	20+	49					
10 <i>Chloris verticillata</i>	3	20+	50					
11 <i>Eriogonum aculeatum</i>	2	20+	51					
12 <i>Cyperus gracilis</i>	2	20+	52					
13 <i>Eriogonum aculeatum</i>	4	20+	53					
14 <i>Dicentra repens</i>	5	20+	54					
15 <i>Hypochaeris radicata</i>	1	1	55					
16 <i>Cirsium vulgare</i>	2	20+	56					
17 <i>Chickweed</i>	2	20+	57					
18 <i>Oxalis small - yellow</i>	2	20+	58					
19 <i>Boraginaceae spinosa</i>	2	20+	59					
20 <i>Eriogonum debile</i>	2	20+	60					
21 <i>Poa annua</i>	2	20+	61					
22 <i>Solanum pinophyllum</i>	1	1	62					
23 <i>Myrica laevis</i>	2	20+	63					
24 <i>Medicago</i>	1	1	64					
25 <i>Taraxacum officinale</i>	1	1	65					
26 <i>Senecio deracematus</i>	1	1	66					
27 <i>Sida rhombifolia</i>	1	1	67					
28 <i>Catella asiatica</i>	2	20+	68					
29 <i>Ranunculus sp.</i>	1	1	69					
30 <i>Solanum nigrum</i>	1	1	70					
31 <i>Erigeron annuus</i>	1	1	71					
32 <i>Oplismenus aegyptius</i>	2	20+	72					
33 <i>Gnaphalium polycephalum</i>	1	1	73					
34 <i>Brunonia australis</i>	1	1	74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	18		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale			Leaf & stick litter					
Modified Braun-blanket 6 scale			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare			Plot Disturbance	Fire damage:				
2 <5% - common			Clearing (inc. logging):	Storm damage:				
3 5 - 25%			Cultivation (inc. pasture):	Trampling:				
4 25 - 50%			Soil erosion:	Flood damage:				
5 50 - 75%			Firewood collection:	Feral herbivores:				
6 75 - 100%			Stock grazing:	Other:				

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BioBanking Field Sheet

Shale Hills - Mod/Good

Entered ✓

Survey Site Form - BioBanking				Site ID: <u>Z Bradley 2</u>	Vegetation zone: <u>CPW</u>
Date:	<u>30/9/2015</u>			Surveyor(s):	
Waypoint ID:	<u>634</u>			Photo numbers:	<u>2170 → 2172 2173</u>
Coordinates:	E <u>286377</u> N <u>6266645</u>	Photo direction:	N	E	S W
Mapped Vegetation type:	<u>CPW</u>			Condition:	Low (<u>Mod-good</u>)
Slope: <u>Gentle</u> , Mod, Steep	Aspect (degrees or cardinal): <u>SE</u>			Altitude: <u>71m</u>	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace					
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel?					
Soil type: sand, loam, clay, organic, gravel, skeletal, ?			Soil disturbance: intact, topsoil removed, fill		
Remnant / Old growth (uncleared): Yes / No / Undecided? <u>No</u>					
Vegetative Structure (formation) = <u>Open forest</u>			Ecologically Dominant Layer (EDL) - most biomass = <u>Canopy</u>		
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance	
E	.				
T1	<u>15-25m</u>			<u>Eucalyptus tereticornis</u> <u>Eucalyptus melliorana</u>	
T2	.				
T3	.				
S1	.			<u>Bursaria spinosa</u>	
S2	.				
G	.			<u>Kikuyu</u> <u>Fireweed.</u>	
Tree height (c/no) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (c/no) from bottom of slope = distance from tree x (top% - bottom%)					
Definitions: Dominance d = dominant; c = co-dominant; s = subordinate; a = associated Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)					
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest					
50m Transect				Ground cover tally sheet, 50 points along 50m transect	
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point	
Point:	Canopy % (photos)	Midstorey %	Exotic %		
5m	<u>50</u>	<u>0</u>	<u>0</u>	Native grass tally - Total (hits/50)	
10m	<u>60</u>	<u>0</u>	<u>0</u>	Total (hits/50)	
15m	<u>40</u>	<u>0</u>	<u>0</u>	Total (hits/50)	
20m	<u>0</u>	<u>0</u>	<u>0</u>	Total (hits/50)	
25m	<u>0</u>	<u>0</u>	<u>0</u>	Total (hits/50)	
30m	<u>10</u>	<u>10</u>	<u>5</u>	Total (hits/50)	
35m	<u>20</u>	<u>20</u>	<u>0</u>	Total (hits/50)	
40m	<u>10</u>	<u>0</u>	<u>0</u>	Total (hits/50)	
45m	<u>10</u>	<u>0</u>	<u>0</u>	Total (hits/50)	
50m	<u>0</u>	<u>20</u>	<u>0</u>	Total (hits/50)	
Total (sum / 10) =	<u>20%</u>	<u>5</u>	<u>0.5</u>	Native shrub tally - Total (hits/50)	
Larger 50 x 20m plot				Total (hits/50)	
Length of woody debris >10cm wide & >0.5m long			<u>1.5m</u>	Total (hits/50)	
Proportion of canopy sp. regeneration			<u>100%</u>	Exotic tally - Total (hits/50)	
Number of trees with hollows >5cm			<u>2</u>	Total (hits/50)	

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Site ID: 2 Bradley 2		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus moluccana	1	1	41					
2 Eucalyptus tenticularis	5	6	42					
3 Scaevola madagascariensis	4	20	43					
4 Solanum peltatum	1	2	44					
5 Lemniscatus cladection	5	20	45					
6 Sida rhombifolia	7	20	46					
7 Capsella bursa-pastoris	2	20	47					
8 Procris umbellata	2	20	48					
9 Crotalaria	2	20	49					
10 Cotula	2	20	50					
11 Medicago	2	20	51					
12 Glycine tabacina	2	20	52					
13 Eriodictyon	2	20	53					
14 Bursera spinosa	2	10	54					
15 Dichandra repens	2	20	55					
16 Malva parviflora	1	1	56					
17 Grevillea ulmaria	1	4	57					
18 Trifolium repens	2	20	58					
19 Sigesbeckia australis	2	20	59					
20 Phytolacca laciniata	2	20	60					
21 Opuntia aculeata	1	2	61					
22 Brunoniella australis	1	2	62					
23 Conyza bonariensis	2	20	63					
24 Rumex crispus	1	1	64					
25 Lotus sp	1	1	65					
26 Hypochaeris radicata	1	1	66					
27			67					
28			68					
29			69					
30			70					
31 Juncus acutus			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	10		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale			Leaf & stick litter					
Modified Braun-blanket 6 scale			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare			Plot Disturbance	Fire damage:				
2 <5% - common			Clearing (inc. logging):	Storm damage:				
3 5 - 25%			Cultivation (inc. pasture):	Trampling:				
4 25 - 50%			Soil erosion:	Flood damage:				
5 50 - 75%			Firewood collection:	Feral herbivores:				
6 75 - 100%			Stock grazing:	Other:				

HN 52a Mod/Good

286207 . 6250337

BioBanking Field Sheet

JACOBS

Shale Hills - Mod/Good

Survey Site Form - BioBanking				Site ID: 149		Vegetation zone: CAW - Hills		
Date	9/9/2015			Surveyor(s): Lukas clews				
Waypoint ID	iphone photo			Photo numbers	1412			
Coordinates	E	-33.865643		Photo direction	N	E	S	
	N	150.688971					W	
Mapped Vegetation type: CAW - Hills				Condition:		Low	Mod-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): S		Altitude: ?				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E	-							
T1	20-25m			Eucalyptus tecticornia (d) Eucalyptus fibrosa (a)				
T2	-							
T3	-							
S1	-			Bursaria spinosa Daviesia Lycium ferocissimum				
S2	-							
G	-			Ehretia Eragrostis curvula Platycodon grandiflorus Olearia Pennisetum				
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>								
50m Transect				Ground cover tally sheet, 50 points along 50m transect				
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point				
Point	Canopy % (photos)	Midstorey %	Exotic %				Total (hits/50)	
5m	30	25	0	Native grass tally - 11			4%	
10m	5	10	0					
15m	0	0	0					
20m	0	0	0					
25m	5	0	0					
30m	10	60	0	Native other (herb, fern, sedge, etc) tally - 111			Total (hits/50)	
35m	10	30	0				6%	
40m	40	0	0					
45m	30	20	0					
50m	0	0	0				100%	
Total (sum / 10) = 13%, 14.5, 0%				Native shrub tally -				Total (hits/50)
Larger 50 x 20m plot								
Length of woody debris >10cm wide & >0.5m long				0			0%	
Proportion of canopy sp. regeneration				1			Total (hits/50)	
Number of trees with hollows >5cm				0			90%	

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Site ID: 149			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1 Centella asiatica	2	20+	41					
2 Eucalyptus tereticornis	4	2	42					
3 Bursera spinoza	4	20+	43					
4 Clusia rosea	2	20+	44					
5 Scaevola taccada	2	20+	45					
6 Hypochaeris radicata	2	20+	46					
7 Plantago lanceolata	2	20+	47					
8 Catula	2	20+	48					
9 Idium peruv	2	20+	49					
10 Clusia rosea	2	20+	50					
11 Eragrostis curvula	2	20+	51					
12 Catula	2	20+	52					
13 Amegilla arvensis	2	20+	53					
14 Persea caroliniana	3	20+	54					
15 Mimosa birostris	1	2	55					
16 Dichandra repens	2	20+	56					
17 Scaevola	1	1	57					
18 Avicennia coriaria	1	1	58					
19 Cirsium vulgare	1	1	59					
20 Solanum elaeagnifolium	2	20+	60					
21 Cyperus bispinosus	2	20+	61					
22 Sida rhomboides	2	20+	62					
23 Miconia affinis	2	20+	63					
24 Oxalis	2	20+	64					
25 Thunbergia alata	1	1	65					
26			66					
27			67					
28			68					
29			69					
30			70					
31			71	SEA EAGLE!				
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	11		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
			Plot Disturbance	Fire damage:				
Clearing (inc. logging):	Storm damage:							
Cultivation (inc. pasture):	Trampling:							
Soil erosion:	Flood damage:							
Firewood collection:	Feral herbivores:							
Stock grazing:	Other:							

HNS2a Mod/Good

JACOBS

BioBanking Field Sheet

Entered. ✓
Shale Hills - Good

Survey Site Form - BioBanking			Site ID: P2-1 sub		Vegetation zone: CPW	
Date	18/11/2015		Surveyor(s): LL			
Waypoint ID	680		Photo numbers		2384 → 2395	
Coordinates	E		Photo direction	N	E	S W
Mapped Vegetation type: CPW			Condition:		Low	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): 42		Altitude:		98m
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace						
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?						
Soil type: sand, loam, clay, organic, gravel, skeletal, ?			Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?						
Vegetative Structure (formation): <i>Open Forest</i>			Ecologically Dominant Layer (EDL) - most biomass = <i>Canopy</i>			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance		
E						
T1	10-25m			<i>Eucalyptus tereticornis</i> (d) <i>E. mellibayana</i> (c)		
T2						
T3						
S1	1-10m			<i>Bursaria spinosa</i> - dense		
S2						
G				<i>Microstachya</i> <i>Bromeliella</i> <i>Thamnia</i> <i>Dichandra</i>		
Tree height (cino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (cino) from bottom of slope = distance from tree x (top% - bottom%) Definitions Dominance d = dominant; c = co-dominant; s = subdominant; a = associated Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%) Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest						
50m Transect		10 Points - Foliage Projective Cover		Ground cover tally sheet, 50 points along 50m transect		
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point		
5m	5	0	0	Native grass tally - <i> </i> Total (hits/50)		
10m	10	0	0	70%		
15m	30	0	0			
20m	40	10	0			
25m	30	30	0			
30m	20	60	0	Native other (herb, fern, sedge, etc) tally - <i> </i> Total (hits/50)		
35m	10	20	0	18%		
40m	20	60	0			
45m	10	50	0			
50m						
Total (sum / 10) =		17.5	23	0	Native shrub tally - Total (hits/50)	
Larger 50 x 20m plot				0%		
Length of woody debris >10cm wide & >0.5m long		1.5m				
Proportion of canopy sp. regeneration		100%		Exotic tally - <i> </i> Total (hits/50)		
Number of trees with hollows >5cm		1		12%		

