



**AUSTRALIAN
ZIRCONIA LTD**

(A wholly owned subsidiary of Alkane Resources Ltd)

ABN 51 091 489 511

Dubbo Zirconia Project

Biodiversity Management Plan





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TABLE OF REVISIONS

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R.W. CORKERY & CO. PTY. LIMITED

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FOREWORD

This Biodiversity Management Plan (“the Plan”) for the Dubbo Zirconia Project (DZP) has been prepared by R.W. Corkery & Co. Pty. Limited (RWC), with the assistance of OzArk Environment & Heritage Management Pty Limited (OzArk), on behalf of Australian Zirconia Limited (AZL).



LIST OF ACRONYMS

AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
APZ	Asset Protection Zones
BMP	Biodiversity Management Plan
DEE	Department of the Environment and Energy (Commonwealth)
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DRE	Division of Resources and Energy
EEC	Endangered Ecological Community
EPA	Environment Protection Agency
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
LLS	Local Land Services
MOP	Mining Operations Plan
OEH	Office of Environment and Heritage
PA	Project Approval
RFS	Rural Fire Service
ROM	Run of Mine
SFA	Surface Facility Area
TARP	Trigger-Action-Response Plan

1. SCOPE

1.1 PURPOSE

This Biodiversity Management Plan (“the Plan”) has been prepared on behalf of Australian Zirconia Limited (AZL) for the Dubbo Zirconia Project (DZP). Through its involvement in biodiversity management planning, AZL will ensure the following.

- Recovery efforts for threatened species and communities are coordinated and prioritised. Emphasis will be to manage the conservation of the Pink-tailed Worm-lizard, a listed threatened species directly impacted by the DZP.
- Biodiversity corridors and the integrity of species' habitats are maintained or re-established.
- Government and other land management agencies, the Indigenous community, landholders (where relevant) and community groups (where relevant) work together to conserve or improve biodiversity.
- Priority areas for conservation and rehabilitation are identified.

The Plan synthesises the recommendations made during the preparation of an Environmental Impact Statement (EIS) for the DZP, subsequent assessment and approval of SSD-5251, as well as the conditional requirements of a Controlled Action Approval issued for the DZP by the Commonwealth Department of the Environment. The Plan provides AZL personnel and contract staff with a first point of reference for the management of biodiversity related issues.

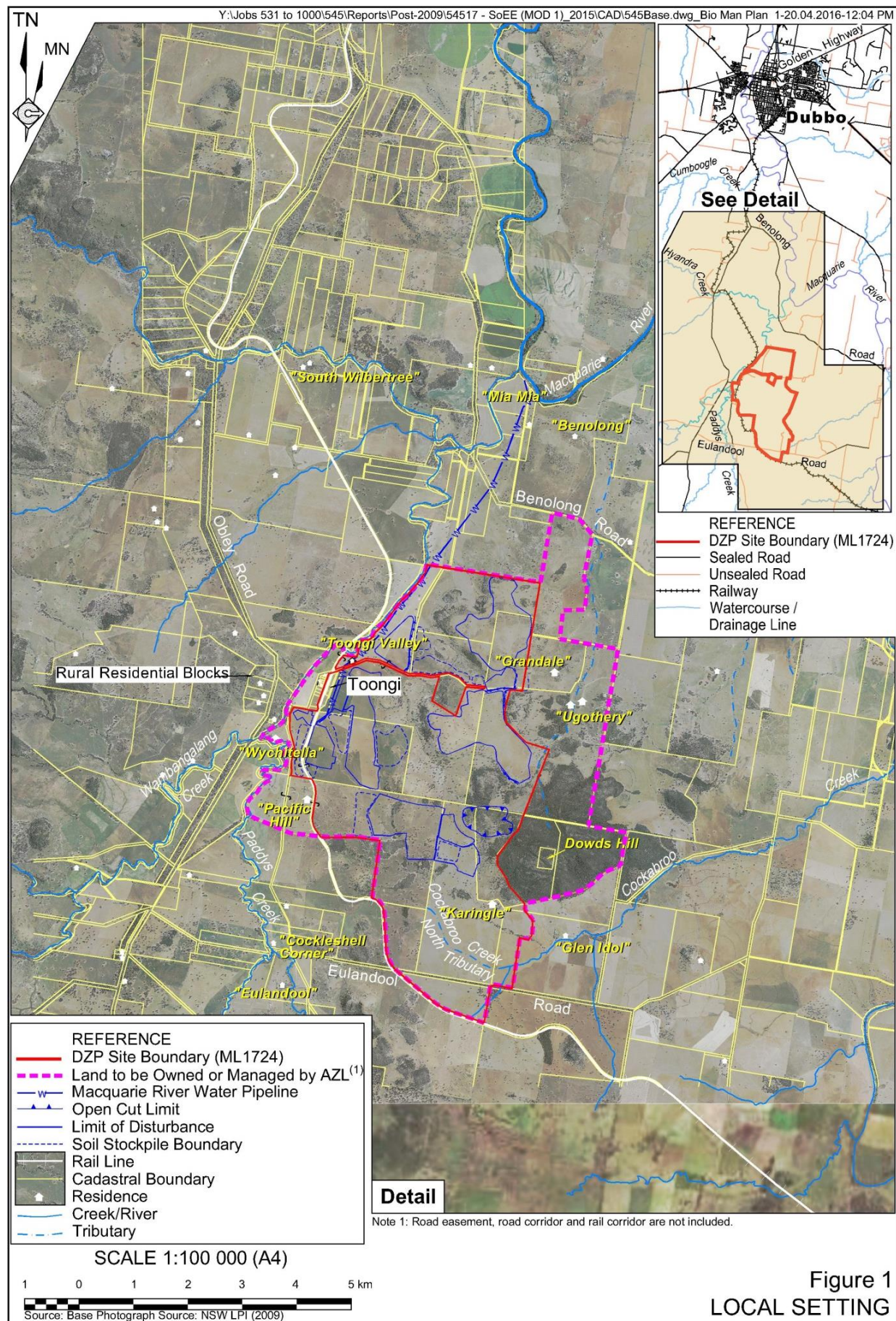
The Plan is consistent with the intent of *Guidelines for the Preparation of Biodiversity Management Plans for Major Projects* (Office of Environment & Heritage – Aug 2014).

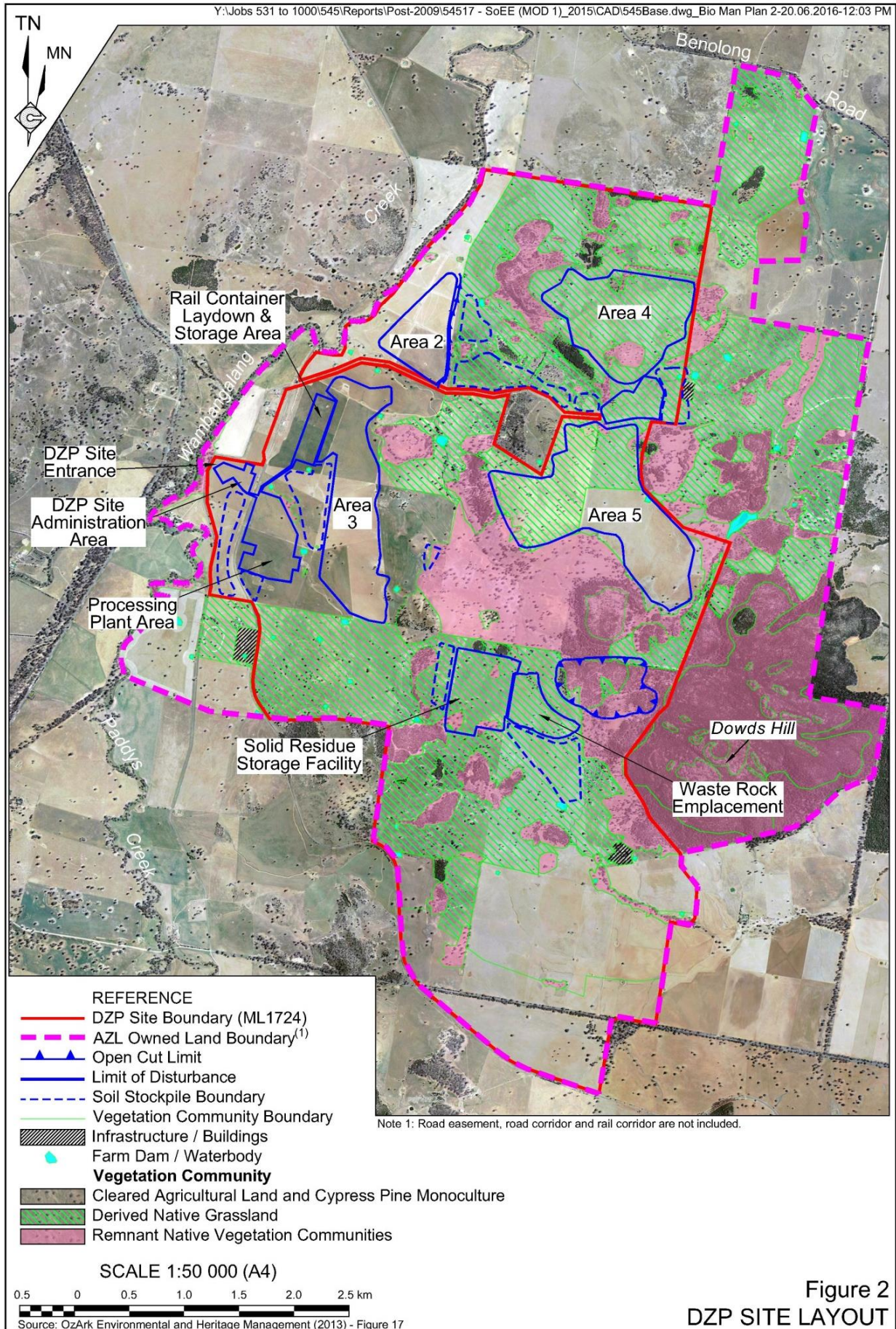
1.2 PROJECT OVERVIEW

The DZP, approved as SSD-5251 by the NSW Planning Assessment Commission (PAC) on 28 May 2015, comprises a small scale open cut mine supplying ore containing rare metals (zirconium, niobium, hafnium and tantalum) and rare earth elements (REEs) to a processing plant near the locality of Toongi, approximately 25km south of Dubbo (see **Figure 1**). Waste residues produced by the processing operations will be managed in residue storage facilities, designed to contain and encapsulate these residues.

Figure 2 provides the approved layout of the DZP Site and the following provides an overview of the various activities to be undertaken.

- Ore would be mined by standard drill and blast, load and haul methods from a shallow Open Cut developed to a maximum depth of 32m below natural ground level (355m AHD) (remaining above the groundwater table).
- Waste rock from the margins of the ore body would be transferred to a small Waste Rock Emplacement (WRE) to the southwest of the open cut.





- The ore would be hauled to a Run-of-Mine (ROM) Pad where it would be crushed and ground before being transferred to the processing operations of the Processing Plant Area for the separation of the rare metals and REEs.
- A rail siding may be constructed as a spur from the Toongi-Dubbo Rail Line along with a Rail Container Laydown and Storage Area for the unloading and temporary storage of reagents and loading of products for despatch. Construction of the rail siding will be contingent on further feasibility review and assessment following commencement of operations.
- Solid residues produced by the processing of the ore would be neutralised with crushed limestone and transported on a conveyor to a Solid Residue Storage Facility (SRSF).
- Water used in the processing operations which cannot be recycled would be pumped to a Liquid Residue Storage Facility (LRSF), comprising a series of terraced salt crystallization cells within four separate areas of the DZP Site.
- Salt which accumulates within the LRSF would be periodically excavated from the salt crystallization cells and disposed of within a series of Salt Encapsulation Cells adjoining the WRE and SRSF.
- Other features of the DZP Site illustrated on **Figure 2** and critical to the development and operation of the DZP include:
 - DZP Site Administration Area;
 - Mine Haul Road;
 - contractor management area; and
 - soil stockpile areas.

As components of the DZP are completed or no longer required, they will be rehabilitated in accordance with a Rehabilitation Management Plan (prepared as a Mining Operations Plan) in accordance with *Condition 3(59)* of SSD-5251.

Overall the DZP approves the disturbance of approximately 808ha of land, of which:

- 424ha is either cleared agricultural land or white cypress pine monoculture;
- 313ha has been classified as derived grassland containing >50% exotic weed species and which is managed for rotational cropping; and
- 71ha occurs as remnant native vegetation (including 28ha of vegetation listed as Endangered Ecological Communities under the *Threatened Species Conservation Act 1995*).

To offset this disturbance to native vegetation and habitat of threatened species, a Biodiversity Offset Strategy will be implemented for the management and enhancement of 1 021ha of vegetation (refer to Section 3.3.4).

1.3 STATUTORY REQUIREMENTS

The DZP is a State Significant Development and Development Consent SSD-5251 was granted by the NSW Planning Assessment Commission (PAC), following assessment of an

Environmental Impact Statement (EIS) and supporting documents completed in accordance with Schedule 2, Part 3 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), on 28 May 2015. SSD-5251 approves the development and operation of the DZP in accordance with the EIS, subject to 91 conditions. *Condition 33* (of Schedule 3) requiring the preparation of a Biodiversity Management Plan.

The DZP also operates in accordance with the following approvals, leases and licences.

- EPBC 2012/6625: issued by the Commonwealth Department of the Environment on 24 August 2015 permits the DZP as a Controlled Action under Section 18 and 18A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), for impacts on a listed threatened species, Pink-tailed Worm-lizard, subject to 15 conditions. *Condition 2* requires the preparation of a Pink-tailed Worm-lizard Management Plan (PTWLMP) and *Condition 4* requires the preparation of a Biodiversity Offset Management Plan (BOMP).
- Environment Protection Licence 20702: issued by the NSW Environment Protection Authority on 14 March 2016, approving the following scheduled activities.
 - Cement or Lime Works.
 - Chemical Storage.
 - Crushing Grinding or Separating.
 - Mineral Processing.
 - Mining For Minerals.
- Mining Lease 1724: issued by the Minister for Industry, Resources & Energy on 18 December 2015.

1.4 FORMAT

The Plan has been prepared in 15 sections to address the requirements of *Condition 3(33)* of SSD-5251 and the suggested contents provided by the following NSW government documents.

- *Guidelines for the Preparation of Biodiversity Management Plans for Major Projects* produced by NSW OEH as a draft in August 2014.
- *Hunter Valley Coal Mines – Best Practice Guidelines for Biodiversity Offset Management Plans* prepared by Eco Logical Australia Pty Ltd on behalf of the Department of the Department of Planning & Infrastructure as a draft in 2013 and updated in February 2014.

1.5 REQUIREMENTS OF THE PLAN

The Plan provides addresses the conditional requirements of *Condition 3(33)* SSD-5251 (to prepare and implement a Biodiversity Management Plan) (see also **Appendix 1**). **Table 1** identifies the requirements of *Condition 3(33)* and where in the Plan individual requirements have been addressed.

Table 1
Conditional Requirements of SSD-5251 for a Biodiversity Management Plan

Condition	Section
33. The Applicant shall prepare and implement a Biodiversity Management Plan for the development to the satisfaction of the Secretary. This plan must:	
(a) be prepared in consultation with OEH, and submitted to the Secretary for approval prior to any development under this consent, unless the Secretary agrees otherwise;	1.8.1
(b) a description of the short, medium and long term measures that would be implemented to: <ul style="list-style-type: none"> – manage the remnant vegetation and fauna habitat on the site; – implement the biodiversity offset strategy; and 	5 3.3.4
(c) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy and triggering remedial action (if necessary);	5, 6
(d) a detailed description of the measures that would be implemented over the next three years, including the procedures to be implemented for: <ul style="list-style-type: none"> – minimising clearing and avoiding unnecessary disturbance associated with the construction and operation of the development; – protecting vegetation and fauna habitat outside the approved disturbance areas; – enhancing the quality of existing vegetation and fauna habitat on the site; – maximising the salvage of resources within the approved disturbance area – including vegetative and soil resources – for beneficial reuse in the enhancement of the offset area or the rehabilitation of the site; – collecting and propagating seed; – minimising the impacts of fauna on site, including undertaking pre-clearance surveys; – managing salinity using best practice dryland salinity management revegetation measures; – controlling weeds and feral pests; – controlling erosion; – managing grazing and agriculture on site; – controlling access; and – managing bushfire risk; 	5.6.1.1 5.7 and 5.8 5.6, 5.8 5.6.1.2 5.6.1.3 5.7.2 5.10 and 5.11 5.12 5.13 5.4 5.14
(e) include a seasonally-based program to monitor and report on the effectiveness of these measures;	6
(f) identify the potential risks to the successful implementation of the biodiversity offset strategy, and include a description of the contingency measures that would be implemented to mitigate against these risks;	4, 7
(g) include a Pink-tailed Worm Lizard Management Plan, which includes detailed information on the: <ul style="list-style-type: none"> – baseline data on the local Pink-tailed Worm lizard population and habitat on site, in the biodiversity offset areas and release areas; – measures to mitigate and manage the identified impacts on Pink-tailed worm lizard, including: <ul style="list-style-type: none"> o progressive clearing in the project disturbance area; and o a detailed translocation procedure prepared generally in accordance with the NPWS Policy and Procedure Statement No. 9 – Policy for the translocation of Threatened Fauna in NSW; – include a program to monitor: <ul style="list-style-type: none"> o resident Pink-tailed Worm lizard distribution and population size on site and in the biodiversity offset areas; o translocated Pink-tailed Worm lizard distribution and population size; and o existing and revegetated potential distribution and population size habitat; and 	App 3 and App 4
(h) include details of who would be responsible for monitoring, reviewing and implementing this plan	1.7 and 10

A *Pink-tailed Worm-lizard Management Plan* (PTWLMP) and *Pink-tailed Worm-lizard Biodiversity Offset Management Plan* (PTWL BOMP) have been prepared separately and are appended to the Plan (**Appendices 3 and 4**).

1.6 PLAN OBJECTIVES

Table 2 presents the objectives and key performance outcomes for this *Biodiversity Management Plan* and the DZP.

Table 2
Objectives and Key Performance Outcomes

OBJECTIVES	KEY PERFORMANCE OUTCOMES
(a) To ensure compliance with all relevant conditions of SSD-5251, stated commitments to biodiversity management and reasonable community expectations.	(i) Compliance with all relevant criteria and reasonable community expectations, as determined in consultation with the relevant government agencies.
(b) To minimise and measure impact to biodiversity.	(ii) Implementation of the biodiversity management and mitigation measures nominated in the Plan. (iii) Establishment of performance indicators and targets. (iv) Achievement of performance targets or implementation corrective actions. (v) Actively manage threats to biodiversity through innovative land and natural resource management practices.
(c) To mitigate and offset residual impact to the NSW and Commonwealth vulnerable Pink-tailed Worm-lizard (<i>Aprasia parapulchella</i>).	(vi) Pink-tailed Worm-lizard Management Plan prepared, approved and implemented. (vii) Pink-tailed Worm-lizard Biodiversity Offset Management Plan prepared, approved and implemented. (viii) Increase the species area of occupancy by reinstating habitat connectivity. (ix) Targeting environmental rehabilitation in areas mapped as high quality PTWL habitat to meet vegetation benchmarks. (x) Successful improvement in condition of targeted areas mapped low and moderate condition habitat.
(d) To implement and manage the approved DZP Biodiversity Offset Strategy.	(xi) DZP Biodiversity Offset Strategy identified and implemented, in accordance with the Plan, within the identified timeframes.
(e) To manage land in the DZP Site outside of the Biodiversity Offset Area to achieve the approved final landform and land use.	(xii) Operations managed in a manner that does not result in off-site impacts and ensures that the approved final landform and land use is established.
(f) To implement corrective and preventative actions, if required.	(xiii) Corrective and preventative actions implemented.
(g) To implement an incident reporting program, if required.	(xiv) Incidents reported in an appropriate manner.

1.7 ROLES AND RESPONSIBILITIES

Table 3 presents the roles and responsibilities of key DZP personnel.

Table 3
Roles and Responsibilities

ROLES	RESPONSIBILITY
Operations Manager	<ul style="list-style-type: none"> Accountable for the overall environmental performance of the Operations, including the outcomes of the Plan. Must ensure adequate resources are available to enable implementation of the Plan.
Environmental Manager / Supervisor	<ul style="list-style-type: none"> Ensure the implementation of the Plan, including reporting of non-compliances with the trigger values, and subsequent implementation of the relevant action plan. Ensure monitoring is undertaken in accordance with the Plan. Ensure all internal and external reporting requirements are met. Ensure employees are competent through training and awareness programs. Update the BMP as required. Undertake/organise, review and analyse all monitoring data.
Employees and Contractors	<ul style="list-style-type: none"> Operate in a manner that minimises risks of incidents to themselves, fellow workers and biodiversity values of the Mine Site. Ensure operations are undertaken in accordance with instructions. Ensure appropriate notification and response in the event of an environmental incident. Show due care not to cause environmental harm. Follow direction provided by the Environmental and Community Manager. Show due care not to cause environmental harm. Notify Supervisor/Environmental and Community Manager of any environmental non-compliance.

1.8 CONSULTATION

1.8.1 Government Consultation

Local Land Services

Following approval of SSD-5251 on 28 May 2015, AZL commenced discussions with Central West Local Land Services (LLS) in relation to the establishment of a Conservation Property Vegetation Plan (PVP), under the *Native Vegetation Act* 2003 (NV Act), over the 1 021ha of land which forms the Biodiversity Offset Area for the DZP (refer to Section 3.3.4). Following advice from the LLS, AZL submitted a Property Vegetation Plan Enquiry Form on 27 August 2015.

AZL contacted Central West LLS again on 2 February 2016 to discuss progress of the enquiry, during which the potential repeal of the NV Act. AZL has every intention of committing to the Conservation PVP and should the NV Act be repealed during 2016, it is understood responsibility for oversight of existing Conservation PVPs will rest with the NSW Conservation Trust.

AZL met with CEO of LLS on 19 April 2016 and reaffirmed intention to negotiate a Conservation PVP with LLS as soon as practical after final property acquisitions (settlement) are achieved. Key issues raised and agreed during this discussion included the following.

- The PVP area does not include land required for mining.
- The primary objective of the biodiversity offset will be to achieve positive biodiversity outcomes.
- Opportunistic/periodic grazing will be used as a management tool in some parts only of the BOA to reduce bushfire risk and manipulate vegetation communities.

AZL met with LLS staff again on 17 June 2016 to discuss progress of the PVP application through the LLS approvals system.

A draft Conservation PVP issued by the LLS on 21 November 2016 was reviewed and several amendments requested on 25 November 2016. On issue and acceptance of the Conservation PVP, which provides for the in perpetuity management of 1 021ha of AZL-owned land for conservation purposes, will be appended to the Plan (as **Appendix 2**).

NSW Office of Environment & Heritage

On 1 September 2015, an email was sent to the NSW Office of Environment & Heritage (OEH) seeking feedback in relation to the content requirements of the Plan. OEH responded on 9 September 2015 and referenced the requirements of Condition 3(33) of SSD-5251. **Table 1** identifies where each of the individual requirements of Condition 3(33) are addressed in the Plan.

OEH suggests the format of the Plan should reference the following guideline documents:

- *Draft Guidelines for the Preparation of Biodiversity Management Plans for Major Projects* (Office of Environment & Heritage August 2014); and
- *Hunter Valley Coal Mines – Best Practice Guidelines for Biodiversity Offset Management Plans* (Department of Planning & Infrastructure 2014).

The format of this Plan conforms to the suggested sequencing of information presented in these guidelines.

OEH requested specific information is to be provided for management of the Pink-tailed Worm-lizard, with cross-referencing to the PTWL MP (see **Appendix 3**).

A draft version of the Plan was supplied to the following government agencies for review and comment.

- NSW OEH.
- Central West LLS.
- Commonwealth Department of Environment¹.

The comments and queries received from these agencies have been addressed in this version of the Plan.

¹ Pink-tailed Worm-lizard Management Plan and Pink-tailed Worm-lizard Biodiversity Offset Management Plans only.

1.8.2 Community Consultation

The Dubbo Field Naturalist & Conservation Society (DFN&CS) volunteered to assist in a survey and targeted monitoring of the Pink-tailed Worm-lizard in the DZP. The DFN&CS participated in the site assessment in 2012 and 2013 and have provided assistance in the annual monitoring program in 2015. The preparation of the PTWL MP (see **Appendix 3**) has been discussed with members of the DFN&CS, with information as relevant to monitoring to be provided to the participants in future field monitoring programs.