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Site ID: P21-sub			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus tocharis	- 5	6	41					
2 E. hollockiana	- 1	1	42					
3 Eucalyptus sp. sp.	- 6	20+	43					
4 Arundinaria aciculata	- 2	20+	44					
5 Microblatta streptopoda	- 6	20+	45					
6 Cirsium vulgare	- 1	1	46					
7 Tineo unguiculata	- 2	20+	47					
8 sida	- 2	20+	48					
9 Dichandra repens	- 2	20+	49					
10 ramulosa cycas	- 2	20+	50					
11 Oxalis pumila	- 2	20+	51					
12 Bidens	- 1	1	52					
13 Alysic tabacum	- 2	20+	53					
14 Hydrocotyle	- 1	1	54					
15 Brunanilla australis	- 2	20+	55					
16 Opercularia diphylla	- 1	1	56					
17 Solanum griseoblanum	- 2	20+	57					
18 Anagallis arvensis	- 1	1	58					
19 Anthriscus nillifolius	- 1	1	59					
20 Cyperus gracilis	- 1	1	60					
21 Small plant	- 1	1	61 Suttolainia humilis					
22 Aristida vagans	- 1	1	62					
23 Asperula latifolia	- 1	1	63					
24 Centella asiatica	- 1	1	64					
25 Chelidonium sibiricum	- 1	1	65					
26 Euphorbia	- 1	1	66					
27			67					
28			68					
29			69					
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	21		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blauquet 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

UN52a Mod/Good

Entoria
BioBanking Field Sheet

Hills

JACOBS

Shale Hills - Mod/Good

Survey Site Form - BioBanking				Site ID: 2627 NR		Vegetation zone: CPW	
Date	1/10/2015			Surveyor(s): Lukas Clews			
Waypoint ID	672			Photo numbers	2281		2285
Coordinates	E	286035		Photo direction	N	E	S
	N	625670					W
Mapped Vegetation type: CPW				Condition:		Low	Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): SE		Altitude: 92m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided? Roadside trees							
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	-			Eucalyptus molluccana			
T2	-						
T3	-						
S1	-			Bursaria spinosa Lycium ferocissimum			
S2	-						
G	-			Lolium perenne Platago Thymus Dichondra repens Erigeron annuus Atriplex			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-8m = low; 8-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	20	0	0	Native grass tally -			
10m	5	0	0				
15m	30	0	0				
20m	30	0	0				
25m	25	0	0				
30m	20	0	0	Native other (herb, fern, sedge, etc) tally -			
35m	30	0	0				
40m	30	0	0				
45m	0	0	0				
50m	10	0	0				
Total (sum / 10) = 20				Native shrub tally -			
Larger 50 x 20m plot				Total (hits/50)			
Length of woody debris >10cm wide & >0.5m long			2.4m	0%			
Proportion of canopy sp. regeneration			100%	Exotic tally -			
Number of trees with hollows >5cm			2	Total (hits/50)			
				38%			

2289
2291

96%

JACOBS

Site ID: 2627 NR			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1 Eucalyptus molluccana	5	10	41						
2 Picramnia longifolia	1	3	42						
3 Anthopodium uellatium	2	20+	43						
4 Dichandra repens	4	20+	44						
5 Arundinaria scitula	1	1	45						
6 Scaevola taccada	2	20+	46						
7 Platypodium elegans	3	20+	47						
8 Pandanus tectorius	1	2	48						
9 Olea curatella	1	1	49						
10 Echinops polystachyus	3	20+	50						
11 Bidens pilosa	1	1	51						
12 Eragrostis amabilis	3	20+	52						
13 Eragrostis australis	3	20+	53						
14 Themeda triandra	3	20+	54						
15 Eragrostis nutans	3	20+	55						
16 Lantana camara	1	1	56						
17 Lantana camara	1	1	57						
18 Asplenium platyneuron	2	20+	58						
19 Cirsium vulgare	1	1	59						
20 Lantana camara	3	20+	60						
21 Lolium perenne	3	20+	61						
22 Sida rhomboides	1	1	62						
23 Lycopodium obscurum	1	1	63						
24 Pennisetum clandestinum	3	20+	64						
25 Echinops	1	1	65						
26			66						
27			67						
28			68						
29			69						
30			70						
31			71						
32			72						
33			73						
34			74						
35			75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	10		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:					
			Clearing (inc. logging):	Storm damage:					
			Cultivation (inc. pasture):	Trampling:					
			Soil erosion:	Flood damage:					
			Firewood collection:	Feral herbivores:					
			Stock grazing:	Other:					

JACOBSHN 52a DNG
Entered ✓

Survey Site Form - BioBanking				Site ID: 33 DNG		Vegetation zone:	
Date	21/01/2016			Surveyor(s):			
Waypoint ID	710			Photo numbers	2324	2325	2326
Coordinates	E 0225897 N 6246843			Photo direction	N	E	S
Mapped Vegetation type:				Condition:		Low	Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal):		Altitude:			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone (shale), alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) = GRASSLAND				Ecologically Dominant Layer (EDL) - most biomass = GROUNDLAYER			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	-						
T2	-						
T3	-						
S1	-						
S2	-						
G	-			<i>Themeda triandra</i> <i>Briza subaristata</i> <i>Paspalum</i> <i>Hydrochloa radiata</i>			
Tree height (c/no) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (c/no) from bottom of slope = distance from tree x (top% - bottom%) Definitions Dominance d = dominant; c = co-dominant; s = subdominant; a = associated Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%) Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	0	0	0	Native grass tally - HHT HHT HHT HHT HHT HHT HHT			Total (hits/50) 70%
10m							
15m							
20m							
25m							
30m				Native other (herb, fern, sedge, etc) tally - IIII			Total (hits/50) 8%
35m							
40m							
45m							
50m							
Total (sum / 10) = 0 0 0				Native shrub tally -			Total (hits/50)
Larger 50 x 20m plot							0%
Length of woody debris >10cm wide & >0.5m long			0				
Proportion of canopy sp. regeneration			0	Exotic tally -			Total (hits/50) 22%
Number of trees with hollows >5cm			0	HHT HHT I			

JACOBS

Site ID: 33 DNG

Survey type: Quadrat 20m x 20m

Species	Cover	Abund.	Species	Cover	Abund.
1 <i>Themeda triandra</i>	6	100+	41		
2 <i>Hypochaeris radiata</i>	2	20+	42		
3 <i>Senecio madagascariensis</i>	2	20+	43		
4 <i>Commersonia sp. exultans</i>	2	20+	44		
5 <i>Asperula conferta</i>	2	20+	45		
6 <i>Bizia sub.</i>	3	20+	46		
7 <i>Cynodon dactylon</i>	3	20+	47		
8 <i>Glycine tabacina</i>	1	20+	48		
9 <i>Hypericum ascyronum</i>	1	5	49		
10 <i>Portulaca luteolata</i>	1	1	50		
11 <i>Conyza bonariensis</i>	1	5	51		
12 <i>Lophium distalatum</i>	3	20+	52		
13 <i>Trichorine elatior</i>	1	1	53		
14 <i>Centella asiatica</i>	2	20+	54		
15 <i>Raspallidium distans</i>	2	20+	55		
16 <i>Phyllanthus sp.</i>	1	1	56		
17 <i>Zakna</i>	1	1	57		
18 <i>Eriobrystalis dicentra</i>	1	1	58		
19 <i>Boerhaavia merita</i>	1	1	59		
20 <i>Eragrostis prawnii</i>	1	1	60		
21 <i>Scorol pimpinell</i>	1	1	61		
22			62		
23			63		
24			64		
25			65		
26			66		
27			67		
28			68		
29			69		
30			70		
31			71		
32			72		
33			73		
34			74		
35			75		
36			76		
37			77		
38			78		
39			79		
40			80		

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	14		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN S29 DNG
Entered ✓**JACOBS**

Survey Site Form - BioBanking				Site ID: <u>P2 DNG</u>		Vegetation zone: <u>DNG</u>	
Date	<u>3/2/2016</u>			Surveyor(s): <u>Lukas Clews</u>			
Waypoint ID	<u>804</u>			Photo numbers	<u>iPhone</u>		
Coordinates	E	<u>0285811</u>		Photo direction	N	E	S W
	N	<u>6254935</u>					
Mapped Vegetation type: <u>NA</u>				Condition:		Low	Mod-good
Slope: <u>Gentle</u> Mod, Steep		Aspect (degrees or cardinal): <u>flat</u>		Altitude: <u>92m</u>			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / <u>No</u> / Undecided?							
Vegetative Structure (formation) = <u>cross land</u>				Ecologically Dominant Layer (EDL) - most biomass = <u>ground layer</u>			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E							
T1							
T2							
T3							
S1							
S2							
G			<u>95%</u>	<u>Themeda triandra (d)</u>			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	0	0	0	Native grass tally - <u> </u>			
10m				Total (hits/50) <u>54%</u>			
15m							
20m							
25m							
30m							
35m				Native other (herb, fern, sedge, etc) tally - <u> </u>			
40m				Total (hits/50) <u>10%</u>			
45m							
50m							
Total (sum / 10) = <u>0</u>				Native shrub tally -			
Larger 50 x 20m plot				Total (hits/50) <u>0%</u>			
Length of woody debris >10cm wide & >0.5m long			<u>0</u>				
Proportion of canopy sp. regeneration			<u>0</u>	Exotic tally - <u> </u>			
Number of trees with hollows >5cm			<u>0</u>	Total (hits/50) <u>36%</u>			

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Site ID: P2 PNG		Survey type: Quadrat 20m x 20m				
Species	Cover	Abund.	Species	Cover	Abund.	
1. Themeda triandra	- 6	100+	41			
2. Digitaria	- 4	20+	42			
3. Cynodon dactylon	- 3	20+	43			
4. Hypochaeris radicata	- 3	20+	44			
5. Phytolacca dioica	- 2	20+	45			
6. Hypericum gramineum	- 2	20+	46			
7. Sesuvium portulacastrum	- 2	20+	47			
8. Centella asiatica	- 1	20+	48			
9. Setaria	- 1	20+	49			
10. Briza subaristata	- 2	20+	50			
11. Cyperus tenuis	- 1	20+	51			
12. Aristida vagans	- 1	5	52			
13. Eragrostis tenuis	- 1	1	53			
14. Sporobolus parviflorus	- 1	1	54			
15. Stachytarpheta	- 1	1	55			
16. Euphorbia	- 1	1	56			
17. Wedelia gracilis	- 1	1	57			
18. Oxalis pes-caprae	- 1	10+	58			
19. Eragrostis brownii	- 1	1	59			
20. Cyrtopogon retrofractus	- 1	2	60			
21			61			
22			62			
23			63			
24			64			
25			65			
26			66			
27			67			
28			68			
29			69			
30			70			
31			71			
32			72			
33			73			
34			74			
35			75			
36			76			
37			77			
38			78			
39			79			
40			80			

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	12		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

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Survey Site Form - BioBanking				Site ID: DNG 131	Vegetation zone:			
Date	2/2/2016			Surveyor(s):	IC			
Waypoint ID	803			Photo numbers	2486	2487	2488	2489
Coordinates	E	0286625		Photo direction	N	E	S	W
	N	6251787						
Mapped Vegetation type: N/A				Condition:	Low		Mod-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): flat		Altitude: 98m				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) = grassland				Ecologically Dominant Layer (EDL) - most biomass = ground				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E								
T1								
T2								
T3								
S1								
S2								
G	0-0.5m	95%		Thunbergia Digitaria Sporobolus				
<p>Tree height (cino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (cino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>								
50m Transect				Ground cover tally sheet, 50 points along 50m transect				
Point	10 Points - Foliage Projective Cover			- every 1m record if plant intersects (hits) point				
	Canopy % (photos)	Midstorey %	Exotic %					
5m	0	0	0	Native grass tally -				
10m								
15m								
20m								
25m								
30m				Native other (herb, fern, sedge, etc) tally - 1				
35m								
40m								
45m								
50m								
Total (sum / 10) = 0				Native shrub tally -				
Larger 50 x 20m plot				Total (hits/50)				
Length of woody debris >10cm wide & >0.5m long				0				
Proportion of canopy sp. regeneration				0				
Number of trees with hollows >5cm				0				
				Exotic tally -				
				Total (hits/50)				
				36%				

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Site ID: <u>DNG 139</u>			Survey type: <u>Quadrat 20m x 20m</u>			
Species	Cover	Abund.	Species	Cover	Abund.	
1. <i>Themeda triandra</i>	5	100+	41			
2. <i>Digitaria</i>	4	100+	42. <i>Axonopus</i>			
3. <i>Amistida ramosa</i>	2	100+	43			
4. <i>Setaria</i>	2	100+	44			
5. <i>Briza subaristata</i>	2	20+	45			
6. <i>Sporobolus ciliaris</i>	2	20+	46			
7. <i>Paspalum dilatatum</i>	2	20+	47			
8. <i>Senecio madagascariensis</i>	1	20+	48			
9. <i>Cyperus compositus</i> sp.	2	10	49			
10. <i>Bothriochloa macrochaeta</i>	2	20+	50			
11. <i>Wahlenbergia gracilis</i>	1	20+	51			
12. <i>Euphorbia sp.</i>	1	1	52			
13. <i>Hypericum gramineum</i>	2	20+	53			
14. <i>Hypericum radicans</i>	2	20+	54			
15. <i>Sporobolus peruvianus</i>	1	1	55			
16. <i>Fimbristylis dichotoma</i>	1	10	56			
17. <i>Centaurium erythraea</i>	1	1	57			
18. <i>Canva bonariensis</i>	1	1	58			
19. <i>Eragrostis brownii</i>	1	1	59			
20. <i>Cynodon dactylon</i>	2	20+	60			
21			61			
22			62			
23			63			
24			64			
25			65			
26			66			
27			67			
28			68			
29			69			
30			70			
31			71			
32			72			
33			73			
34			74			
35			75			
36			76			
37			77			
38			78			
39			79			
40			80			