A copy of the Plan will be made available to the Farm Manager and staff of Toongi Pastoral Company (a subsidiary of Alkane Resources). TPC staff will be actively involved in the obligations of biodiversity offsetting.

A Community Consultative Community (CCC) has been formed to provide a forum for open discussion between AZL, the community, Council and other stakeholders on issues directly relating to the mine's operations, environmental performance and community relations, and to keep the community informed on these matters. The CCC provides an opportunity for issues of concern related to biodiversity management to be raised and solutions identified and discussed.

AZL will continue to publish a community newsletter that will inform the local community of relevant developments which may impact on local biodiversity. AZL has and will continue to operate an open door policy to those wishing to raise and discuss issues of concern.

1.9 RELATIONSHIP TO OTHER PLANS AND PROGRAMS

The management of biodiversity on the DZP Site as presented in the Plan forms part of the overall environmental management system of the DZP. This environmental management system provides for the integration and inter-relationship of the Plan with several other management plans (see **Figure 3**).

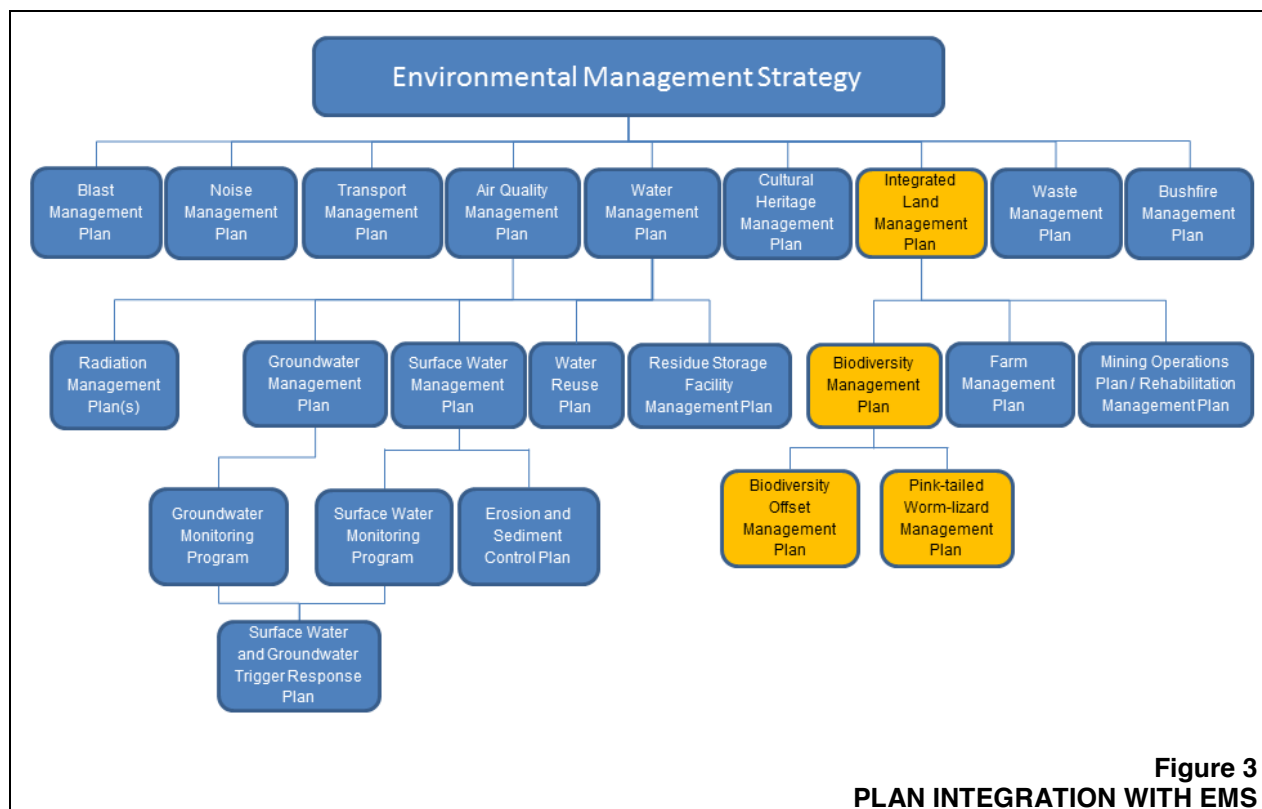


Figure 3
PLAN INTEGRATION WITH EMS

As illustrated in **Figure 3**, the Plan forms part of an over-riding *Integrated Land Management Plan* which also includes:

- a *Mining Operations Plan* (incorporating the requirement of a *Rehabilitation Management Plan*) which identifies the objectives, methods, criteria, performance indicators and contingency management for the rehabilitation of disturbance on the DZP Site; and
- a *Farm Management Plan* which provides for the objectives and management of agricultural activities on the DZP Site.

A *Pink-tailed Worm-lizard Management Plan* is required by both SSD-5251 and EPBC 2012/6625 to provide specific information on the management of this threatened species. The PTWL MP (see **Appendix 3**) is cross-referenced as required throughout this document. A *Pink-tailed Worm-lizard Biodiversity Offset Management Plan* (PTWL BOMP) required by *Condition 4* of EPBC 2012/6625 to provide for the establishment, management and monitoring of an offset for the Pink-tailed Worm-lizard has also been prepared as a separate plan (see **Appendix 4**).

2. ENVIRONMENTAL SETTING

2.1 LAND USE HISTORY

Land use in the Macquarie-Bogan Catchment is dominated by extensive agriculture with over 80% of the catchment being used for grazing. Dryland cropping accounts for approximately 9% of land use and occurs predominantly in the middle and lower parts of the catchment. Forestry, conservation and other native landscapes together account for approximately 5% of the catchment area (NOW, 2011).

From anecdotal evidence gathered (DGP/RWC, 2013), it would appear that following European settlement of the area in the 19th Century, the Toongi area consisted of a small number of large holdings. Production involved some cereal crops (and dryland lucerne) on the creek flats, but was focussed on livestock grazing over the hill slopes and timbered areas. Since the 1960s, the area has been increasingly sub-divided (creating smaller farms) and cleared of native vegetation for cropping and pasture improvement, with grazing remaining the dominant land use. Along with clearing of native woodland (mainly Grassy White Box Woodland), mechanical rock picking has also been widespread on all arable areas other than the creek flats. Soil conservation works (contour banks and earth tanks) have been constructed since the 1960s and continue to reduce the erosive force of rain events.

To this day, cropping includes growing wheat, oats, barley and canola for grain. Oats, barley and wheat varieties suited to grazing are also a feature of livestock production enterprises. Improved pastures are generally sown under a cover cereal crop. Top dressing with superphosphate (and occasionally ag lime) has also been a feature on some properties since the 1960s. Grazing across the Toongi district consists of sheep and cattle enterprises, predominantly breeding and/or fattening livestock with some merino wool growing.

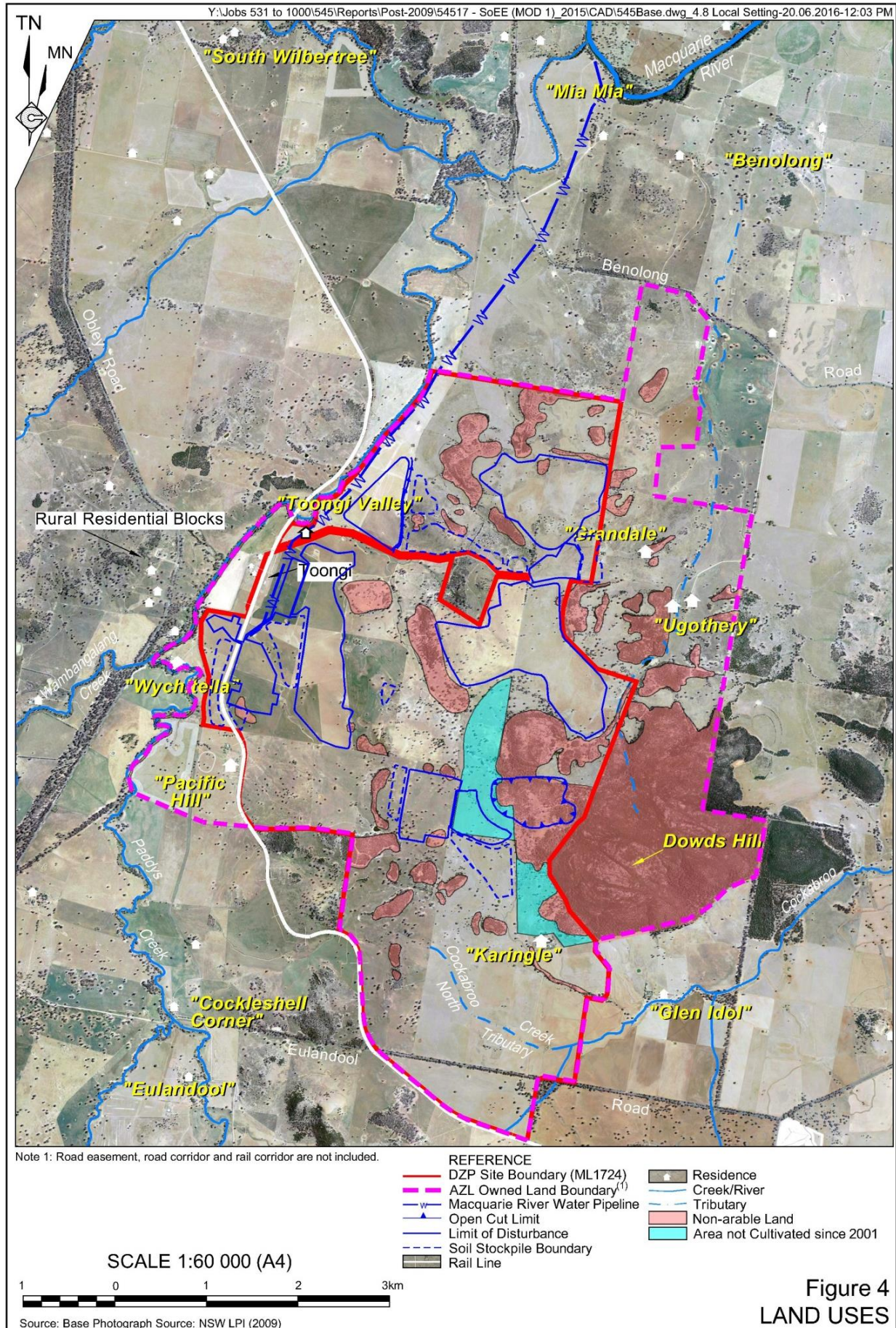
Lucerne and cereal hay is grown and stored on farm for use when seasonal conditions require supplementary feeding. Cereal grains are also stored on farms for later sale to traders or supplementary feeding stock for market or as seasonal conditions require.

Figure 4 illustrates the land use on and immediately surrounding the DZP Site. This is dominated by cleared land used for grazing and occasional cropping with pockets or ribbons of remnant vegetation occurring on land less conducive to farming, e.g. on the rockier slopes of hills and riparian edges of creeks. Other areas of the DZP Site have been excised from intensive farming activities, i.e. cropping, since 2001. Closer to the Macquarie River, irrigation based cropping is also undertaken (see northern-most part of **Figure 4**).

2.2 CLIMATIC CONDITIONS

2.2.1 Data Sources

The closest Bureau of Meteorology (BoM) site that collects climatic information is located at Dubbo Airport, approximately 30km north of the DZP Site. The data are summarised in **Table 4** which presents information on temperature, relative humidity and rainfall.



2.2.2 Temperature and Humidity

January is typically the warmest month of the year with a mean daily maximum temperature of 33°C and mean minimum temperature of 18.1°C being the highest throughout the year. The coolest month of the year is typically July with the lowest mean daily maximum temperature of 15.4°C and coldest mean minimum temperature of 3.1°C.

In both the 9:00am and 3:00pm relative humidity data sets, the highest humidity was recorded in June with 86% and 57% respectively. Again for both 9am and 3 pm, the lowest humidity was recorded in December with 52% and 30% respectively.

Table 4
Local Climate Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
9am Mean Temperature (°C) and Relative Humidity (%)													
Temp	23.8	22.4	19.6	17.0	12.2	8.6	7.5	9.6	14.0	17.9	20.3	22.8	16.3
Humidity	56	62	64	64	76	86	86	76	67	56	56	52	67
3pm Mean Temperature (°C) and Relative Humidity (%)													
Temp	31.6	30.2	27.6	23.7	19.2	15.4	14.5	16.5	19.9	23.5	27.0	29.7	23.2
Humidity	32	36	36	37	47	57	55	47	43	36	35	30	41
Daily Maximum Temperature (°C)													
Mean	33.0	31.8	28.7	24.6	19.9	16.2	15.4	17.4	21.0	24.5	28.2	30.8	24.3
Daily Minimum Temperature (°C)													
Mean	18.1	17.7	14.4	10.1	6.5	4.3	3.1	3.4	6.2	9.3	13.5	15.7	10.2
Rainfall (mm)													
Monthly mean	52.4	49.7	48.9	35.6	41.1	43.2	41.0	39.4	42.3	49.2	70.5	62.0	576.2
Rain days (Number)													
Mean rain days	4.7	4.8	4.9	3.1	4.1	5.2	5.3	4.2	5.1	5.3	6.0	5.1	57.8
Station number: 065070; Commenced 1946; Currently Operating; Elevation: 284m AHD; Latitude: 32.22; Longitude: 148.58													
Source: PEL (2013) – Table 10													

2.2.3 Rainfall and Evaporation

Rainfall collected at the BoM Station No. 065070 indicates November has on average the highest rainfall per month within 70.5mm which equates to approximately 12.3% of the total rain falling through the year. April has the least amount of rainfall in the year with only 35.6mm which equates to approximately 6.2% of the total rain falling throughout the year.

On-site rainfall data was also analysed for the years 2001-2015 and is presented in **Table 5**. The rainfall data collected at the DZP Site meteorological station has been influenced by the predominantly drought conditions during this period of measurement. However, the data does compare to that collected at the BoM Station 065070 in that the highest and lowest rainfall months are similar (November/December and April/May).

Table 5
Rainfall (mm) for Toongi 2001-2015

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	-	-	62.6	62.0	9.6	61.4	60.0	22.2	41.4	63.4	65.0	23.8
2002	30.4	107.4	20.6	25.8	29.2	6.4	7.4	5.4	43.0	0.6	18.0	39.8
2003	42.0	71.0	8.4	42.8	3.8	68.3	28.0	102.2	9.0	61.4	38.8	28.2
2004	56.4	19.0	13.6	20.8	55.5	37.5	50.5	23.6	22.8	53.8	70.0	77.0
2005	50.2	39.2	46.0	2.4	2.6	89.8	38.8	23.2	102.6	86.8	109.8	31.8
2006	86.6	38.0	21.6	11.2	0.6	32.0	88.2	3.8	7.6	2.8	59.0	79.2
2007	14.6	24.8	37.8	27.2	72.6	96.2	12.4	18.0	1.0	3.0	54.2	157.8
2008	63.4	76.6	29.6	0.6	18.6	37.8	20.2	35.2	51.0	51.2	80.6	51.2
2009	9.6	47.0	14.6	33.0	9.4	72.4	22.8	8.6	42.4	40.4	11.4	131.6
2010	19.4	133.6	96.6	62.0	45.4	24.6	61.2	48.6	60.6	49.4	162.4	155.6
2011	12.0	30.8	44.0	35.4	48.8	8.6	8.6	49.5	77.8	33.2	119.6	61.2
2012	64.2	71.6	122.8	3.0	66.6	34.6	51.4	2.8	24.2	3.8	25.2	6.8
2013	34.4	59.2	49.0	3.6	15.6	75.6	27.4	7.6	55.8	7.4	34.8	34.6
2014	37.2	52.4	93.2	44.2	21.4	46.4	29.4	21.8	14.4	3.4	14.6	52.8
2015	83.4	9.2	12.6	78.2	33.6	44.8	48.8	33.0	8.8	48.4	64.0	39.8
Source: AZL operated "Whychitella" Meteorological Station												

2.2.4 Wind

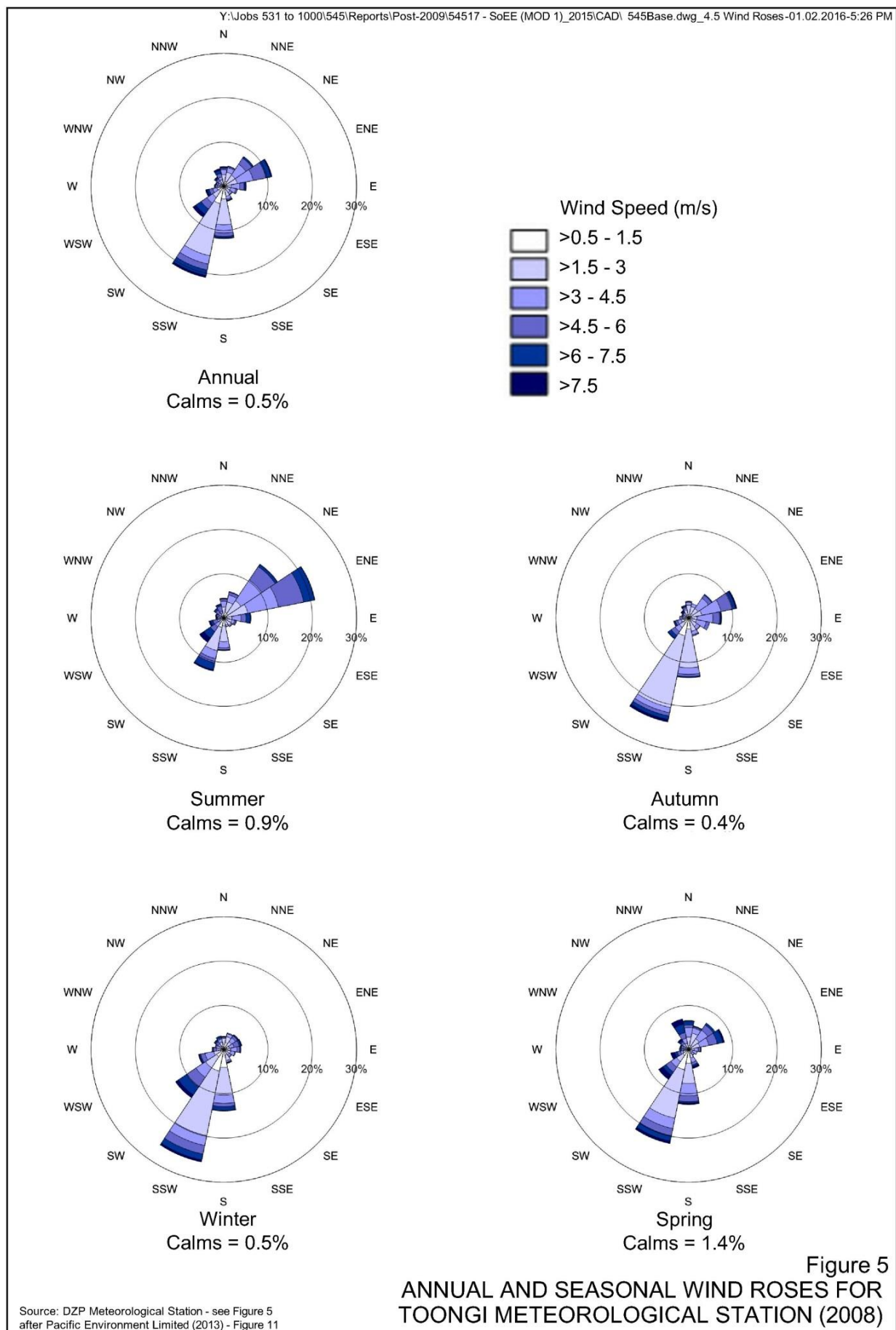
Pacific Environment Limited (PEL) (2013) reviewed wind data collected for three different periods, namely 2003, 2005-2008 and 2010-2012, at the Toongi Meteorological Station and Dubbo Airport AWS. That data was used to inform a model of the local wind environment prepared using the CALMET software, an industry standard software package.

Figure 7 to 14 of PEL (2013) present the wind roses for each of the eight years during which data has been collected. The year 2008 was ultimately selected as representative of the prevailing annual conditions of the local setting by PEL (2013) and **Figure 5** presents the wind roses for this year.

In summary, wind distribution patterns at the DZP Site are dominated by winds from the south-southwest in autumn, winter and spring, with northeasterly winds dominating in summer.

2.3 GEOLOGY

The DZP Site is located at the northern end of the Palaeozoic Lachlan Fold Belt where the volcanic-sedimentary-intrusive sequences are covered by on-lapping Mesozoic sediments of the Gunnedah Basin. The oldest rocks present in the locality are the Silurian age Cudal Group (430 to 410 million years ago) comprising a sequence of fine and medium grained sedimentary and rare volcanic rocks.



The DZP Site is centred on an alkaline suite of intrusive and extrusive rocks that intrude and partly onlap relatively flat lying sediments. This sequence occupies the southern edge of the Great Australian Basin forming a broad embayment of 10km in diameter and overlays a tightly folded Siluro-Devonian volcano-sedimentary terrain.

The alkaline igneous rocks are of Jurassic age (140 to 205 million years) and are considered part of a relatively extensive alkaline igneous complex in the region south of Dubbo (in turn part of the major Eastern Australian volcanic event).

2.4 TOPOGRAPHY AND DRAINAGE

Figure 6 presents the topography and drainage within the DZP Site. In summary, the DZP Site is dominated by a series of hills with maximum elevations between 325m AHD and 400m AHD. Dowds Hill, located immediately to the southeast of the DZP Site has an elevation of 425m AHD. The lowest sections of the DZP Site are located on the western boundary of the Site, with elevations of approximately 275m AHD, adjacent to the Wambangalang Creek.

Slopes within the DZP Site vary from approximately 1:60 (V:H) in the vicinity of Wambangalang Creek to approximately 1:5 (V:H) on the flanks of the higher hills. The surface of the steeper sections of the DZP Site varies from a common semi-continuous rock pavement to steeper outcrops of boulders.

The DZP Site includes four catchments as follows.

- **Cockabroo Creek Catchment.**

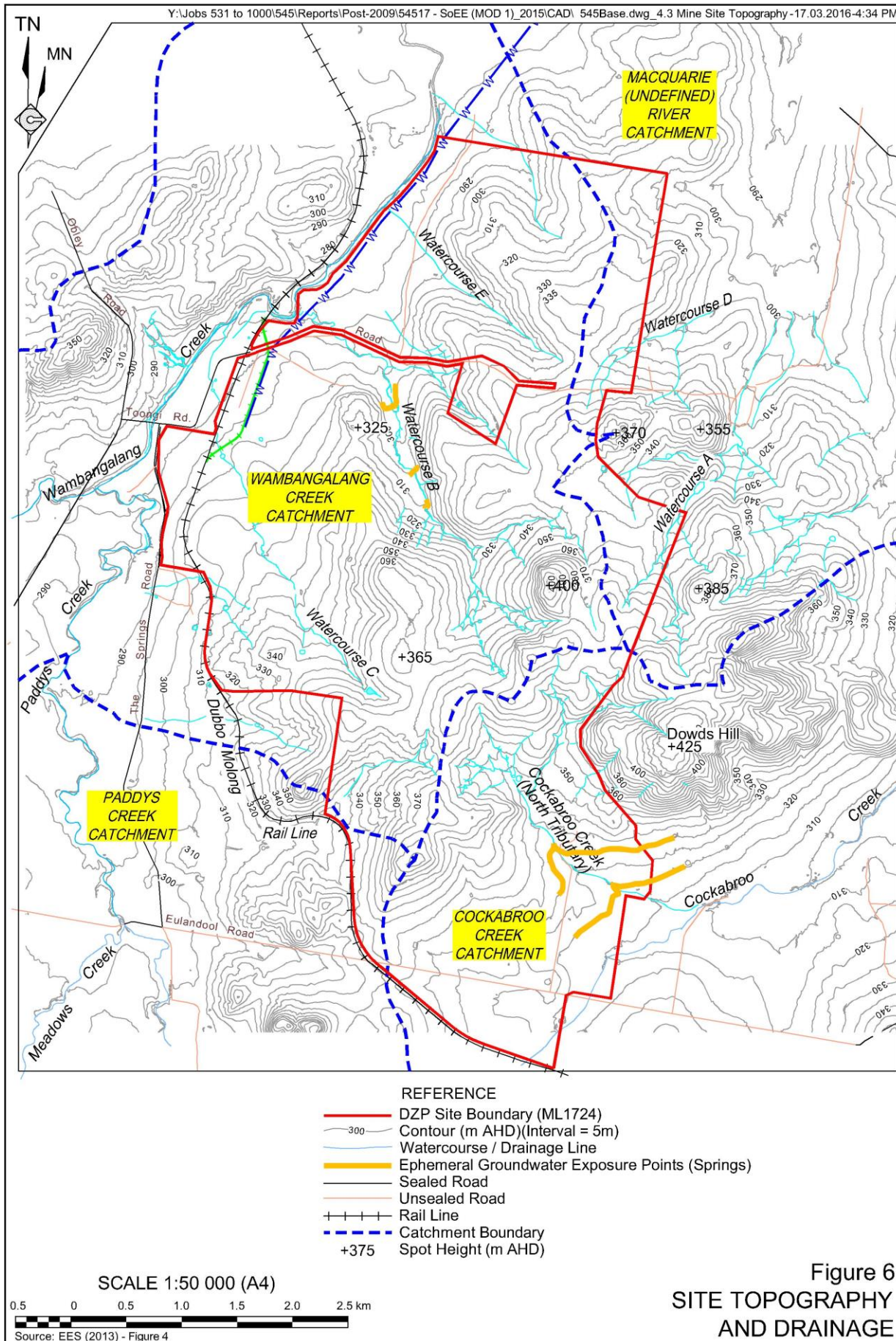
The Cockabroo Creek Catchment occupies the southeastern section of the DZP Site. Within the DZP Site, the catchment drains to an unnamed, ephemeral creek which, for the purposes of this assessment, is referred to as Cockabroo Creek (North Tributary). Approximately 1km of that creek within the DZP Site may be classified as a third order stream (based on the Strahler stream ordering classification).