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree			Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing: -	Other:				

HN529 DNG
entered ✓**JACOBS**

Survey Site Form - BioBanking				Site ID: 30 DNG 1	Vegetation zone:			
Date	21/01/2016			Surveyor(s):				
Waypoint ID	771			Photo numbers	2328	2329	2330	2331
Coordinates	E	0286349		Photo direction	N	E	S	W
	N	6247533						
Mapped Vegetation type:				Condition:		Low		Mod-good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal):		Altitude:				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes/ No / Undecided?								
Vegetative Structure (formation) = GRASSLAND				Ecologically Dominant Layer (EDL) - most biomass = GROUNDLAYER				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E	-							
T1	-							
T2	-							
T3	-							
S1	-			<i>E. terrestris</i>				
S2	-							
G	-			<i>Themeda triandra</i> <i>B. sub.</i>				
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>								
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect				
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point				
5m	0	0	0	Native grass tally -				
10m				Total (hits/50)				
15m				80%				
20m								
25m								
30m				Native other (herb, fern, sedge, etc) tally -				
35m				Total (hits/50)				
40m				2%				
45m								
50m								
Total (sum / 10) =	0	0	0	Native shrub tally -				
Larger 50 x 20m plot				Total (hits/50)				
Length of woody debris >10cm wide & >0.5m long	0			0%				
Proportion of canopy sp. regeneration	0			Exotic tally -				
Number of trees with hollows >5cm	0			Total (hits/50)				
				18%				

Regen - no canopy

JACOBS

Site ID: 39 DN9

Survey type: Quadrat 20m x 20m

Species	Cover	Abund.	Species	Cover	Abund.
1 <i>Themeda tri</i>	6	20+	41		
2 <i>Brua sub.</i>	4	190+	42		
3 <i>Glycine tabacina</i>	2	20+	43		
4 <i>Paspalum dilatatum</i>	3	20+	44		
5 <i>Verbena</i>	2	20+	45		
6 <i>Plantago lanceolata</i>	2	20+	46		
7 <i>Hypochaeris radicata</i>	2	20+	47		
8 <i>Centorium</i>	1	1	48		
9 <i>Scorlet perennell</i>	1	1	49		
10 <i>Sedum</i>	2	20+	50		
11 <i>Rosa rubiginosa</i>	1	1	51		
12 <i>Oxalis pernan</i>	1	1	52		
13 <i>Glyceria chondroloph</i>	1	1	53		
14 <i>Eucalyptus tereticornis</i>	1	3	54		
15 <i>Rumex crispus</i>	1	7	55		
16 <i>Arishida kamosa</i>	1	1	56		
17			57		
18			58		
19			59		
20			60		
21			61		
22			62		
23			63		
24			64		
25			65		
26			66		
27			67		
28			68		
29			69		
30			70		
31			71		
32			72		
33			73		
34			74		
35			75		
36			76		
37			77		
38			78		
39			79		
40			80		

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	6		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blauquet 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging)	Storm damage:				
			Cultivation (inc. pasture)	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN 52a Mod/wood - High

BioBanking Field Sheet

entirely

JACOBS

Shale Hills - mod/good - High quality

Survey Site Form - BioBanking				Site ID: 332	Vegetation zone: CPW - Hills			
Date	21/1/2016			Surveyor(s): Lukas Clews				
Waypoint ID	769			Photo numbers	2316 to 2319			
Coordinates	E	0285928		Photo direction	N	E	S	W
	N	6246941						
Mapped Vegetation type: CPW				Condition:		Low	Mod-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): W to NW		Altitude: 94m				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) = Open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E	-							
T1	15-25	20		Eucalyptus moluccana Eucalyptus tereticornis				
T2	-							
T3	-							
S1	1-6	4		African olive Lantana cam African boxthorn Bursaria spin E. moluccana				
S2	-							
G	0-1			Miconia stip. Sida rhomb. Conyza				
Tree height (clim) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clim) from bottom of slope = distance from tree x (top% - bottom%)								
Definitions								
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated								
Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)								
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall								
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest								
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect				
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point				
5m	30	0	0	Native grass tally -				
10m	10	0	0					
15m	5	0	0					
20m	5	0	0					
25m	40	0	40					
30m	10	0	0	Native other (herb, fern, sedge, etc) tally -				
35m	10	50	0					
40m	5	60	0					
45m	0	0	0					
50m	0	0	0					
Total (sum / 10) =	11.5	11	4	Native shrub tally -				
Larger 50 x 20m plot				Total (hits/50)				
Length of woody debris >10cm wide & >0.5m long	11.5m			0%				
Proportion of canopy sp. regeneration	100%			Exotic tally -				
Number of trees with hollows >5cm	1							
				Total (hits/50)				
				28%				

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Site ID: 332		Survey type: Quadrat 20m x 20m				
Species	Cover	Abund.	Species	Cover	Abund.	
1 Eucalyptus tereticornis	- 2	2	41 Eucalyptus sparsus	- 1	12	
2 Eucalyptus molluccana	- 5	29	42 Tricoryne elatior	- 1	1	
3 Acaia europaea	3	5	43 Hypericum gramineum	- 1	2	
4 Carex lanceolata	3	59	44 Scholet pimpernell	- 1	1	
5 Citrus vulgare	2	4	45 Busaria spinosa	- 1	2	
6 Scaevola ericifolia	1	1	46 Bathochloa marica	- 1	10	
7 Plectractilus parviflorus	- 2	20+	47 Limbonitus lawsoni	- 1	2	
8 Commelina cyanea	- 2	20+	48 Phyllanthus sp.	- 1	1	
9 Gentella asiatica	- 1	1	49 Chelidonium sibiricum	- 1	1	
10 Oxalis perennans	- 1	1				
11 Silene aubertii	- 7	20+				
12 Glycine tabacina	- 2	20+				
13 Microseris stipoides	- 5	20+				
14 Cyclosporus lachryllos	- 2	20+				
15 Asperula conferta	- 2	20+				
16 Scaevola mollebracensis	- 2	20+				
17 Platago lanceolata	- 2	20+				
18 Bromnella australis	- 2	20+				
19 Lepidium africanum	- 1	1				
20 Limnolobos australis	- 1	1				
21 Caesia sp.	- 1	1				
22 Dicentra repens	- 2	20+				
23 Erodia trigonos (saltbush)	- 1	1				
24 Madia	- 2	20+				
25 Convolvulus erubescens	- 1	1				
26 Bidens pilosa	- 2	2				
27 Alcea paxthorn	- 2	2				
28 Astragalus tenuis	- 2	20+				
29 Cyperus gracilis	- 2	20+				
30 Alternanthera dentifolia	- 1	2				
31 Scaevola orientalis	- 1	1				
32 Rhus prunifolia	- 1	1				
33 Linaria palustris	- 2	20+				
34 Echinops naespilosus	- 1	3				
35 Paspalum sp.	- 2	20+				
36 Cyperus (small)	- 1	1				
37 Solanum sp.	- 2	20+				
38 Chloris verticillata	- 2	20+				
39 Plantago cordylloides	- 1	2				
40 Opuntia stricta	- 1	1				

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	39		Native perennial grass					
Shrub	34		Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN 529 Mod/Good - High

BioBanking Field Sheet

JACOBS

Shale Hills - mod/Good - high quality

Survey Site Form - BioBanking				Site ID: 34-1		Vegetation zone: CPW Good	
Date	20/1/2016			Surveyor(s): Lukas Clews			
Waypoint ID	768			Photo numbers			
Coordinates	E 0285891 N 6246984			Photo direction		N E S W	
Mapped Vegetation type: CPW				Condition:		Low Mod (good)	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal):		Altitude:			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided? Young trees							
Vegetative Structure (formation): Open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E							
T1	15-25m	20m		Eucalyptus tereticornis Eucalyptus mollissima			
T2							
T3							
S1	1-6m			Bursaria spinosa Olea europaea subsp. cuspidata			
S2							
G	0-02		95%	Microseris stipoides			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	5	0	0	Native grass tally -			
10m	20	60	10				
15m	20	60	0				
20m	15	10	0				
25m	5	40	0				
30m	0	10	60	Native other (herb, fern, sedge, etc) tally -			
35m	0	60	0				
40m	0	20	0				
45m	5	20	0				
50m	5	10	0				
Total (sum / 10) =	7.5	27	7	Native shrub tally -			
Larger 50 x 20m plot				Total (hits/50)			
Length of woody debris >10cm wide & >0.5m long	77m			0%			
Proportion of canopy sp. regeneration	100%			Exotic tally -			
Number of trees with hollows >5cm	2						
				Total (hits/50)			
				8%			

100%

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Site ID: 34-1		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1 <i>Eucalyptus melluriana</i>	- 6	50+	41					
2 <i>Bursaria spinosa</i>	- 6	50+	42					
3 <i>Olea europaea</i>	4	20+	43					
4 <i>Panicum simile</i>	- 2	20+	44					
5 <i>Echinopogon caespitosus</i>	- 2	20+	45					
6 <i>Microlaena stans</i>	- 6	100+	46					
7 <i>Fiabristylis dichotoma</i>	- 2	20+	47					
8 <i>Plectralthia parviflora</i>	- 2	20+	48					
9 <i>Conyza</i>	3	20+	49					
10 <i>Glycine tabacina</i>	- 2	20+	50					
11 <i>Sarcocolla nodigera</i>	2	20+	51					
12 <i>Waltheria gracilis</i>	- 2	20+	52					
13 <i>Phyllanthus</i>	- 1	1	53					
14 <i>Commersonia bartramia</i>	- 2	20+	54					
15 <i>Caesia</i>	- 1	20+	55					
16 <i>Echiton aphelandra</i>	- 1	20+	56					
17 <i>Nakea platensis</i>	- 2	20+	57					
18 <i>Brauneria australis</i>	- 2	20+	58					
19 <i>Dichandra repens</i>	- 2	20+	59					
20 <i>Chilactis bicolor</i>	- 2	20+	60					
21 <i>Cyperus gracilis</i>	- 1	20+	61					
22 <i>Bidens pilosa</i>	1	1	62					
23 <i>Cyperus</i>	1	1	63					
24 <i>Cirsium vulgare</i>	3	20+	64					
25 <i>Oxalis penicillata</i>	- 1	20+	65					
26 <i>Setaria</i>	1	1	66					
27 <i>Opilionea aculeata</i>	- 2	20+	67					
28 <i>Cyperus nodosus</i>	- 1	20+	68					
29 <i>Calium gedichnoides</i>	- 1	20+	69					
30 <i>Solanum phaeophyllum</i>	- 2	20+	70					
31 <i>Sida rhomboides</i>	1	1	71					
32 <i>Anagallis arvensis</i>	1	1	72					
33 <i>Paspalum dilatatum</i>	1	1	73					
34 <i>Pennisetum purpureum</i>	- 1	1	74					
35 <i>Paspalum</i>	- 2	20+	75					
36 <i>Umbellatus laevis</i>	- 1	1	76					
37 <i>Mentha citrifolia</i>	- 1	20+	77					
38 <i>Chenopodium</i>	- 1	1	78					
39 <i>Bothriocla</i>	- 1	1	79					
40 <i>Arundo donax</i>	- 1	1	80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	90		Native perennial grass					
Shrub	20		Native other grass					
Grass (annual)	20		Native forb & other					
Grass (perennial)	20		Native shrub (<1m)					
Other (annual)	20		Exotic grass					
Other (perennial)	20		Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN 529 Mod/Good - High

BioBanking Field Sheet

Entered ✓

JACOBS

Shale Hills - Mod/Good - High

Survey Site Form - BioBanking				Site ID: 39-3		Vegetation zone: CPW - Hills	
Date: 2/9/2015				Surveyor(s): Lukas Clews			
Waypoint ID: 39-3				Photo numbers: 1249		1255	
Coordinates: E N				Photo direction: N		E S W	
Mapped Vegetation type: CPW - Hills				Condition: Low		Mod (good)	
Slope: Gentle, Mod, Steep				Aspect (degrees or cardinal): N		Altitude: 105m	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ? - ironstone nodules							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?				High quality CPW			
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	-						
T1	20 - 25m			Eucalyptus tecticornis Eucalyptus melluciana Eucalyptus acrida Eucalyptus egeiroides			
T2	-						
T3	-						
S1	10 - 1m			Bursaria spinosa - sparse Lamprologia Monarda scoparia			
S2	-						
G	-			Aristida, Themeda, Microseris Chloris villosa Chloris villosa			
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)							
Definitions							
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated							
Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)							
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall							
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest							
50m Transect				10 Points - Foliage Projective Cover			
Point	Canopy % (photos)	Midstorey %	Exotic %	Ground cover tally sheet, 50 points along 50m transect			
5m	10	0	0	- every 1m record if plant intersects (hits) point			
10m	20	0	0	Native grass tally -			
15m	30	0	0	Native other (herb, fern, sedge, etc.) tally -			
20m	40	0	0	Native shrub tally -			
25m	30	0	0	Total (hits/50)			
30m	20	0	0	80%			
35m	20	0	0	Total (hits/50)			
40m	30	0	0	10%			
45m	30	0	0	92%			
50m	30	0	0	Total (hits/50)			
Total (sum / 10) = 24%				0%			
Larger 50 x 20m plot				0%			
Length of woody debris >10cm wide & >0.5m long				13.7m			
Proportion of canopy sp. regeneration				100%			
Number of trees with hollows >5cm				2			
				Exotic tally - 1			
				Total (hits/50)			
				2%			

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Site ID: 39-3			Survey type: Quadrat 20m x 20m							
Species	Cover	Abund.	Species	Cover	Abund.					
1 Eucalyptus tereticornis	4	4	41							
2 E. resinosa argentea	1	2	42							
3 Bursaria spinosa	2	20+	43							
4 Chialothus sieberi	3	20+	44							
5 setaria	2	20+	45							
6 Themeda	4	20+	46							
7 Lycopodium	3	20+	47							
8 Senecio madagascariensis	2	20+	48							
9 Chrysanthemum	2	20+	49							
10 Microseris stipoides	4	20+	50							
11 Wahlenbergia sp.	2	20+	51							
12 Verbena borbonica	2	20+	52							
13 Sida rhomboides	2	20+	53							
14 Cyperus asperifolius	2	20+	54							
15 Solanum pseudocapense	1	1	55							
16 Oxalis yellow	2	20+	56							
17 Solanum praeputium	2	20+	57							
18 Solanum peltatum	1	2	58							
19 Hypochaeris radicata	4	2	59							
20 Aristida vagans	2	20+	60							
21 Camphorospha	1	1	61							
22 Paspallidium dictum	1	1	62							
23 Veronica plicata	7	5	63							
24 Phyllanthus	1	1	64							
25 Glycine clandestina	2	20+	65							
26 Hypocissus	2	20+	66							
27 Calotis sp.	1	1	67							
28 Cotula	1	1	68							
29 Mimosa oxalis	1	20+	69							
30 Hibiscus sp.	2	20+	70							
31 Herb 1 - stockhouse?	1	1	71							
32 Anagallis arvensis	2	20+	72							
33 Jilte	1	2	73							
34 Goodenia heterocarpa	1	1	74							
35 Lomandra filiformis	2	20+	75							
36 Monarda sagittata	1	1	76							
37 Dichondra repens	1	1	77							
38 Pratia purpurascens	1	1	78							
39 Desmodium viciifolium	1	1	79							
40			80							
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5		
Tree	35		Native perennial grass							
Shrub			Native other grass							
Grass (annual)			Native forb & other							
Grass (perennial)			Native shrub (<1m)							
Other (annual)			Exotic grass							
Other (perennial)	28		Exotic forb & other							
Cover abundance scale Modified Braun-blanket 6 scale 1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Leaf & stick litter							
			Rocks							
			Bare ground							
			Cryptogams							
			Total	100	100	100	100	100		
			Plot Disturbance			Fire damage:				
			Clearing (inc. logging):			Storm damage:				
			Cultivation (inc. pasture):			Trampling:				
			Soil erosion:			Flood damage:				
			Firewood collection:			Feral herbivores:				
Stock grazing:			Other:							

Aulchordia vinosa.

HNS2A Mod/Good - High

BioBanking Field Sheet

Entered ✓

JACOBS

Mod/Good - High

Survey Site Form - BioBanking				Site ID: P2 CPW regen		Vegetation zone: CPW good	
Date	3/2/2016			Surveyor(s): Lukas Deurs			
Waypoint ID	805			Photo numbers		10956	
Coordinates	E	0285774		Photo direction	N	E	S
	N	6254812					
Mapped Vegetation type: CPW				Condition:		Low	Mod-good
Slope: Gentle Mod, Steep		Aspect (degrees or cardinal): E		Altitude: 91m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes/No/Undecided?							
Vegetative Structure (formation): Open forest				Ecologically Dominant Layer (EDL) - most biomass = canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E							
T1	10-20	14m	10%	Eucalyptus mellucera Eucalyptus tereticornis			
T2	3-6m	6m	40%	eucalyptus regen			
T3							
S1	1-4m	2m	20%	Acacia falcata Eucalyptus regen Acacia paniculata			
S2							
G	0-1m	0.2m	90%	Microbora, Thymus, Acaia, Apocynum Dichroa, Bosquin, protuber, Libertia, Myrica Diverse ground layer.			
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)							
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)							
Definitions							
Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated							
Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)							
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall							
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest							
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect			
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point			
5m	5	10	0	Native grass tally -			
10m	0	20	0				
15m	0	40	0				
20m	0	60	0				
25m	0	0	0				
30m	5	10	0	Native other (herb, fern, sedge, etc) tally -			
35m	20	20	0				
40m	0	5	0				
45m	0	5	0				
50m	0	2	0	Native shrub tally -			
Total (sum / 10) = 3%				17.2			
Larger 50 x 20m plot				Total (hits/50)			
Length of woody debris >10cm wide & >0.5m long				4m			
Proportion of canopy sp. regeneration				100%			
Number of trees with hollows >5cm				1			
				Exotic tally -			
				1			
				Total (hits/50)			
				2%			

JACOBS

Site ID: P2 CPH regen			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1. <i>Baccharis forficata</i>	- 3	50+	41. <i>Richardia</i>	1	1				
2. <i>Baccharis mollis</i>	- 2	6	42. <i>Conyza</i>	1	1				
3. <i>Arachis</i>	- 3	20+	43. <i>Arachis paraguayensis</i>	- 1	2				
4. <i>Baccharis spinosa</i>	- 1	2	44. <i>native plant</i>	- 1	2				
5. <i>Thymus triandra</i>	- 3	20+	45. <i>Glossocordia bidens</i>	- 1	2				
6. <i>Amelanchier refracta</i>	- 2	20+	46. <i>Ozothamnus diorectus</i>	1	1				
7. <i>Cyperus longistylis</i>	- 1	20+	47. <i>Bira subaristata</i>	1	2				
8. <i>Phytolacca sp.</i>	- 3	20+	48. <i>olea europaea</i>	1	1				
9. <i>Melastoma ciliolobos</i>	- 1	5	49. <i>Eucalyptus sp.</i>	- 1	1				
10. <i>Orchidaceae</i>	- 1	20+	50. <i>Phyllanthus / euphorbia</i>	- 1	20+				
11. <i>Acerium sp.</i>	- 1	20+	51. <i>Conyza ciliolata</i>	- 1	1				
12. <i>Cynodon dactylon</i>	- 3	20+	52. <i>Cyperus gracilis</i>	- 1	1				
13. <i>Stemodia mollis</i>	- 1	2	53. <i>Thymus sp.</i>	- 1	1				
14. <i>Albizia tuberosa</i>	- 2	20+	54. <i>Elacanthus gracilis</i>	- 1	1				
15. <i>Microseris stipoides</i>	- 5	20+	55. <i>Vernonia ciliata</i>	- 1	1				
16. <i>Hypericum sp.</i>	- 2	20+	56.						
17. <i>Melastoma ciliolobos</i>	- 2	20+	57.						
18. <i>Albizia tuberosa</i>	- 1	1	58.						
19. <i>Conyza heterophylla</i>	- 2	20+	59.						
20. <i>Bidens pilosa</i>	2	20+	60.						
21. <i>Centella asiatica</i>	- 2	20+	61.						
22. <i>Stachytaraxa viminea</i>	- 1	20+	62.						
23. <i>Arachis sp.</i>	- 2	20+	63.						
24. <i>Conyza sp.</i>	- 1	20+	64.						
25. <i>Conyza sp.</i>	- 2	20+	65.						
26. <i>Digitaria</i>	- 2	20+	66. <i>Axonopus</i>						
27. <i>Centella asiatica</i>	- 2	20+	67.						
28. <i>Eragrostis sp.</i>	- 2	20+	68.						
29. <i>Centella asiatica</i>	- 1	1	69.						
30. <i>Asplenium sp.</i>	- 1	20+	70.						
31. <i>Zornia sp.</i>	- 1	20+	71.						
32. <i>Hibiscus sp.</i>	- 1	3	72.						
33. <i>Fimbristylis diandra</i>	- 2	20+	73.						
34. <i>Conyza sp.</i>	- 2	20+	74.						
35. <i>Polypodium japonica</i>	- 1	1	75.						
36. <i>Decaschisma ciliata</i>	- 1	1	76.						
37. <i>Baccharis prostrata</i>	- 2	20+	77.						
38. <i>Amelanchier</i>	- 1	1	78.						
39. <i>Conyza sp.</i>	- 1	10	79.						
40. <i>Centella</i>	1	1	80.						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	47		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale			Leaf & stick litter						
Modified Braun-blanket 6 scale			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1	<5% - rare		Plot Disturbance	Fire damage:					
2	<5% - common		Clearing (inc. logging):	Storm damage:					
3	5 - 25%		Cultivation (inc. pasture):	Trampling:					
4	25 - 50%		Soil erosion:	Flood damage:					
5	50 - 75%		Firewood collection:	Feral herbivores:					
6	75 - 100%		Stock grazing:	Other:					

Solenopsis

HN 52A Mod/Good - Medium Medium

BioBanking Field Sheet

Entered ✓

JACOBS

Shale Plains - mod/good - Olive fest

Survey Site Form - BioBanking				Site ID: 29-2	Vegetation zone:			
Date	21/01/2016			Surveyor(s):				
Waypoint ID	773			Photo numbers	2336	2337	2338	2339
Coordinates	E 0285915 N 6246621			Photo direction	N	E	S	W
Mapped Vegetation type:				Condition:		Low		Mid-good
Slope (Gentle) Mod, Steep		Aspect (degrees or cardinal):		Altitude:				
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant: Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) = Woodland				Ecologically Dominant Layer (EDL) - most biomass = <i>PAND SHARP LAYER</i>				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E	20-25			<i>E. teretiformis</i> <i>E. moluccana</i>				
T1	-							
T2	-							
T3	-							
S1	1-8			<i>Acacia eucalypta</i> (RWD) - dominant - dense <i>Bursaria spinosa</i>				
S2	-							
G	0-1			<i>Mitrasacme stip</i> <i>Dioscorea spumosa</i>				
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>								
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet. 50 points along 50m transect				
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point				
5m	0	0	50	Native grass tally -				
10m	0	0	70					
15m	0	0	60					
20m	0	0	90					
25m	0	0	40					
30m	0	20	60	Native other (herb, fern, sedge, etc) tally -				
35m	5	0	60					
40m	0	0	20					
45m	5	10	70					
50m	0	0	70	Native shrub tally -				
Total (sum / 10) =	1%	3%	59%	Total (hits/50)				
Larger 50 x 20m plot				Total (hits/50)				
Length of woody debris >10cm wide & >0.5m long				0%				
Proportion of canopy sp. regeneration				0				
Number of trees with hollows >5cm				2				
				Exotic tally -				
				Total (hits/50)				
				22%				

JACOBS

Site ID: 292		Survey type: Quadrat 20m x 20m			
Species	Cover	Abund.	Species	Cover	Abund.
1 E. terebinthifolia	3	1	41		
2 E. moluccana	4	3	42		
3 Alia eurpea	6	40	43		
4 Eursana spm	1	3	44		
5 Dinkandra repens	3	100+	45		
6 Micro. stip.	4	100+	46		
7 Optismenis aimilus	3	50	47		
8 Setaria sp.	2	20+	48		
9 Scarlet pmp.	1	1	49		
10 Cashing plant	1	1	50		
11 Cyperis gracilis	2	20+	51		
12 Sphaerostelea orientalis	1	1	52		
13 Bidens pilosa	1	2	53		
14 Velema bonariensis	1	3	54		
15 Cirsium vulgare	1	1	55		
16 Greca caroliniana	2	20+	56		
17 Salvinum morum	1	1	57		
18 Cyperis eragrostis	2	20+	58		
19 Spha rhom.	2	20+	59		
20 Paspalum	2	20+	60		
21 Salvinum praphyllum	1	1	61		
22 Cynodactylum (couch)	4	100+	62		
23 Commelina	2	20+	63		
24 Ricinus communis	1	2	64		
25 Cyperis congestus	2	20+	65		
26 Galanina	1	3	66		
27 Asthera weed	1	1	67		
28 Peltis spurge	2	20+	68		
29 Alternanthera dent.	1	1	69		
30 Adiantum sp.	1	5	70		
31			71		
32			72		
33			73		
34			74		
35			75		
36			76		
37			77		
38			78		
39			79		
40			80		

Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	16		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blauquet 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HN52a Mod/wood - Poor