- **Macquarie River (Undefined) Catchment.**

The Macquarie River (undefined) Catchment occupies the eastern section of the DZP Site. Within the DZP Site, the catchment drains to one of two unnamed ephemeral creeks, which, for the purposes of this assessment, are referred to as Watercourse A and Watercourse D. Watercourse A may be classified as a second order stream within the DZP Site, while Watercourse D becomes a third order stream approximately 600m upstream of the DZP Site boundary.

- **Wambangalang Creek Catchment.**

The Wambangalang Creek Catchment occupies the western section of the DZP Site. Within the DZP Site, the catchment drains to one of three unnamed ephemeral creeks, which, for the purposes of this assessment, are referred to as Watercourse B, Watercourse C and Watercourse E. Watercourse B may be classified as a third order stream within the DZP Site, while Watercourse C and Watercourse E are second and first order streams respectively.



- **Paddys Creek Catchment.**

The Paddys Creek Catchment, which forms part of the larger Wambangalang Creek Catchment, occupies a very small area in southwestern section of the DZP Site.

Ephemeral springs occur within the DZP Site, generally at the break point of steeper slopes where the surface is intermittently incised by a rising groundwater table following rainfall events. Such springs are known to occur on Cockabroo Creek (North Tributary), Watercourse B and Watercourse A, feeding several of the farm dams (see **Figure 6**).

2.5 WATER RESOURCES

2.5.1 Surface Water and Drainage

The region is within the Macquarie-Bogan River Catchment with elevation ranges from 1 300m in the mountains south of Bathurst, to less than 100m near Brewarrina in the catchment's far north. Below Dubbo, the valley mainly comprises flat alluvial plains with elevations less than 300m. Burrendong Dam, located on the Macquarie River, is the largest storage in the catchment with a capacity of 1 190 110ML. It provides storage for irrigation, town water, stock and domestic use. The Macquarie-Bogan catchment supports a range of water users including local councils, water utilities, dryland agriculture, livestock grazing and some irrigated agriculture (NOW, 2013).

2.5.2 Groundwater

Groundwater within the regional area is based upon the underlying geology of the region with the igneous, Jurassic age intrusives, known as the Toongi deposit within the wider Dubbo igneous complex and the overlying Tertiary and Quaternary geological strata. These sedimentary rocks are at the edge of the Gunnedah Basin and the derived alluvial plains are water intake beds for the Great Australian Basin, a large Jurassic-Cretaceous basin covering a large part of eastern Australia.

Ephemeral springs outflow on Watercourse B during relatively wet seasons. The Plan area contains stock and domestic quantities of groundwater only. The Upper Macquarie Alluvial aquifer lies approximately 7km north of the Plan area.

2.6 SOILS AND EROSION

The soils of the DZP Site fall into five classes which generally correlate with the underlying geology (see **Table 6**). Following soil survey completed in 2013 by Sustainable Soils Management Pty Ltd, 10 soil landscapes (following the Soil Landscapes of the Dubbo 1:250 000 Sheet, Murphy and Lawrie, 1998) have been identified (see **Figure 7**).

The soils landscapes display varying dispersion potential and erodibility, however, under current land management practices are considered stable with erosion limited to some gully formation within soils of the Belowrie Soil Landscape.

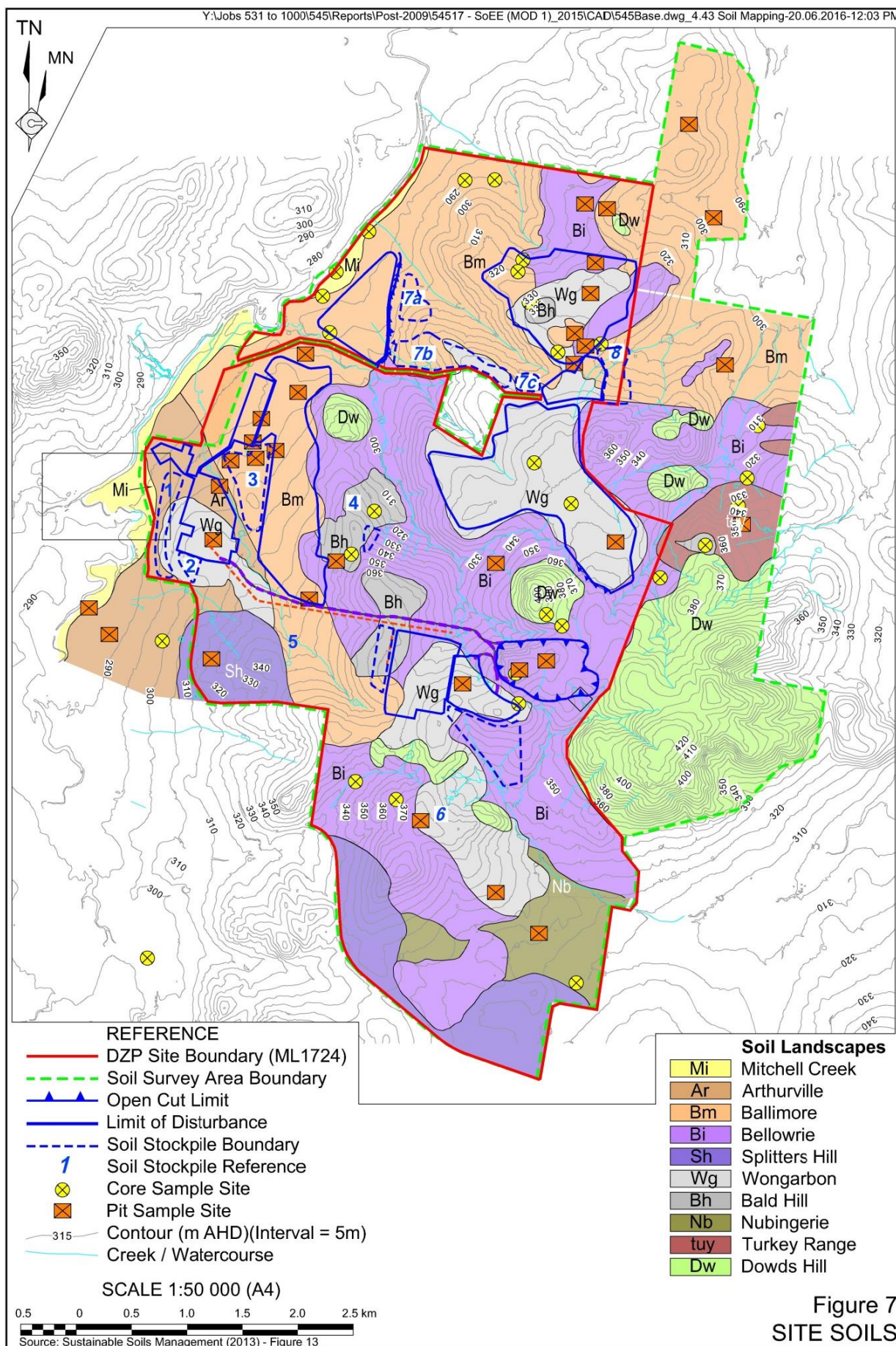


Table 6
Soil Landscapes of the DZP Site

Soil Class	Landscape	Landscape Summary	Erodibility
Alluvium	Mitchell Creek (Mi)	Recent alluvial deposits with highly variable soils including sandy Stratic Rudosols and loamy alluvial soils (Brown Dermosols) along Wambangalang Creek.	0.031 (moderate)
Chromosols (Duplex, but not acidic)	Arthurville (Ar)	Gently undulating rises and undulating low hills with mixed sedimentary and volcanics in Cowra Trough. Red Chromosols with Yellow Sodosols along drainage lines.	0.026 (moderate)
	Ballimore (Bm)	Undulating low hills on flat lying Napperby formation of sandstone, conglomerates ferruginous material and siltstone. Red Chromosols with Siliceous Sands on steeper scarps and Yellow Sodosols on lower slopes and depressions.	0.026 (moderate) to 0.041 (high)
Red Podzolics (Duplex and Acidic)	Belowrie (Bi)	Rises and low hills Jurassic trachyte. Red Chromosols with Red Kandosols and Brown Chromosols on more stable lower slopes and Yellow Sodosols on flatter lower areas. Shallow Rudosols and Tenosols on rocky crests. Hard setting and acidic surfaces.	0.036 (moderate) to 0.046 (high)
	Splitters Hill (Sh)	Undulating and rolling hills on Silurian vertically bedded shale and sandstone. Mainly Red Chromosols but a variety of others depending on parent material. If sandstones are present the soils can be very acidic and have aluminium toxicity.	0.031 (moderate)
	Turkey Range (Tr)	Undulating to rolling low hills and hills on sandstones, shales, lutite and mudstones with broad crests and gently sloping upper footslopes. Shallow to moderately deep Brown Kurosols and Yellow Sodosols.	0.032 (moderate)
Euchrozems (Clayey soil with little shrink/swell capacity)	Bald Hill (Bh)	Low hillocks with moderately steep slopes. Basalt rock outcrop and shallow Red Ferrosols and Brown Ferrosols on lower slopes.	0.019 (low)
	Wongarbon (Wg)	Gently undulating and low hills with minor basaltic hillocks. Red Ferrosols and Red & Brown Vertosols with linear gilgais. Fertile soils.	0.013 and 0.020 (low)
	Nubingerie (Nb)	Undulating low hills mainly andesites from Cowra trough. Red Ferrosols and Red & Brown Vertosols.	0.021 (moderate)
Shallow Soils	Dowd (Dw)	Hills of rock pavements and scarps. Trachyte volcanic plugs may be sodic. Shallow soils Leptic Rudosols low fertility not suitable for stripping.	N/T
Source: Modified after SSM (2013) – Table 1			

3. EXISTING BIODIVERSITY VALUES

3.1 REGIONAL BIODIVERSITY

The DZP Site is located within the NSW Central West Catchment which comprises the Castlereagh, Bogan and Macquarie River valleys and covers approximately 92 000km². A wide diversity of landforms, vegetation species and communities occur within this catchment which is associated with two bioregions, namely:

- South-western Slopes Bioregion; and
- Brigalow Belt South Bioregion.

As a consequence of the confluence of the eastern and western influences, the Central West Catchment has a high level of biodiversity. At the time of European settlement, the catchment supported a complex mosaic of forests, temperate and semi-arid woodlands, wetlands, shrub lands, heaths and grasslands. Clearing and subsequent degradation have reduced this natural vegetation cover to a large number of small, isolated remnants on the less fertile and productive soils.