BioBanking Field Sheet

Entered ✓

JACOBS394
39-4

Shale Hills - Poor

Survey Site Form - BioBanking				Site ID: 394 CPW	Vegetation zone:			
Date	21/01/16			Surveyor(s)				
Waypoint ID	772			Photo numbers	2332	2333	2334	2335
Coordinates	E 0286184 N 6247434			Photo direction	N	E	S	W
Mapped Vegetation type:				Condition: DIBACK	(Low)		Mod-good	
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal):		Altitude:				
Topography (crest) ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace								
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?								
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?								
Vegetative Structure (formation) = WOODLAND				Ecologically Dominant Layer (EDL) - most biomass =				
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance				
E	20 - 25	22.5		E. moluccana				
T1	-							
T2	-							
T3	-							
S1	1 - 2	1.5		Bursaria spm Alchornea boerhaavia				
S2	-							
G	0 - 1.2	0.6		Paspalum dilatatum Setaria				
Tree height (clim) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clim) from bottom of slope = distance from tree x (top% - bottom%)								
Definitions Dominance d = dominant; c = co-dominant; s = subdominant; a = associated Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)								
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest								
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect				
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point				
5m	5	0	0	Native grass tally -				
10m	5	0	0	Total (hits/50)				
15m	0	0	0	12%				
20m	0	0	0					
25m	5	0	0					
30m	10	0	0	Native other (herb, fern, sedge, etc) tally -				
35m	0	0	0	Total (hits/50)				
40m	2	0	0	16%				
45m	20	0	2					
50m	0	0	0					
Total (sum / 10) =	4.7	0	0.2	Native shrub tally -				
Larger 50 x 20m plot				Total (hits/50)				
Length of woody debris >10cm wide & >0.5m long	37			0%				
Proportion of canopy sp. regeneration	1			Exotic tally -				
Number of trees with hollows >5cm	0			Total (hits/50)				
				72%				

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Site ID: 394		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1. <i>E. moluccana</i>	4	7	41					
2. <i>Setaria</i>	3	20+	42					
3. <i>Paspalum dilatatum</i>	5	100+	43					
4. <i>Chloris verticosa</i>	3	20+	44					
5. <i>Andropogon tenax</i>	1	1	45					
6. <i>Sida rhomb.</i>	4	100+	46					
7. <i>Gnaphalium cyania</i>	3	20+	47					
8. <i>Senecio madag.</i>	3	20+	48					
9. <i>Pinaria trigona</i>	4	100+	49					
10. <i>Altanthera (fat leaf)</i>	1	1	50					
11. <i>Glycine tapachina</i>	2	20+	51					
12. <i>Oxalis petenensis</i>	2	20+	52					
13. <i>Paspalum</i>	2	20+	53					
14. <i>Cyperus long brachis</i>	1	1	54					
15. <i>Ricardia</i>	2	20+	55					
16. <i>Lepidium africanum</i>	2	20+	56					
17. <i>Modiola capillanaga</i>	2	20+	57					
18. <i>Peperomia Stinky toe</i>	1	1	58					
19. <i>Thonella Thonella</i>	1	5	59					
20. <i>Gnaphalium celosianthes</i>	1	1	60					
21. <i>African Boxthorn</i>	1	1	61					
22. <i>Chloris gayana</i>	1	2	62					
23. <i>Solanum merina</i>	1	1	63					
24. <i>Cirsium volucre</i>	1	5	64					
25. <i>Indigofera australis</i>	1	1	65					
26. <i>Plantago lanceolata</i>	1	1	66					
27. <i>Alternanthera deflexilata</i>	1	2	67					
28. <i>Verbena sp</i>	1	1	68					
29. <i>Riza sub</i>	1	1	69					
30. <i>Wallenbergia gracilis</i>	1	1	70					
31. <i>Conziza</i>	1	1	71					
32. <i>Scorlet princeps</i>	1	1	72					
33. <i>Hypochaeris radiata</i>	1	1	73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	14		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale: Modified Braun-blauquet 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
			Stock grazing:	Other:				

HNS2a Mod/wood - poor

BioBanking Field Sheet

Shale Hills - Poor

JACOBS

Eton Rd

Entered ✓

Survey Site Form - BioBanking				Site ID: 530 371		Vegetation zone: CPW	
Date	3/9/2015			Surveyor(s): Lukas Clews			
Waypoint ID	530 371			Photo numbers	1270		
Coordinates	E N			Photo direction	N E S W		
Mapped Vegetation type: CPW				Condition:	Low Mod-grass		
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): NNW		Altitude: 91m			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact/topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation): open forest				Ecologically Dominant Layer (EDL) - most biomass = Canopy			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E							
T1	20-25m			Eucalyptus tereticornis			
T2							
T3							
S1	2-8m			Exocarpos cupressiformis Olea europaea			
S2	1-4m			Bursaria spinosa			
G				Thymelicus lineator delais scabra Eragrostis curvula			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				Ground cover tally sheet, 50 points along 50m transect			
10 Points - Foliage Projective Cover				- every 1m record if plant intersects (hits) point			
Point	Canopy % (photos)	Midstorey %	Exotic %				
5m	20	25	90	Native grass tally - 			Total (hits/50)
10m	30	65	0				42%
15m	20	80	0				
20m	20	0	60				
25m	40	50	0				
30m	40	60	30	Native other (herb, fern, sedge, etc) tally - 			Total (hits/50)
35m	30	70	0				4%
40m	5	50	0				
45m	5	25	0				
50m	0	0	50				
Total (sum / 10) = 21 42.5 23				Native shrub tally - 			Total (hits/50)
Larger 50 x 20m plot							2%
Length of woody debris >10cm wide & >0.5m long 4.6m							
Proportion of canopy sp. regeneration 100%				Exotic tally - 			Total (hits/50)
Number of trees with hollows >5cm 4							52%

BMAO

JACOBS

Site ID: 530971			Survey type: Quadrat 20m x 20m 10x40m roadside					
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus tecticornis	5	12	41					
2 Eucalyptus mellucera	4	10	42					
3 Olea europaea	5	20+	43					
4 Bursaria spinosa	4	20+	44					
5 Dichondra repens	2	20+	45					
6 Thymela triadica	3	20+	46					
7 Setaria	3	20+	47					
8 Eriogonum curvula	3	20+	48					
9 Verbena	2	20+	49					
10 Chamaecyparis	3	20+	50					
11 Sarcocolla madagascariensis	1	1	51					
12 Sarcocolla alba	1	9	52					
13 Hypericum	2	20+	53					
14 Exocarpos appressifolius	1	2	54					
15 Muehlenbergia eucalyptoides?	1	2	55					
16 Brachyotum capillare	1	1	56					
17 Vicia sativa	2	20+	57					
18 Hypochaeris radicata	1	8	58					
19 Sigesbeckia orientalis	1	1	59					
20 Plantago lanceolata	1	1	60					
21 Solanum procumbens	2	10	61					
22 Desmodium	1	1	62					
23 Glycine clandestina	1	1	63					
24 Marsdenia?	1	1	64					
25 Neria pinnatifida	1	1	65					
26 Acrocalymma	1	1	66					
27 Crinoidella australis	1	1	67					
28 Asperula conferta	1	1	68					
29 Bidens pilosa	2	20+	69					
30 Trifolium repens	1	1	70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	17		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale			Leaf & stick litter					
Modified Braun-blanket 6 scale			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1	<5% - rare		Plot Disturbance	Fire damage:				
2	<5% - common		Clearing (inc. logging):	Storm damage:				
3	5 - 25%		Cultivation (inc. pasture):	Trampling:				
4	25 - 50%		Soil erosion:	Flood damage:				
5	50 - 75%		Firewood collection:	Feral herbivores:				
6	75 - 100%		Stock grazing:	Other:				

Entered

Shale Hills - Poor

1

JACOBS

Site ID: 1071			Survey type: Quadrat 20m x 20m					
Species	Cover	Abund.	Species	Cover	Abund.			
1 Eucalyptus tereticornis -	5	17	41					
2 Eucalyptus mollurca -	5	14	42					
3 Lycium ferocissimum	3	5	43					
4 Glinolia hastata -	3	20+	44					
5 Sida rhombifolia	2	20+	45					
6 Eleocharis acuta	4	20+	46					
7 Dichondra repens -	3	20+	47					
8 Arachis scitiformis	2	20+	48					
9 Crotalaria -	1	1	49					
10 Oxalis yellow -	2	20+	50					
11 Chickweed	2	20+	51					
12 Phytolacca octandra	1	1	52					
13 Conyza bonariensis	1	3	53					
14 Cynodon dactylon -	2	20+	54					
15 Cirsium vulgare	1	1	55					
16 Solanum nigrum	1	2	56					
17 Plantago lanceolata	1	1	57					
18 Penstemon claudii	4	20+	58					
19 Juncus acutus	1	4	59					
20 Hypochaeris radicata	1	1	60					
21			61					
22			62					
23			63					
24			64					
25			65					
26			66					
27			67					
28			68					
29			69					
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	7		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
1 <5% - rare			Plot Disturbance		Fire damage:			
2 <5% - common			Clearing (inc. logging):		Storm damage:			
3 5 - 25%			Cultivation (inc. pasture):		Trampling:			
4 25 - 50%			Soil erosion:		Flood damage:			
5 50 - 75%			Firewood collection:		Feral herbivores:			
6 75 - 100%			Stock grazing:		Other:			

HN 630 Mod/Wood-Other

BioBanking Field Sheet

JACOBS

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Survey Site Form - BioBanking				Site ID: P12-wetland	Vegetation zone: Wetland
Date	2/2/2016			Surveyor(s): Lukas Clews	
Waypoint ID	781			Photo numbers	2448 2449 2450 2451
Coordinates	E 0286937 N 6257521			Photo direction	N E S W
Mapped Vegetation type: NA				Condition:	Low Med/good
Slope: Gentle, Mod, Steep		Aspect (degrees or cardinal): Flat		Altitude: 62m	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace					
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, gneiss, limestone, metamorphics, gravel, ?					
Soil type: sand, loam, clay, organic, gravel, skeletal, ?			Soil disturbance: insect, topsoil removed, fill, other: small		
Remnant / Old growth (uncleared): Yes / No / Undecided? man made dams on watercourse					
Vegetative Structure (formation) =				Ecologically Dominant Layer (EDL) - most biomass =	
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance	
E					
T1					
T2					
T3					
S1					
S2					
G	0-3m	1.8m	98%	<i>Juncus acutus</i> (d), <i>Juncus acutatus</i> <i>Paspalum distichum</i> , <i>Pennisetum hydrophorum</i> <i>Utricularia pedicularis</i> , <i>Typha orientalis</i> , <i>Panicum virgatum</i>	
Tree height (cm) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (cm) from bottom of slope = distance from tree x (top% - bottom%)					
Definitions Dominance d = dominant; c = co-dominant; s = subdominant; a = associated Estimated cover i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)					
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest					
50m Transect		10 Points - Foliage Projective Cover		Ground cover tally sheet, 50 points along 50m transect	
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point	
5m	0	0	0	Native grass tally -	
10m					
15m					
20m					
25m					
30m				Native other (herb, fern, sedge, etc) tally -	
35m					
40m					
45m					
50m					
Total (sum / 10) =		0%	0%	0%	Native shrub tally -
Larger 50 x 20m plot				Total (hits/50)	
Length of woody debris >10cm wide & >0.5m long		0		0%	
Proportion of canopy sp. regeneration		0%		Exotic tally -	
Number of trees with hollows >5cm		0		Total (hits/50)	
				58%	

JACOBS

Site ID: P12 Wetland 1		Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.			
1 <i>Pennisetum hydrogiper</i>	- 3	20+	41					
2 <i>Pennisetum decipiens</i>	- 2	10	42					
3 <i>Tenax acutus</i>	5	20+	43					
4 <i>Paspalum distichum</i>	- 84	20+	44					
5 <i>Cynodon dactylon</i>	- 84	20+	45					
6 <i>Acer sapotatus</i>	2	20+	46					
7 <i>Saccio madagascariensis</i>	2	20+	47					
8 <i>Platago lanceolata</i>	2	20+	48					
9 <i>Atriplex</i>	- 3	20+	49					
10 <i>Conyza bonariensis</i>	2	14	50					
11 <i>Bidens pilosa</i>	2	20+	51					
12 <i>Trifolium repens</i>	2	20+	52					
13 <i>Juncus acutus</i>	- 5	20+	53					
14 <i>Typha orientalis</i>	- 2	20+	54					
15 <i>Ranunculus inundatus</i>	- 2	20+	55					
16 <i>Pumex crispus caeruleus</i>	- 2	20+	56					
17 <i>Hydrogila prostrata</i>	- 3	20+	57					
18 <i>Echinochloa crus-galli</i>	1	3	58					
19 <i>Pennisetum purpureum</i>	- 2	20+	59					
20 <i>Eleocharis spicata</i>	- 1	10	60					
21 <i>Microphyllum</i>	- 2	20+	61					
22 <i>Philydium lanuginosum</i>	- 1	3	62					
23 <i>Trioloph</i>	- 1	20+	63					
24 <i>Sparganium</i>	- 1	20+	64					
25 <i>Azolla pinnata</i>	- 2	20+	65					
26 <i>Lachnagrostis filiformis</i>	- 2	20+	66					
27 <i>Rubus fruticosus</i>	1	1	67					
28 <i>Calochortus dubius</i>	- 1	2	68					
29			69					
30			70					
31			71					
32			72					
33			73					
34			74					
35			75					
36			76					
37			77					
38			78					
39			79					
40			80					
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Tree	19		Native perennial grass					
Shrub			Native other grass					
Grass (annual)			Native forb & other					
Grass (perennial)			Native shrub (<1m)					
Other (annual)			Exotic grass					
Other (perennial)			Exotic forb & other					
Cover abundance scale Modified Braun-blanket 6 scale 1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Leaf & stick litter					
			Rocks					
			Bare ground					
			Cryptogams					
			Total	100	100	100	100	100
			Plot Disturbance	Fire damage:				
			Clearing (inc. logging):	Storm damage:				
			Cultivation (inc. pasture):	Trampling:				
			Soil erosion:	Flood damage:				
			Firewood collection:	Feral herbivores:				
Stock grazing:	Other:							