The DZP Site has been highly cleared for agriculture with remnants of native vegetation largely restricted to the riparian corridors of the Macquarie River and tributaries, elevated hill tops and ridges and within road easements. OzArk (2013) describes the local setting as supporting a mosaic of Box Gum Woodland, Fuzzy Box Woodland, Inland Grey Box Woodland, derived native grasslands and cleared / cropped land.

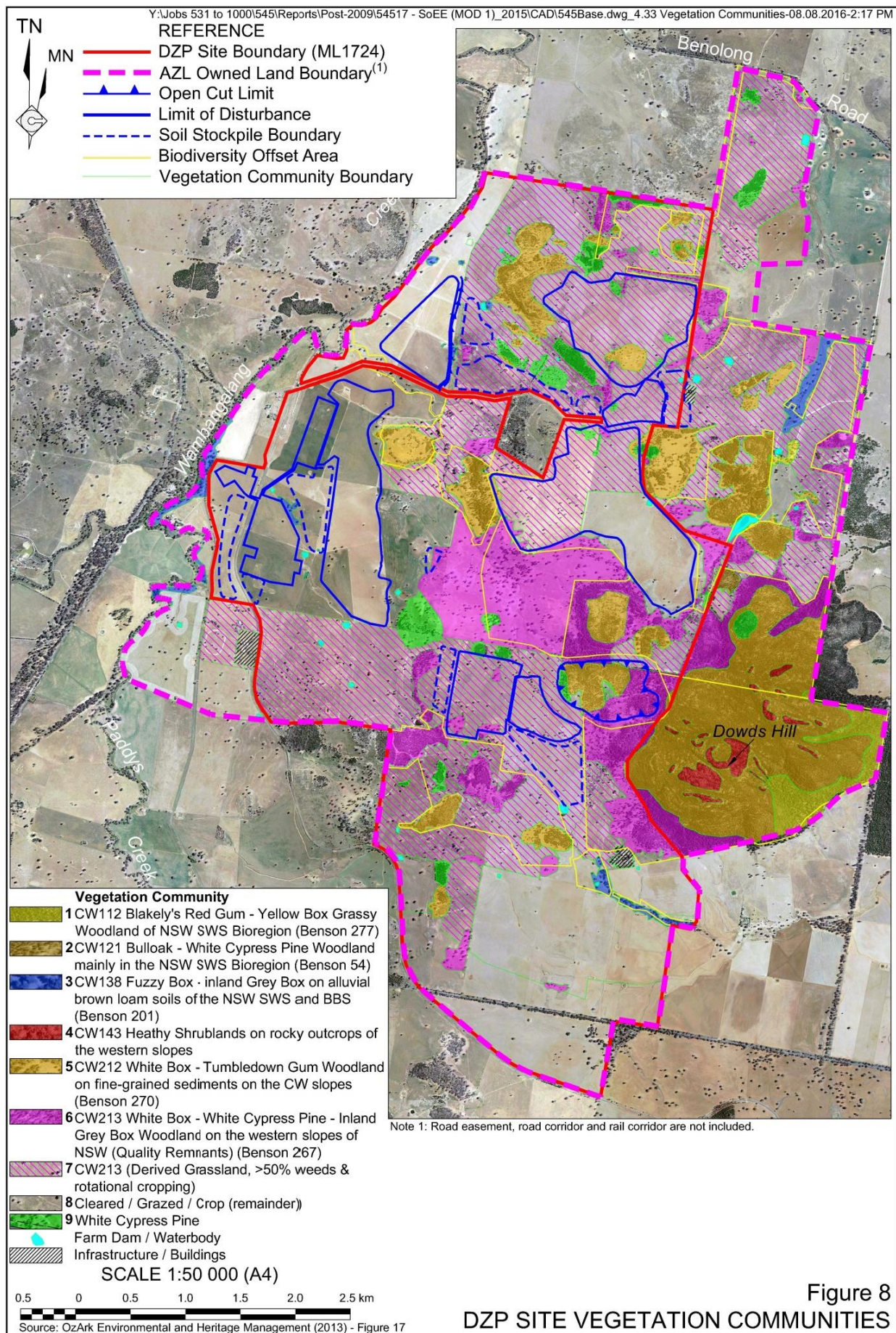
3.2 LOCAL BIODIVERSITY VALUES

OzArk undertook a survey of the DZP Site to identify the biodiversity setting and features (OzArk, 2013). The results of that survey are presented in RWC (2013) but are summarised below.

Vegetation Communities

While a large proportion of the DZP Site has been cleared, significant areas retain native groundcover species with other areas providing remnant native woodland formations, generally in associated with watercourses or land unsuitable for tilling. The dominant canopy species are Fuzzy box, Inland grey box, Tumbledown gum, Black cypress pine, White cypress pine, Bulloak, White box and Blakely's red gum, with groundcover of generally poor diversity and structural complexity and very low levels of natural recruitment. The following nine vegetation communities were mapped within the DZP Site (see **Figure 8**).

1. CW112: Blakely's Red Gum – Yellow Box Grassy Woodland of NSW South West Slopes Bioregion (Benson 277).
2. CW121: Bulloak – White Cypress Pine Woodland mainly in the NSW South West Slopes Bioregion (Benson 54).



3. CW138: Fuzzy Box – Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201). This community is a component of the Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South bioregions EEC.
4. CW143: Heathy Shrublands on rocky outcrops of the western slopes.
5. CW212: White Box – Tumbledown Gum Woodland on fine-grained sediments on the Central NSW central western slopes (Benson 270).
6. CW213: White Box – White Cypress Pine – Inland Grey Box Woodland on the western slopes of NSW (Benson 267). This community is a component of the White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland) EEC.
7. CW213: Derived grassland, >50% weeds & rotational cropping.
8. Cleared/Grazed/Cropped (remainder).
9. White Cypress Pine.

Threatened Ecological Communities

Two TSC Act listed EECs have been mapped within the DZP Site (see **Figure 8**).

- CW213: White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland) (Quality Remnants).
- CW138: Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South bioregions.

Two communities meeting the classification of EPBC Act listed TECs have been mapped within the DZP Site (see **Figure 8**).

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (CEEC).
- Grey Box Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia EEC.

Flora Species

No threatened flora species have been identified within the DZP Site (OzArk, 2013).

Fauna Species

A list of the fauna species identified within the DZP Site is presented in OzArk (2013). The threatened species present within the DZP Site as identified by OzArk (2013) and biological databases are presented in **Table 7**.

Table 7
Threatened Species present within the DZP Site

Species	Listing		Source		
	TSC Act	EPBC Act	OzArk (2013)	Goldney (2002)	NSW Wildlife Atlas
Great Egret (<i>Ardea alba</i>)		Y	Y		
Superb Parrot (<i>Polytelis swainsonii</i>)	Y	Y	Y		
Pink-tailed Worm-lizard (<i>Aprasia parapulchella</i>)	Y	Y	Y		
Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	Y	Y	Y		
Greater Long-eared Bat (<i>Nyctophilus timoriensis / corbeni</i>)	Y	Y	Y		
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)	Y		Y		
Little Eagle (<i>Hieraaetus morphnoides</i>)	Y		Y	Y	
Flame Robin (<i>Petroica phoenicea</i>)	Y		Y	Y	
Eastern Bentwing Bat (<i>Miniopterus schreibersii orianae oceanensis</i>)	Y		Y		
Barking Owl (<i>Ninox connivens</i>)	Y		Y	Y	
Brown Tree-creeper (<i>Climacteris picumnus</i>)	Y		Y	Y	
Diamond Firetail (<i>Stagonopleura guttata</i>)	Y		Y	Y	
Glossy Black Cockatoo (<i>Calyptorhynchus lathamii</i>)	Y		Y		
Grey-crowned Babbler (<i>Pomatostomus temporalis temporalis</i>)	Y		Y	Y	
Hooded Robin (<i>Melanodryas cucullata</i>)	Y		Y	Y	
Little Pied Bat (<i>Chalinolobus picatus</i>)	Y		Y		
Speckled Warbler (<i>Pyrrholaemus sagittatus</i>)	Y		Y	Y	
Yellow-bellied Sheath-tail bat (<i>Saccolaimus flaviventris</i>)	Y		Y		
Swift Parrot (<i>Lathamus discolor</i>)	Y	Y		Y	
Koala (<i>Phascolarctos cinereus</i>)	Y	Y		Y	
Spotted Harrier (<i>Circus assimilis</i>)	Y			Y	
Square-tailed Kite (<i>Lophoictinia isura</i>)	Y			Y	
Rainbow Bee-eater (<i>Merops ornatus</i>)		Y			Y
Black-chinned Honeyeater (<i>Meliphreptus gularis gularis</i>)	Y				Y
Masked Owl (<i>Tyto novaehollandiae</i>)	Y				Y
Grey Falcon (<i>Falco hypoleucos</i>)	Y				Y
Painted Honeyeater (<i>Grantiella picta</i>)	Y				Y
Varied Sittella (<i>Daphoenositta chrysoptera</i>)	Y				Y
Source: Modified after OzArk (2013) – Section 5.4.3					

3.3 BIODIVERSITY MANAGEMENT AREAS

3.3.1 Introduction

The management of biodiversity within the Site has been divided into three Biodiversity Management Areas (BMAs) based on a combination of current vegetation community (refer to Section 3.2), impact during the life of the DZP and final land use. The relative areas of these BMAs, which are described in the following subsections, are identified on **Figure 9**.

3.3.2 Impact BMA

3.3.2.1 Description

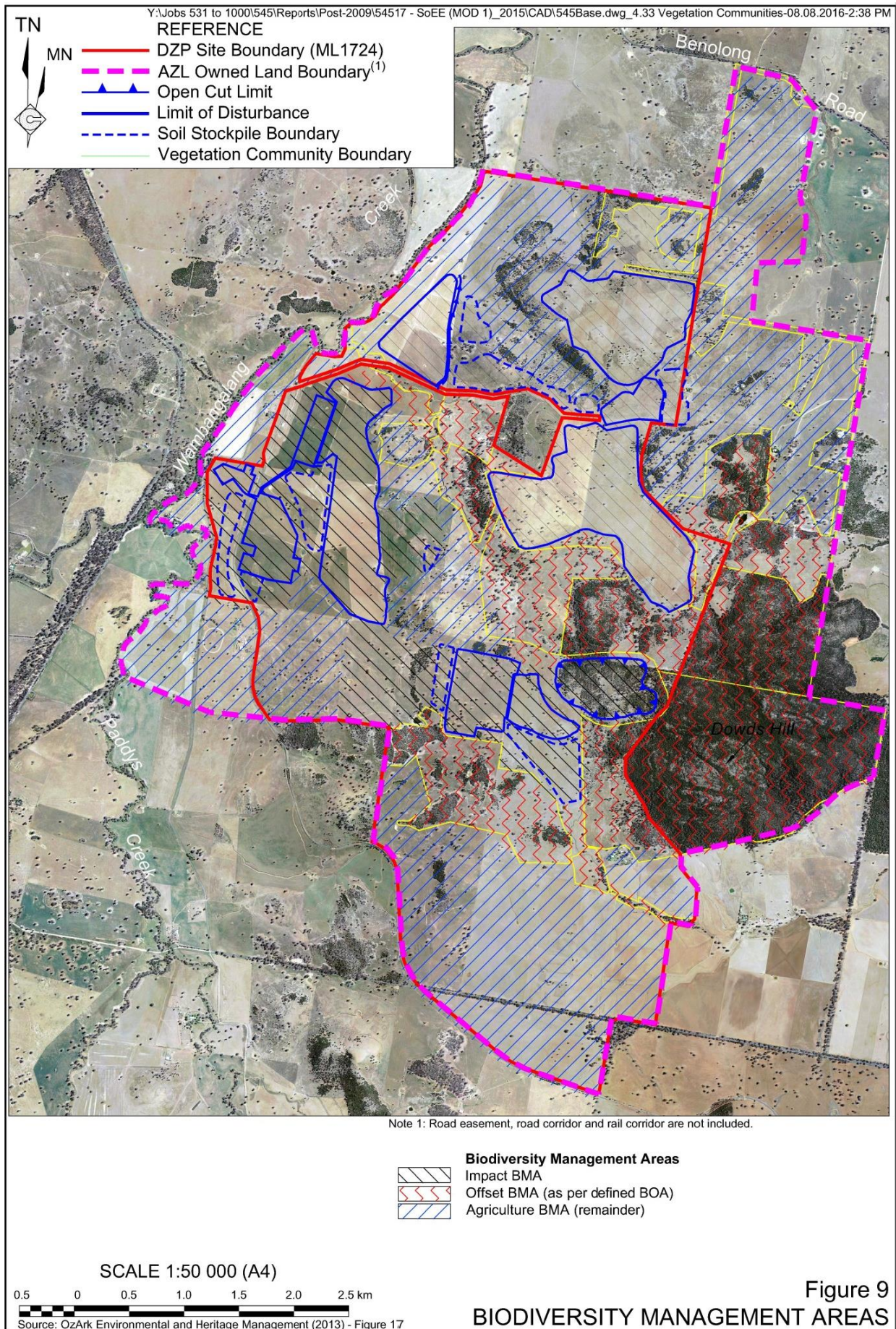
The Impact BMA comprises that area of the DZP to be directly impacted by activities of the DZP. Based on the maximum impact footprint assessed, an area of up to 808ha of land will be directly disturbed, of which 484.9ha is mapped as native vegetation (**Table 8**). CW213, a derived grasslands community, represents 85% of mapped native vegetation affected by the DZP.