HN 630

Mod/Good - Other

BioBanking Field Sheet

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Survey Site Form - BioBanking				Site ID: P12 Wetland 2	Vegetation zone: Wetland
Date	2/2/2016			Surveyor(s):	
Waypoint ID	782			Photo numbers	2454 2455 2456 2457
Coordinates	E 0286948 N 6257386			Photo direction	N E S W
Mapped Vegetation type:	N+			Condition:	Low Mod-good
Slope: Gentle, Mod, Steep	Aspect (degrees or cardinal):			Altitude:	57m
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace					
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?					
Soil type: sand, loam, clay, organic, gravel, skeletal, ?			Soil disturbance: intact, topsoil removed, fill		
Remnant / Old growth (uncleared): Yes / No / Undecided?			Water - shin deep - 20cm		
Vegetative Structure (formation) = wetland			Ecologically Dominant Layer (EDL) - most biomass = ground		
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance	
E					
T1					
T2					
T3					
S1					
S2					
G	0-3m			<i>Proserpinaca</i> <i>distichum</i> , <i>Taraxacum officinale</i> <i>Persicaria hydropiper</i> , <i>Hydrocotyle vulgaris</i> <i>Typha angustifolia</i> , <i>Phytolacca rugosa</i>	
Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%) Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)					
Definitions Dominance d = dominant; c = co-dominant; s = subdominant; a = associated Estimated cover l = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)					
Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest					
50m Transect	10 Points - Foliage Projective Cover			Ground cover tally sheet, 50 points along 50m transect	
Point	Canopy % (photos)	Midstorey %	Exotic %	- every 1m record if plant intersects (hits) point	
5m				Native grass tally -	
10m				Total (hits/50)	
15m				48%	
20m					
25m					
30m				Native other (herb, fern, sedge, etc) tally -	
35m				Total (hits/50)	
40m				50%	
45m					
50m					
Total (sum / 10) =	0	0	0	Native shrub tally -	
Larger 50 x 20m plot				Total (hits/50)	
Length of woody debris >10cm wide & >0.5m long				0%	
Proportion of canopy sp. regeneration				0%	
Number of trees with hollows >5cm				0%	

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Site ID: P12 Wetland 2			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1. <i>Paspalum distichum</i>	5	100+	41						
2. <i>Juncus rostratus</i>	4	100+	42						
3. <i>Philydron lanuginosum</i>	2	20+	43						
4. <i>Panicum lanuginosum</i>	2	20+	44						
5. <i>Lactuca pectinoides</i>	3	20+	45						
6. <i>Myriophyllum</i>	2	20+	46						
7. <i>Juncus procumbens</i>	2	10	47						
8. <i>Triplachne</i>	1	20+	48						
9. <i>Pennisetum hydropiper</i>	4	20+	49						
10. <i>Pennisetum decipiens</i>	2	10	50						
11. <i>Pennisetum glaucum</i>	1	2	51						
12. <i>Typha orientalis</i>	2	20+	52						
13. <i>Alternanthera dentata</i>	2	20+	53						
14. <i>Danthonia minus</i>	2	20+	54						
15. <i>Sporobolus</i>	1	20+	55						
16. <i>Panicum capense</i>	1	5	56						
17. <i>Cyperus bispinosus</i>	1	2	57						
18. <i>Juncus acutis</i>	1	3	58						
19. <i>Setaria</i>	1	1	59						
20. <i>Coryza baccata</i>	2	10	60						
21. <i>Centella asiatica</i>	2	20+	61						
22. <i>Eleusine indica</i>	1	20+	62						
23. <i>Plantago lanceolata</i>	1	20+	63						
24. <i>Paspalum dilatatum</i>	1	2	64						
25. <i>Schizanthus validus</i>	1	1	65						
26			66						
27			67						
28			68						
29			69						
30			70						
31			71						
32			72						
33			73						
34			74						
35			75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	18		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-Blanquet 6 scale:			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Plot Disturbance	Fire damage:					
			Clearing (inc. logging):	Storm damage:					
			Cultivation (inc. pasture):	Trampling:					
			Soil erosion:	Flood damage:					
			Firewood collection:	Feral herbivores:					
			Stock grazing:	Other:					

UN 630

Mod / Wood - other (dam)

BioBanking Field Sheet

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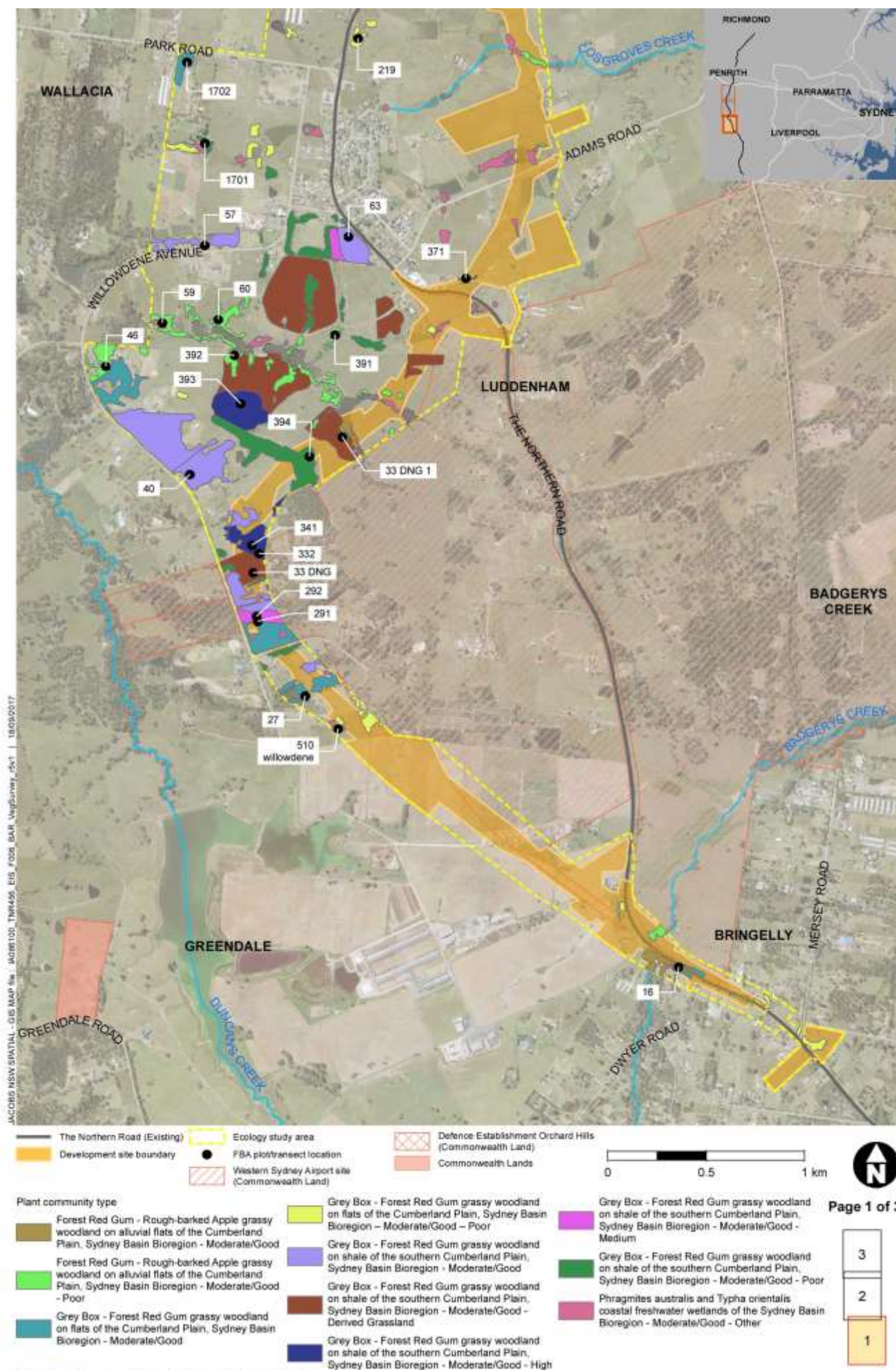
Entered ✓

Survey Site Form - BioBanking				Site ID: P13 wellad		Vegetation zone: wellad	
Date: 4/2/2016				Surveyor(s): Lukas Clews			
Waypoint ID: 806				Photo numbers: 2192		2493 2494 2495	
Coordinates: E 0286692 N 6256688				Photo direction: N		E S W	
Mapped Vegetation type: NL				Condition: Low		Med-good	
Slope: Gentle, Mod, Steep				Aspect (degrees or cardinal): flat		Altitude: 69m	
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace							
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?							
Soil type: sand, loam, clay, organic, gravel, skeletal, ?				Soil disturbance: intact, topsoil removed, fill			
Remnant / Old growth (uncleared): Yes / No / Undecided?							
Vegetative Structure (formation) = wellad				Ecologically Dominant Layer (EDL) - most biomass = grand layer			
Strata	Height interval	Median	Est. cover	Dominant Species & Dominance			
E	10-15m	10m	5%	Cascavina glauca			
T1							
T2							
T3							
S1							
S2							
G	2.5m	1m	98%	Juncus dolus (d) Typha, Paspalum, decipiens Eragrostis, clactylon, & Lycopodium			
<p>Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)</p> <p>Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)</p> <p>Definitions</p> <p>Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated</p> <p>Estimated cover: i = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)</p> <p>Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall</p> <p>W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest</p>							
50m Transect				10 Points - Foliage Projective Cover			
Point	Canopy % (photos)	Midstorey %	Exotic %	Ground cover tally sheet, 50 points along 50m transect			
5m	0	0	0	- every 1m record if plant intersects (hits) point			
10m				Native grass tally -			
15m				Total (hits/50)			
20m				30%			
25m							
30m				Native other (herb, fern, sedge, etc) tally -			
35m				Total (hits/50)			
40m				0%			
45m							
50m							
Total (sum / 10) = 0				Native shrub tally -			
Larger 50 x 20m plot				Total (hits/50)			
Length of woody debris >10cm wide & >0.5m long				0%			
Proportion of canopy sp. regeneration				0			
Number of trees with hollows >5cm				0			
				Exotic tally -			
				Total (hits/50)			
				70%			

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Site ID: P13 wetland			Survey type: Quadrat 20m x 20m						
Species	Cover	Abund.	Species	Cover	Abund.				
1. <i>Juncus acutus</i>	6	100	41						
2. <i>Larrea tridentata</i>	2	30	42						
3. <i>Furcraea rigida</i>	1	2	43						
4. <i>Pennisetum setaceum</i>	1	20+	44						
5. <i>Cynodon dactylon</i>	3	>100	45						
6. <i>Setaria</i>	2	20+	46						
7. <i>Plantago lanceolata</i>	2	20+	47						
8. <i>Senecio madagascariensis</i>	1	3	48						
9. <i>Reboulia hirtellus</i>	1	3	49						
10. <i>Araucaria arborescens</i>	1	1	50						
11. <i>Casuarina glauca</i>	2	1	51						
12. <i>Halimolobos</i>	2	20+	52						
13. <i>Cirsium vulgare</i>	2	20+	53						
14. <i>Bidens pilosa</i>	1	1	54						
15. <i>Callitriche falcata</i>	1	1	55						
16. <i>Medicago lupulina</i>	1	1	56						
17. <i>Alternanthera versicolor</i>	2	20+	57						
18. <i>Centella asiatica</i>	2	50	58						
19. <i>Leptocarpum leptophyllum</i>	1	20+	59						
20. <i>Aster subulatus</i>	2	20+	60						
21. <i>Juncus acutus</i>	2	20+	61						
22. <i>Epilobium hilladinae</i>	1	2	62						
23. <i>Senecio glaucus</i>	1	1	63						
24. <i>Verbena bonariensis</i>	1	1	64						
25. <i>Oxalis perennans</i>	1	1	65						
26. <i>Trifolium repens</i>	1	1	66						
27. <i>Anagallis arvensis</i>	1	1	67						
28. <i>Cyperus eragrostis</i>	1	1	68						
29. <i>Adiantum punctatum</i>	1	10	69						
30. <i>Pennisetum hydrogiper</i>	1	1	70						
31. <i>Atriplex</i>	1	1	71						
32			72						
33			73						
34			74						
35			75						
36			76						
37			77						
38			78						
39			79						
40			80						
Sp. Richness	Native	Exotic	Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5	
Tree	13		Native perennial grass						
Shrub			Native other grass						
Grass (annual)			Native forb & other						
Grass (perennial)			Native shrub (<1m)						
Other (annual)			Exotic grass						
Other (perennial)			Exotic forb & other						
Cover abundance scale Modified Braun-blauquet 6 scale 1 <5% - rare 2 <5% - common 3 5 - 25% 4 25 - 50% 5 50 - 75% 6 75 - 100%			Leaf & stick litter						
			Rocks						
			Bare ground						
			Cryptogams						
			Total	100	100	100	100	100	
			Plot Disturbance		Fire damage:				
			Clearing (inc. logging):		Storm damage:				
			Cultivation (inc. pasture):		Trampling:				
			Soil erosion:		Flood damage:				
			Firewood collection:		Feral herbivores:				
Stock grazing:		Other:							