Table 8
Vegetation Communities of the Impact BMA

Biometric Vegetation Type		Disturbance (ha)
ID	Name	
CW112	Blakely's Red Gum – Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277).	0.00
CW213	White Box - White Cypress Pine – Inland Grey Box woodland on the western slopes of NSW (Benson 267) – Quality remnants.	43.70
CW213	White Box - White Cypress Pine – Inland Grey Box woodland on the western slopes of NSW (Benson 267) – Derived Grassland (>50% weedy, rotationally cropped).	414.00
CW138	Fuzzy Box – Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201).	0.10
CW143	Heathy shrublands on rocky outcrops of the western slopes.	0.00
CW121	Bullock – White Cypress Pine woodland mainly in the NSW South Western Slopes Bioregion (Benson 54).	0.00
CW212	White Box – Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270).	27.10
N/A	Cleared / Grazed Crop (remainder).	313.0
N/A	White Cypress Pine monoculture.	9.6
		807.5

Potential indirect impacts associated with mining activities include the following.

- Artificial lighting of operational and administrative areas.
- General changes to local drainage.



- Habitat fragmentation.
- Erosion of the landscape due to surface disturbance and modification to topography.
- Noise and dust impacts associated with operations.
- Potential introduction of feral and overabundant native species and disease.
- Vehicle trauma to native fauna.

3.3.2.2 Objectives

The primary objectives of biodiversity management within the Impact BMA are as follows.

1. Restrict disturbance to the defined Impact BMA.
2. Manage weeds effectively, focusing on noxious species.
3. Manage feral and overabundant native species effectively.
4. Optimise use/recycling of the cleared vegetation and soils or vegetation requiring clearing or thinning.
5. Remove loose rock from open cut area to re-create habitat for Pink-tailed Worm-lizard.
6. Rehabilitate the impacted areas to establish a safe and non-polluting landform and sustainable ecological communities.

More detailed objectives for the rehabilitation of Impact BMA are provided in the MOP² and vary dependent on the planned final landform / land use (Secondary Domain). In general terms, the rehabilitation objectives are as follows

- **Water Management Structures:** Vegetation consistent with riparian / woodland community of appropriate undisturbed analogue location.
- **Grassland:** Vegetation dominated by deep-rooted perennial grassland species (understory component of grassy White Box woodland community).
- **Woodland:** Vegetation (diversity, density and coverage) consistent with the White Box, Grey Box or Fuzzy Box Grassy Woodlands.
- **Rural Land:** Land capability similar to existing land capability.

3.3.2.3 Overview of Threats and Biodiversity Management

The threats to the biodiversity objectives of this BMA, which are discussed in Section 4.1, and associated biodiversity management measures to be implemented, which are discussed in Sections 5, are identified in **Table 9**.

² Refer to **Figure 3** for the inter-relationship between the Plan and MOP.

Table 9
Summary of Threats and Associated Management Measures for the Impact BMA

Management Measures	Threats							
	Vegetation Clearing (Section 4.1.1)	Disturbance to Habitat (Section 4.1.2)	Land Use Practices (Section 4.1.3)	Noxious and Environmental Weeds (Section 4.1.4)	Woody Weeds (Section 4.1.5)	Vertebrate Feral and overabundant native species (Section 4.1.6)	Erosion (Section 4.1.7)	Land Contamination (Section 4.1.9)
Rehabilitation (Section 5.2)	✓			✓	✓	✓	✓	✓
Cultural Heritage Management (Section 5.3)	✓						✓	
Fencing Gates and Signage (Section 5.4)	✓		✓					
Access Tracks (Section 5.5)								
Vegetation Clearing Thinning and Timber Management (Section 5.6)	✓			✓				
Vegetation Enhancement (Section 5.7)	✓	✓						
Habitat Augmentation (Section 5.8)		✓						
Native Species Translocation (Section 5.9)	✓	✓						
Weed Management (Section 5.10)			✓	✓	✓			
Vertebrate Pest Management (Section 5.11)			✓			✓		
Erosion and Sediment Control (Section 5.12)			✓				✓	
Injured Fauna Management (Section 5.15)	✓							

3.3.3 Agriculture BMA

3.3.3.1 Description

This area includes the cleared agricultural land, derived native grasslands and isolated remnants of woodland community, on which agricultural activities will be continued (see **Figure 9**). Toongi Pastoral Company proposes to run a sheep and cattle enterprise across the agricultural land.

3.3.3.2 Objectives

The objective of biodiversity management within this BMA is to undertake sustainable agricultural activities which do not adversely impact on the objectives of the adjoining Impact and Offset BMA's. Biodiversity will be improved (voluntarily) through maintenance of wildlife/shelter trees, rocky habitat and shrubs.

3.3.3.3 Overview of Threats and Biodiversity Management

The threats to the biodiversity objective of the Agriculture BMA, which are discussed in Section 5.1, and associated biodiversity management measures to be implemented, which are discussed in Sections 5, are identified in **Table 10**.

Table 10
Summary of Threats and Associated Management Measures for the Agriculture BMA

Management Measures	Threats								
	Vegetation Clearing (Section 4.1.1)	Disturbance to Habitat (Section 4.1.2)	Land Use Practices (Section 4.1.3)	Noxious and Environmental Weeds (Section 4.1.4)	Woody Weeds (Section 4.1.5)	Vertebrate Feral and overabundant native species (Section 4.1.6)	Erosion (Section 4.1.7)	Altered Fire Regimes (Section 4.1.8)	Land Contamination (Section 4.1.9)
Rehabilitation (Section 5.2)									
Cultural Heritage Management (Section 5.3)		✓	✓				✓		
Fencing Gates and Signage (Section 5.4)			✓						
Access Tracks (Section 5.5)			✓				✓		
Vegetation Clearing, Thinning & Timber Management (Section 5.6)	✓								
Vegetation Enhancement (Section 5.7)									
Habitat Augmentation (Section 5.8)		✓							
Native Species Translocation (Section 5.9)									
Weed Management (Section 5.10)			✓	✓	✓				
Vertebrate Pest Management (Section 5.11)						✓			
Erosion and Sediment Control (Section 5.12)							✓		
Grazing and Agriculture Management (Section 5.13)			✓						
Fire Management (Section 5.14)								✓	
Injured Fauna Management (Section 5.15)			✓						
Waste Management									✓

3.3.4 Offset BMA (Biodiversity Offset Area)

3.3.4.1 Description

Location and Scale

The Offset BMA incorporates 1 021ha of land to be managed as a Biodiversity Offset Area (BOA), satisfying *Condition 3(31)* of SSD-5251³ (see **Figure 9**). This area includes remnant native vegetation, derived native grasslands (which until 2016 was grazed and cropped), cleared agricultural land and important habitat for threatened species (see **Figure 8**).

The BOA provides for the conservation of the remnant vegetation of Dowds Hill and linkage of this regionally significant remnant to other significant vegetation or habitat including:

- remnant vegetation of Wambalang Creek which itself provides a corridor to the Macquarie River;
- remnant vegetation (including two highly cleared vegetation types / endangered ecological communities) within the road easement of Benolong Road to the north; and
- potentially isolated habitat of the Pink-tailed Worm-lizard, to the west, northwest and north of Dowds Hill.

The BOA comprises 959.9ha (94%) native vegetation communities, of which 306.8ha (32%) is associated derived grassland communities within CW213 and 61.1ha (6%) cleared land (without derived native grassland) or white cypress pine monoculture. **Table 11** identifies the various vegetation communities incorporated into the Offset BMA.

Land Tenure and (Pre-Plan) Land Use

The land contained within the BOA is all freehold and owned by AZL. As illustrated by **Figure 4**, the pre-Plan land use of the offset area is varied, however, areas of remnant native vegetation which are either not conducive to agriculture or have been excised from more intensive agriculture since 2001 form the core of the BOA. Areas where agricultural activities were recently being undertaken (either derived native grassland or cleared agricultural land – see **Figure 8**) have been selected primarily to allow for linkage between the remnant native vegetation of Downs Hill and other more elevated areas with the riparian or roadside vegetation of Wambalang Creek and Benolong Road.

³ The perimeter of the BOA has been modified slightly from that presented in *Appendix 6* of SSD-5251. The modified perimeter reflects better utilisation of existing fence lines, identification of minor deviation requirements to account for areas where fencing is impractical and incorporates additional areas of Fuzzy Box EEC (high conservation values) to replace areas of derived grasslands (low conservation values). In modifying the perimeter, the total area remains 1 021ha and conservation value equivalent or exceeding that of the original BOA.

Table 11
Vegetation of the Offset BMA

Biometric ID	Community name	Offset Area (ha)
CW212	White Box – Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270).	256.10
CW213	White Box – White Cypress Pine – Inland Grey Box woodland on the western slopes of NSW (Benson 267).	613.30
CW138	Fuzzy Box – Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201).	21.90
CW145	Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76).	0.00
CW143	Heathy shrublands on rocky outcrops of the western slopes.	25.50
CW121	Bullock – White Cypress Pine woodland mainly in the NSW South Western Slopes Bioregion (Benson 54).	3.90
CW112	Blakely's Red Gum – Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277).	39.20
	Cleared / Grazed Crop (remainder).	53.70
	White Cypress Pine monoculture.	7.40
	Total	1 021.00

3.3.4.2 Objectives

The common objectives of biodiversity management within the Offset BMA are as follows.

1. Improve native vegetation.
2. Maintain minimum groundcover.
3. Improve native fauna species diversity.
4. Manage weeds effectively, focusing on noxious species.
5. Manage feral and overabundant native species effectively.
6. Optimise use/recycling of the cleared vegetation and soils or vegetation requiring clearing or thinning.
7. Remove loose rock from open cut area to re-create habitat for Pink-tailed Worm-lizard.

The Offset BMA has been further categorised based on existing and/or planned vegetation community type(s) and/or habitat feature(s). The specific outcomes for each Biodiversity Offset Management Zone (BOMZ) of the BOA are identified in Section 3.3.4.3.

3.3.4.3 Biodiversity Offset Management Zones, Measures and Outcomes

The BOA has been divided into four BOMZs (see **Figure 10**), identified and categorised by the DZP land management team to reflect the approach required to achieve the objectives described in Section 3.3.4.2

The key outcome within each BOMZ is management of the area for conservation, with the incorporation of grazing as a tool to achieve native vegetation community benchmarks. The four BOMZ are described below, with specific biodiversity management outcomes nominated for each.