Appendix B – Revised Figure 3.1 of the BAR



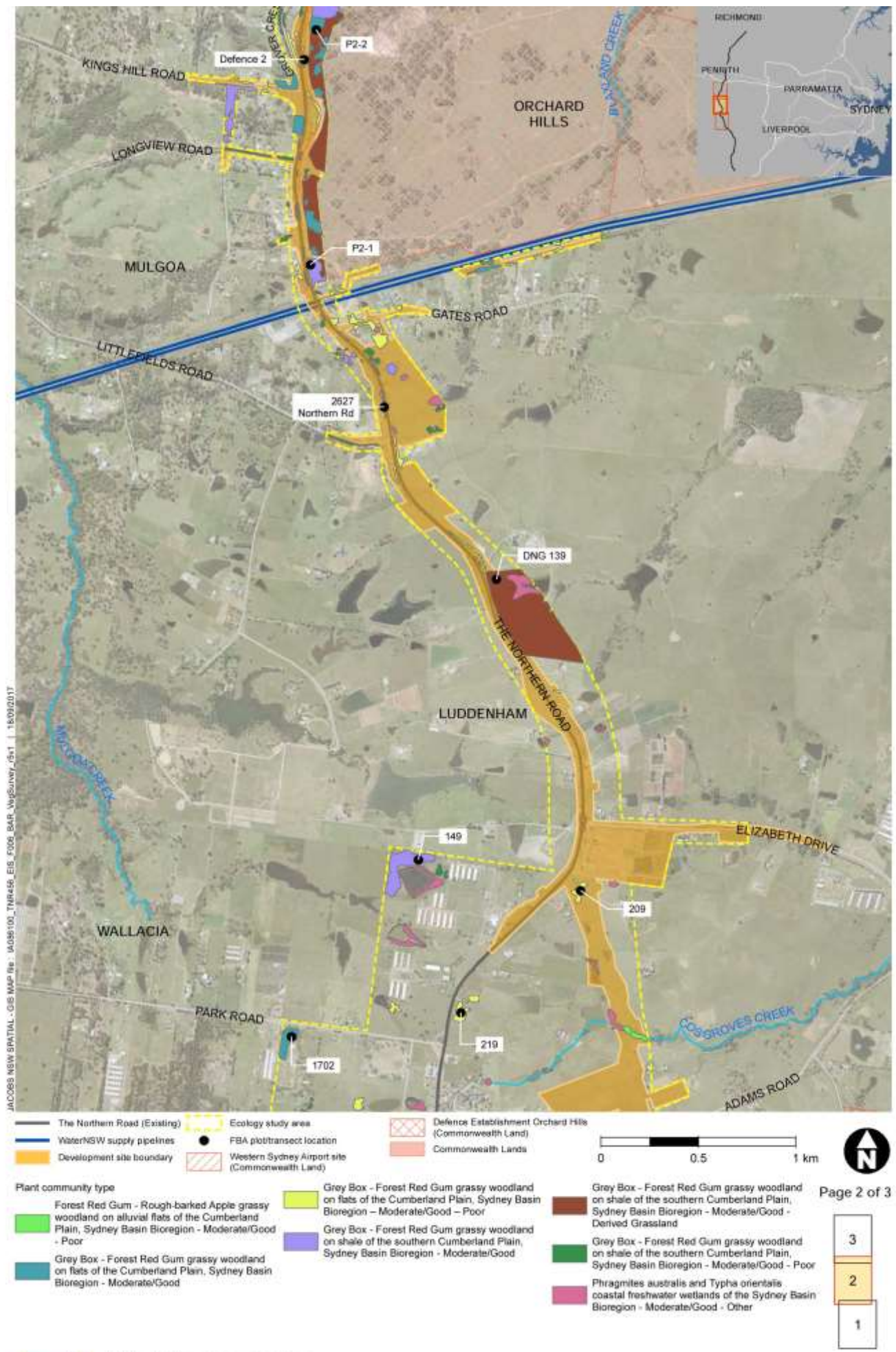


Figure 3-1 | Vegetation survey locations

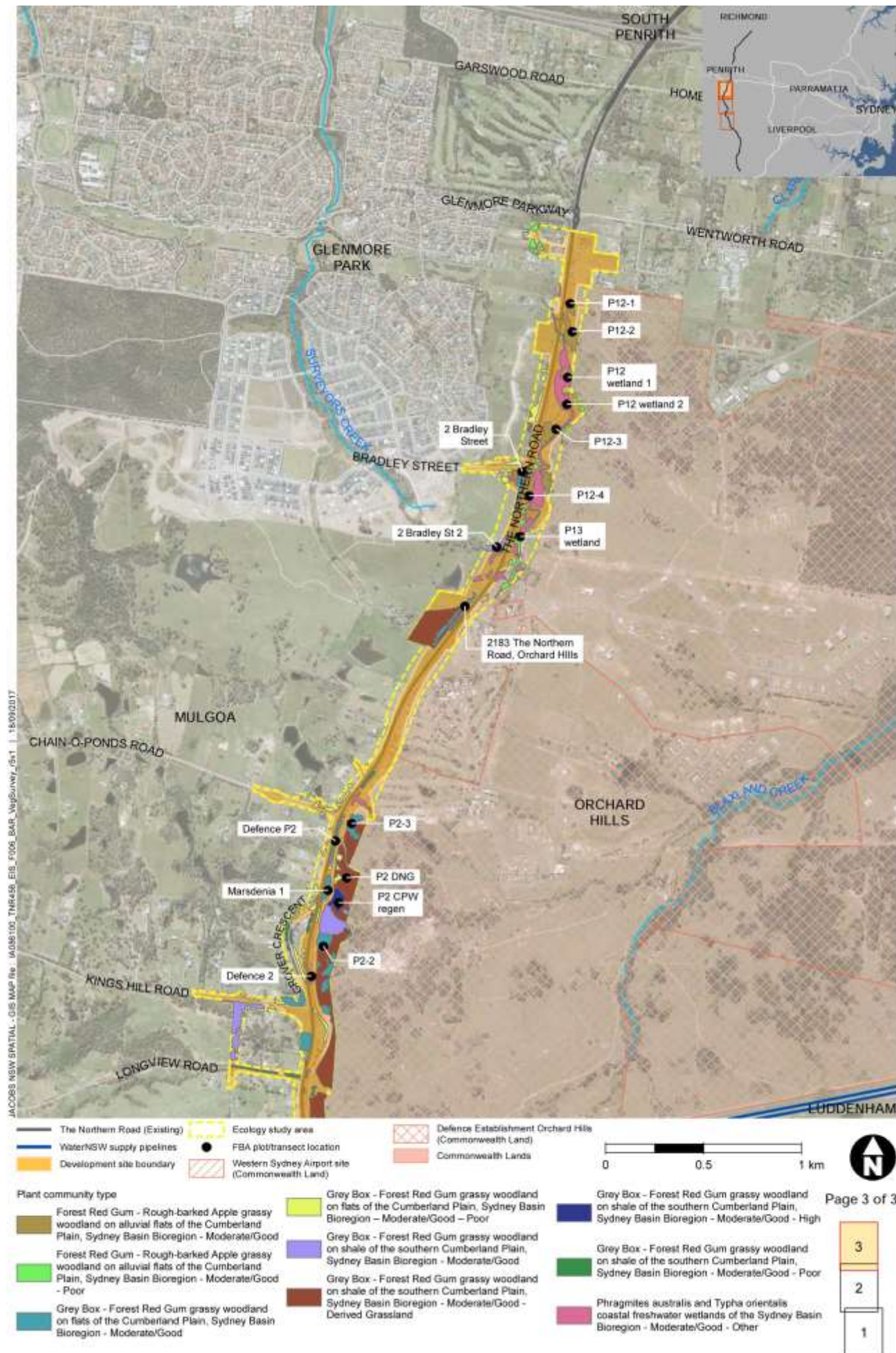


Figure 3-1 | Vegetation survey locations

Appendix C – Habitat assessment for threatened fauna species

Habitat assessment table for threatened fauna species identified from the BioBanking credit calculator and PMST

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Australian Painted Snipe <i>(Rostratula australis)</i>	V	E	The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	1 – OEH Atlas Predicted by BioBank Calculator PMST	Low. Occurs in permanent creeks, vegetated swamps particularly with dense riparian habitat, very few records in the locality, although secretive species. Targeted and not recorded.	Ecosystem
Australasian Bittern <i>(Botaurus poiciloptilus)</i>	E	E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.).	1 – OEH Atlas Predicted by BioBank Calculator PMST	Low. Occurs in permanent creeks, rivers and swamps particularly with dense riparian habitat and emergent vegetation. Very few records in the locality although secretive. This species may occur in dams along drainage lines and adjacent waterways particularly where <i>Phragmites australis</i> and <i>Typha orientalis</i> occur, and is associated with PCT835. Recent records of this species exist from Oran Park from 2011.	Species

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Australian Grayling (<i>Prototroctes maraena</i>)	E (FM Act)	V	The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones such as the Tambo River, which is also known to have granite outcrops. The species has also been associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers (Victoria) and in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). The species has been found over 100 km upstream from the sea.	PMST	Low. No suitable habitat is present.	-
Barking Owl (<i>Ninox connivens</i>)	V	-	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils.	37 – OEH Atlas Predicted by BioBank Calculator	Moderate. Nearest record in locality is from Mulgoa Creek opposite the Golf Course from 2002. May forage in the study area.	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Black Bittern (<i>Ixobrychus flavicollis</i>)	V	-	The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. The species also occurs in the south-west of Western Australia. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	2 – OEH Atlas Predicted by BioBank Calculator	Low. Occurs in permanent creeks, vegetated swamps particularly with dense riparian habitat, very few records in the locality, although secretive species. Targeted during bird surveys.	Species
Black-chinned Honeyeater (eastern subspecies) (<i>Melithreptus gularis subsp. gularis</i>)	V	-	In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range. Occupies mostly upper levels of drier open forests or woodlands.	1 – OEH Atlas Predicted by BioBank Calculator	Moderate. This species was recently recorded on private property off Tyson Rd Greendale in 2013. While likely to only rarely occur in the study area there is a possibility that this species does occur based on the habitat that is present.	Ecosystem
Black-tailed Godwit (<i>Limosa limosa</i>)	V	M	The Black-tailed Godwit is a migratory wading bird. Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.	1 – OEH Atlas Predicted by BioBank Calculator	Low. The wetlands (farm dams) in the study area are not considered likely to provide suitable habitat for this species.	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Broad-headed Snake (<i>Hoplocephalus bungaroides</i>)	V	V	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer.	0 – OEH Atlas PMST	None. This species does not occur in the study area. No habitat is present.	Ecosystem and Species
Brown Treecreeper (eastern subspecies) (<i>Climacteris picumnus subsp. victoriae</i>)	V	-	The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey.	0 – OEH Atlas Predicted by BioBank Calculator	Low. This species has not been recorded from the Cumberland Plain within the locality. The closest records are to the west at the edges of Lake Burragorang. This species is considered unlikely to occur in the study area.	Ecosystem
Brush-tailed Rock-wallaby (<i>Petrogale penicillata</i>)	E	V	Range extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	2 – OEH Atlas PMST	None. This species does not occur in the study area. No habitat is present.	Species

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Bush Stone-curlew (<i>Burhinus grallarius</i>)	E	-	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber.	2 – OEH Atlas Predicted by BioBank Calculator	Low. Two birds previously existed on the Defence Establishment Orchard Hills but have not been seen recently. Records exist from Prestons and Carne's Hill (last recorded in 1950). The species is considered unlikely to occur in the study area due to predation pressure and habitat modification.	Ecosystem
Comb-crested Jacana (<i>Irediparra gallinacea</i>)	V	-	The Comb-crested Jacana occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in south-eastern NSW (possibly in response to unfavourable conditions further north). Inhabits permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.	0 – OEH Atlas Predicted by BioBank Calculator	Low. This species is not known from the locality or study area. Any birds that may occur in the study area would be vagrants. The study area is not in the natural range of this species.	Species
Cumberland Plain Land Snail (<i>Meridolum corneovirens</i>)	E	-	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Known from over 100 different locations, but not all are currently occupied, and they are usually isolated from each other as a result of land use patterns. Primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also	200 – OEH Atlas Predicted by BioBank Calculator	Present Numerous records in the locality, occurs in natural and disturbed woodland of varying patch size. Targeted during the fauna surveys.	Species

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
			known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities.			
Diamond Firetail (<i>Stagonopleura guttata</i>)	V	-	Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands.	1 – OEH Atlas Predicted by BioBank Calculator	Moderate. This species was recorded from the Defence Establishment Orchard Hills in 2006. It was recorded at 'Twin Creeks' Luddenham in 2012. Also recorded near Wallacia in 1990 on the Golf Course. Considered unlikely to be common but a small population may occur in the study area.	Ecosystem
Dural Land Snail (<i>Pommerhelix duralensis</i>)	-	E	The Dural land snail is endemic to New South Wales. The species is a shale-influenced habitat specialist, which occurs in low densities along the northwest fringe of the Cumberland Plain on shale-sandstone transitional landscapes. The species has been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris.	0 – OEH Atlas PMST	None. Study area is habitat for Cumberland Plain Land Snail.	Species
Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>)	V	-	Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	46 – OEH Atlas Not predicted by BioBank Calculator	Present. This species was recorded on Anabat during the field survey.	Ecosystem and Species

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)	V	-	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m	5 – OEH Atlas Predicted by BioBank Calculator	Present. This species was recorded on Anabat during the field survey.	Ecosystem
Eastern Freetail-bat (<i>Mormopterus norfolkensis</i>)	V	-	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	34 – OEH Atlas Predicted by BioBank Calculator	Present. This species was recorded on Anabat during the field survey.	Ecosystem
Eastern Pygmy Possum (<i>Cercartetus nanus</i>)	V	-	Found in a broad range of habitats from rainforest through to wet and dry sclerophyll forest and woodland to heath, but in most areas woodlands and heath appear to be preferred.	1 – OEH Atlas Predicted by BioBank Calculator	Low. May occur in a diversity of forest types depending on distribution, typically in dry sclerophyll forest in coastal areas, with heathy understorey or dry and wet heath. Found in wet forest and rainforest in northern NSW. Not expected in the dry fragmented woodland habitat in the study area.	Species
Flame Robin (<i>Petroica phoenicea</i>)	V	-	The Flame Robin is endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains.	6 – OEH Atlas Predicted by BioBank Calculator	Moderate. Three records of the Flame Robin exist in Mulgoa Nature Reserve from 2001 and 2002. This species may utilise habitat in the study area on occasion in winter as birds move down onto the Cumberland Plain in winter.	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Freckled Duck (<i>Stictonetta naevosa</i>)	V	-	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	0 – OEH Atlas Predicted by BioBank Calculator	Low. Records of this species in the locality are from Penrith Lakes form the 1980s. The dams in the study area are not considered optimal for this species.	Ecosystem
Gang-gang Cockatoo (<i>Callocephalon fimbriatum</i>)	V	-	The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal areas.	17 – OEH Atlas Predicted by BioBank Calculator	Moderate. Inhabits the forests of the lower Blue Mountains to the west of the study area and in winter will move down into the western areas of the Cumberland Plain. Records exist at Mulgoa from December 2015.	Ecosystem
Gang-gang Cockatoo population, Hornsby and Ku-ring-gai Local Government Areas	EP	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	0 – OEH Atlas Predicted by BioBank Calculator	None. The study area is not in the Ku-ring-gai or Hornsby LGA	Species

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Giant Burrowing Frog (<i>Heleioporus australiacus</i>)	V	V	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95 per cent of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are about 0.04 hectares in size. Requires ephemeral and permanent freshwater wetlands, ponds, dams with an open aspect and fringed by Typha and other aquatics, free from predatory fish.	5 – OEH Atlas PMST	Low. No suitable habitat is present.	Species
Greater Broad-nosed Bat (<i>Scoteanax rueppellii</i>)	V	-	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m.	17 – OEH Atlas Predicted by BioBank Calculator	Moderate. Records of this species exist in Mulgoa Nature Reserve from 2004, 2013 and 2014. A record is also present at Wallacia from 1993. This species may utilise habitat in the study area.	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Green and Golden Bell Frog (<i>Litoria aurea</i>)	E	V	Since 1990 there have been about 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range; however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. Ephemeral and permanent freshwater wetlands, ponds, dams with an open aspect and fringed by <i>Typha</i> and other aquatics, free from predatory fish.	8 – OEH Atlas Predicted by BioBank Calculator PMST	Low. Records within 20 years within the study area, although no recent records. Occurs in a variety of ephemeral and permanent creek and pond habitats, typically with emergent vegetation. The abundance of farm dams along creek lines suggests potential habitat is present.	Species
Grey-headed Flying- fox (<i>Pteropus poliocephalus</i>)	V	V	Generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	44 – OEH Atlas PMST Not predicted by BioBank Calculator	Recorded. Recorded in the study area during surveys.	Ecosystem and Species

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Hooded Robin (south-eastern form) (<i>Melanodryas cucullata</i> subsp. <i>cucullata</i>)	V	-	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	3 – OEH Atlas Predicted by BioBank Calculator	Low. A record of this species exists at Mulgoa from 2004. Two records also exist at Greendale from 1990. 1995 and 1996. No records of this species have been made in the locality in the last 12 years. This species is considered to have a low likelihood of occurring in the study area.	Ecosystem
Koala (<i>Phascolarctos cinereus</i>)	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	20 – OEH Atlas Predicted by BioBank Calculator	Low. The Koala is considered to have a very low chance of occurring and there is only one historic record from the study area in 1999 from west of Mulgoa Nature Reserve near the Warragamba River around 8 km from the study area.	Species
Large-eared Pied Bat (<i>Chalinolobus dwyer</i>)	V	V	Forages over a broad range of open forest and woodland habitats, this species is a cave roosting bat which favours sandstone escarpment habitats for roosting, in the form of shallow overhangs, crevices and caves.	9 – OEH Atlas PMST	Moderate. May forage in the study area. Records exist nearby in Mulgoa Nature Reserve.	Ecosystem and Species
Little Eagle (<i>Hieraaetus morphnoides</i>)	V	-	Occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used.	4 – OEH Atlas Predicted by BioBank Calculator	Moderate. This species is likely to fly over the study area and may roost in trees.	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Little Lorikeet (<i>Glossopsitta pusilla</i>)	V	-	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in apples (<i>Angophora</i> sp.), paperbarks (<i>Melaleuca</i> sp.) and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country (e.g. paddocks, roadside remnants) and urban trees also help sustain viable populations of the species.	3 – OEH Atlas Predicted by BioBank Calculator	Moderate. While all records of this species are from the north, the study area provides some foraging resources and may contain potential nesting sites.	Ecosystem
Littlejohn's Tree Frog (<i>Litoria littlejohni</i>)	V	V	Distribution includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.	0 – OEH Atlas PMST	Low. No suitable habitat is present.	Species
Macquarie Perch (<i>Macquaria australasica</i>)	E (FM Act)	E	The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water). Populations may survive in impoundments if able to access suitable spawning sites.	PMST	Low. No suitable habitat is present.	-
Masked Owl (<i>Tyto novaehollandiae</i>)	V	-	Dry eucalypt forests and woodland, typically prefers open forest with low shrub density. Requires old trees for roosting and nesting.	12 – OEH Atlas Predicted by BioBank Calculator	Moderate. Known from the Mulgoa Nature Reserve and may utilise habitat in the study area for foraging.	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
New Holland Mouse (<i>Pseudomys novaehollandiae</i>)	-	V	Distribution is fragmented across all eastern states of Australia, where it inhabits open heath lands, open woodlands with heath understorey and vegetated sand dunes.	0 – OEH Atlas PMST	Low. No suitable habitat is present.	NA
Painted Honeyeater (<i>Grantiella picta</i>)	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree/ Weeping Myall (<i>Acacia pendula</i>), Brigalow (<i>A. harpophylla</i>) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	0 – OEH Atlas PMST Predicted by BioBank Calculator	Low. This species has complex movement patterns and is most likely to be detected in and around the study area when mistletoes are in fruit. Lack of records in locality suggests this species is unlikely to occur.	Ecosystem
Powerful Owl (<i>Ninox strenua</i>)	V	-	Open forests with dense wet gullies and creek areas, requires large mature trees with hollows for breeding and dense areas of vegetation for prey and roosting.	37 – OEH Atlas Predicted by BioBank Calculator	Moderate. Known from the Mulgoa Nature Reserve and may utilise habitat in the study area for foraging.	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Regent Honeyeater (<i>Anthochaera phrygia</i>)	E	CE	Temperate woodlands and open forests of the inland slopes of south-east Australia. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks.	6 – OEH Atlas Predicted by BioBank Calculator PMST	Moderate. Records are associated with PCT835, PCT849 and PCT850 and small fragments of higher quality shale hills woodland may be utilised by this species. This species has complex movement patterns and is most likely to be detected in and around the study area in late autumn to early spring (Department of Environment Water Heritage and the Arts 2010b).	Species
Scarlet Robin (<i>Petroica boodang</i>)	V	-	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and re-growth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps	3 – OEH Atlas Predicted by BioBank Calculator	Moderate. This species may utilise habitat in the study area on occasion in winter as birds move down onto the Cumberland Plain in winter.	Ecosystem
Speckled Warbler (<i>Chthonicola sagittatus</i>)	V	-	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt re-growth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	18 – OEH Atlas Predicted by BioBank Calculator	Moderate. The Speckled Warbler has been regularly recorded from the Defence Establishment Orchard Hills. May utilise habitat in the study area.	Ecosystem
Spotted Harrier (<i>Circus assimilis</i>)	V	-	Occurs throughout the Australian mainland and disperses into NSW as one single population. It occurs on grassy open woodland, inland riparian woodlands, grasslands and shrub steppe.	0 – OEH Atlas Predicted by BioBank Calculator	Moderate. This species may utilise habitat in the study area on occasion. Foraging habitat present in grasslands and open areas.	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Spotted-tailed Quoll (<i>Dasyurus maculatus</i>)	V	E	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	12 – OEH Atlas PMST Predicted by BioBank Calculator	Low. The Spotted-tailed Quoll is considered to have a very low chance of occurring and there are few historic record from the locality.	Ecosystem
Square-tailed Kite (<i>Lophoictinia isura</i>)	V	-	It is widely distributed to the coastal and sub-coastal area of Australia. Migrates to NSW in September for breeding. Occurs in dry woodlands and open forests, and timbered watercourses.	8 – OEH Atlas Predicted by BioBank Calculator	Moderate. This species may utilise habitat in the study area on occasion. Foraging habitat present in woodlands.	Ecosystem
Squirrel Glider (<i>Petaurus norfolcensis</i>)	V	-	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	0 – OEH Atlas Predicted by BioBank Calculator	Low The Squirrel Glider is considered to have a low chance of occurring. Searches of the OEH Atlas shows a lack of records in the study area and the species was absent from two comprehensive targeted fauna surveys conducted in the Defence Establishment Orchard Hills on the Northern Road (AMBS 2003; SKM 2011).	Species
Stuttering Frog (<i>Mixophyes balbus</i>)	V	E	Occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	0 – OEH Atlas PMST	Low. No suitable habitat is present.	Species

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
Swift Parrot (<i>Lathamus discolor</i>)	E	CE	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Red Ironbark, and White Box.	13 – OEH Atlas PMST Predicted by BioBank Calculator	Moderate. Records are associated with PCT835, PCT849 and PCT850 and small fragments of higher quality shale hills woodland may be utilised by this species. This species has complex movement patterns and is most likely to be detected in and around the study area in winter.	Ecosystem
Turquoise Parrot (<i>Neophema pulchella</i>)	V	-	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	1 – OEH Atlas Predicted by BioBank Calculator	Low. Not known from the locality and considered unlikely to occur in western Sydney.	Ecosystem
Varied Sittella (<i>Daphoenositta chrysoptera</i>)	V	-	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and acacia woodland.	40 – OEH Atlas Predicted by BioBank Calculator	Moderate. Likely to use habitats throughout the study area	Ecosystem

Common Name (Scientific Name)	TSC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence	Ecosystem or species credit species?
White-fronted Chat (<i>Epthianura albifrons</i>)	V	-	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.	0 – OEH Atlas Predicted by BioBank Calculator	Low. Not known from the locality and considered unlikely to occur based on absence of suitable habitat.	Ecosystem
Yellow-bellied Sheath-tail-bat (<i>Saccolaimus flaviventris</i>)	V	-	Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Roost in tree hollows and buildings.	3 – OEH Atlas Predicted by BioBank Calculator	Moderate. May utilise habitats in the study area.	Ecosystem



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