1. Fuzzy Box Woodland on Alluvial Soils MZ (49ha).

Description

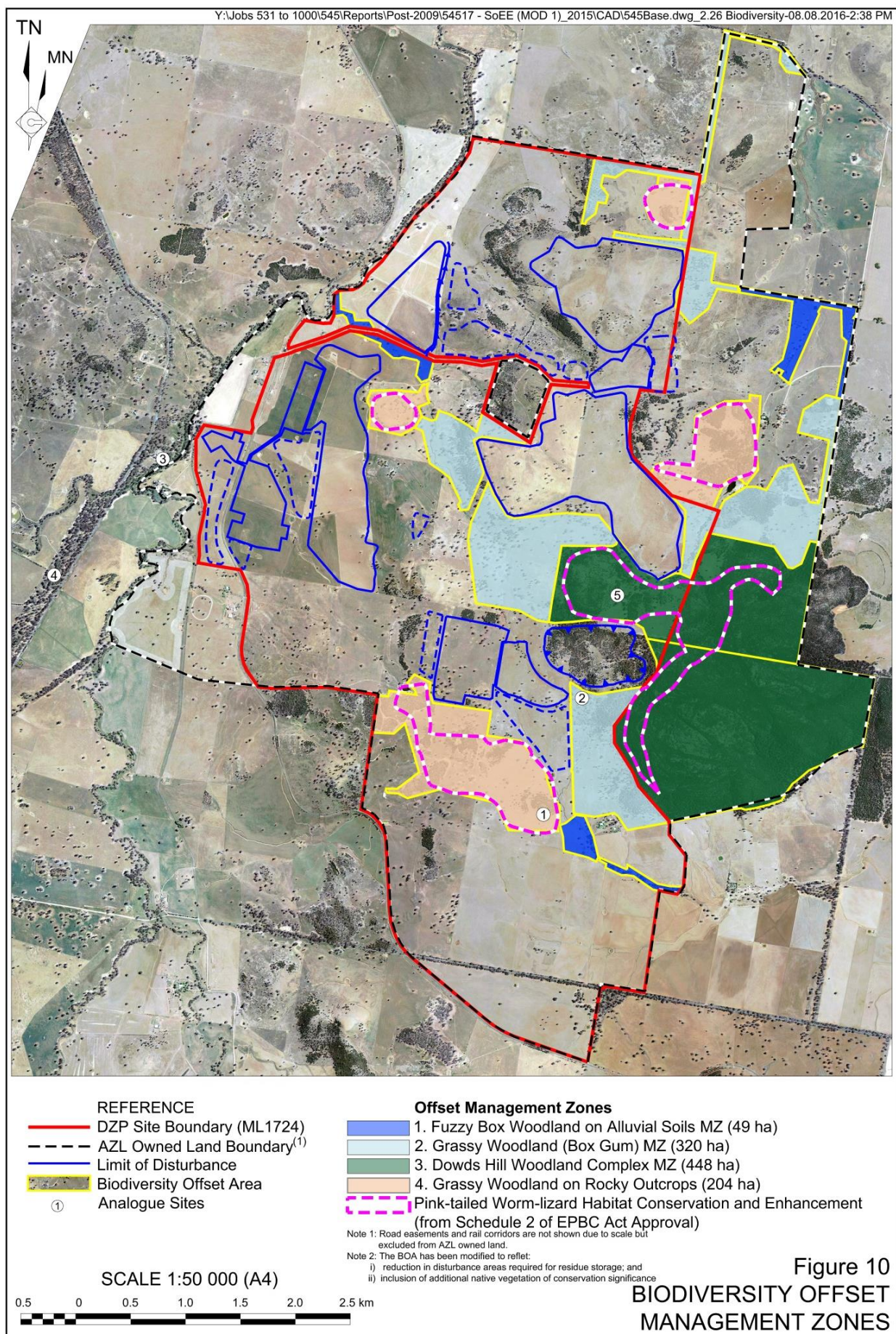
- Dominated by CW138 – Fuzzy Box - Inland Grey Box on alluvial brown loam soils. This is an EEC in NSW and is a highly cleared vegetation type.
- Occurs within and adjacent to ephemeral drainage lines of the lower catchments of the DZP Site.

Biodiversity Management Measures

- Construct stock fencing to exclude this management zone from agricultural activities (refer to Section 5.4).
- Promote natural regeneration of Fuzzy Box and Grey Box community dominated by native grass and forb species (refer to Section 5.7).
- Relocate tree hollows cleared during mine construction (refer to Section 5.8).
- Use Strategic Grazing to control Dry Matter (DM) levels, encourage natural regeneration and minimise bushfire risk. Implement high impact grazing management (where appropriate on some sections of stream bank) to encourage the repair historic stream bank damage (refer to Section 5.13).
- Undertake weed control (refer to Section 5.10).
- Spread locally collected tree crowns with viable seed (refer to Section 5.7).
- Use engineering solutions rock armouring or whole dead trees to slow water and prevent current stream bed lowering (in consultation with NSW Office of Water and LLS).
- Establish vegetation buffer zones containing perennial grasses, trees and shrubs adjacent to drainage lines.

Biodiversity Management Outcomes

- Create a regenerating and sustainable woodland community trending towards more habitat complexity as trees age, form hollows and blow over or burn (bushfire).
- Maintain groundcover in accordance with vegetation benchmarks (refer to Section 5.7.2.2 – **Table 20**) to prevent further increase in erosion.



- Groundcover species >80% native (or equivalent to analogue site – refer to Section 6.2).
- Maintain DM as follows.
 - Avoid DM build up >3 000kg/ha.
 - Minimum DM after grazing (before rest period) – 1 400kg/ha.
- Photo and condition monitoring reports across seasons will record performance towards achieving a standard similar to local analogue site (refer to Section 6.2 and **Figure 12**).

2. Grassy (Box Gum) Woodland MZ (320ha).

Description

- CW213 – White Box – White Cypress Pine - Inland Grey Box woodland. This is an EEC in NSW and is a highly cleared vegetation type.
- Occurs predominantly on the mid catchment slopes over basalt and sandstone derived soils.
- The majority of this BOMZ has been previously cleared for grazing and cultivation.

Biodiversity Management Outcomes

- Prevent cultivation and prohibit use of introduced pastures.
- Construct stock fencing to exclude this management zone from agricultural activities (refer to Section 5.4).
- Promote natural regeneration of White Box-White Cypress Pine-Inland Grey Box woodland community with understorey dominated by native grass and forb species (refer to Section 5.7).
- Manage Invasive Native Species (such as White Cypress Pine) by strategic grazing or thinning and other methods (refer to Section 5.7).
- Use Strategic Grazing to control DM levels, encourage natural regeneration and minimise bushfire risk. Include moderate to long rest periods to preserve groundcover to encourage the restoration of understorey and native grasses (refer to Section 5.13).
- Undertake weed control (refer to Section 5.10).
- Implement vertebrate pest controls (refer to Section 5.11).

Biodiversity Management Outcomes

- Create a regenerating and sustainable woodland community trending towards more habitat complexity as trees age, form hollows and blow over or burn (bushfire).
- Maintain groundcover in accordance with vegetation benchmarks (refer to Section 5.7.2.2 – **Table 20**).
- Maintain DM as follows.
 - Avoid DM build up >3 000kg/ha.
 - Minimum DM after grazing (before rest period) – 1 000kg/ha.

- Increased native vertebrate species diversity over time as habitat is restored from derived grassland.
- Photo and condition monitoring reports across seasons will record performance towards achieving a standard similar to local analogue site (refer to Section 6.2 and **Figure 12**).

3. Dowds Hill Woodland Complex MZ (448ha).

Description

- Complex of various woodland, forest and heath vegetation communities over Dowds Hill and associated ridge features.
- Includes areas of low quality Pink-tailed Worm-lizard (PTWL) habitat on the lower slopes (where suitable topography, geology, soils and occasional microhabitat features occur but which lack sufficient native grass cover, canopy openness and surface rocks of sufficient density).

Biodiversity Management Measures

- Construct stock fencing to exclude this management zone from agricultural activities (refer to Section 5.4).
- Promote natural regeneration of native grass understorey (refer to Section 5.7).
- Manage Invasive Native Species (such as White Cypress Pine) by strategic grazing or thinning and other methods (refer to Section 5.7).
- Conduct controlled burns in consultation with the NSW RFS to reduce fuel loads and promote native under-storey regeneration (refer to Section 5.7).
- Strategic Grazing only undertaken to reduce fuel loads and minimise bushfire risk (refer to Section 5.13).
- Undertake weed control (refer to Section 5.10).
- Implement vertebrate pest controls (refer to Section 5.11).
- Undertake PTWL habitat enhancement through placement of surface rocks and artificial habitat features within nominated areas (see **Figure 10**) (refer to Section 5.8, PTWL MP [**Appendix 3**] and PTWL BOMP [**Appendix 4**]).
- Undertake targeted stream stabilisation works.

Biodiversity Management Outcomes

- Create a complex of regenerating and sustainable vegetation communities trending towards more habitat complexity as trees age, form hollows and blow over or burn (bushfire).
- Maintain groundcover in accordance with vegetation benchmarks (refer to Section 5.7.2.2 – **Table 20**).
- Increase habitat quality for PTWL from low to moderate or good within the nominated PTWL Conservation and Enhancement Areas (see **Figure 10**).
- Increased native vertebrate species diversity over time as habitat is restored to one that is more complex than an INS dominated community.

- Photo and condition monitoring reports across seasons will record performance towards achieving a standard similar to local analogue site (refer to Section 6.2 and **Figure 12**).

4. Grassy Woodland on Rocky Outcrops MZ (204ha).

Description

- White Box-Tumbledown Gum Woodland (CW212) and White Box-White Cypress Pine woodland (CW213).
- Occurs on upper and mid-slopes of rocky ridge lines and outcrops.
- Areas have been largely cleared for previous grazing and cultivation but retain areas of PTWL Habitat of moderate to good quality.

Biodiversity Management Measures

- Construct stock fencing to exclude this management zone from agricultural activities (refer to Section 5.4).
- Promote natural regeneration of native grass understorey (refer to Section 5.7).
- Manage Invasive Native Species (such as White Cypress Pine) by strategic grazing or thinning and other methods (refer to Section 5.7).
- Conduct controlled burns in consultation with the NSW RFS to reduce fuel loads and promote native under-storey regeneration (refer to Section 5.7).
- Strategic Grazing only undertaken to reduce fuel loads and minimise bushfire risk (refer to Section 5.13).
- Undertake weed control (refer to Section 5.10).
- Implement vertebrate pest controls (refer to Section 5.11).
- Undertake PTWL habitat augmentation placement of surface rocks and artificial habitat features within nominated areas (see **Figure 10**) (refer to Section 5.8, PTWL MP [**Appendix 3**] and PTWL BOMP [**Appendix 4**]).

Biodiversity Management Outcomes

- Create a regenerating and sustainable woodland community trending towards more habitat complexity as trees age, form hollows and blow over or burn (bushfire).
- Maintain groundcover in accordance with vegetation benchmarks (refer to Section 5.7.2.2 – **Table 20**).
- Maintain DM as follows.
 - Avoid DM build up >3 000kg/ha.
 - Minimum DM after grazing (before rest period) – 1 400kg/ha.
- Increase habitat quality for PTWL from moderate or good within the nominated PTWL Conservation and Enhancement Areas (see **Figure 10**).
- Increased native vertebrate species diversity over time as habitat is restored from a derived grassland dominated by introduced pasture below White Cypress Pine dominated canopy (where present).

- Photo and condition monitoring reports across seasons will record performance towards achieving a standard similar to local analogue site (refer to Section 6.2 and **Figure 12**).

Pink-tailed Worm-lizard Habitat is considered separately within the PTWL MP and PTWL BOMP (see **Appendices 3** and **4**). **Table 12** provides a summary of the primary features and conditions of these two distinct zones for conservation, namely:

- Pink-tailed Worm-lizard Translocation Zone. Area of disturbance from where surface rocks and individual lizards will be collected and relocated.
- Pink-tailed Worm-lizard Habitat Management Zone. Grassland or open woodland over trachyte intrusions, with various additional habitat features conducive to the occurrence of Pink-tailed Worm-lizard, for conservation and enhancement.

Table 12
Pink-tailed Worm-lizard Habitat

Biodiversity Offset Management Area	Vegetation Community / Habitat Feature	Size (ha)	Condition
Pink-tailed Worm-lizard Translocation Zone	As above but occurring where impact avoidance is not possible.	33.7	<ul style="list-style-type: none"> • 25.5ha of high quality habitat (23.6% of all mapped high quality habitat); and • 8.2ha of medium quality habitat (4.6% of all mapped medium quality habitat).
Pink-tailed Worm-lizard Habitat Management Zone	Habitat features which incorporate a combination of the following. <ul style="list-style-type: none"> • Recorded occurrence. • Intermediate volcanic rocks • Moderate sloping aspect. • Well drained soil. • Open canopy formation. • Diverse native grass understorey. • Occurrence of loose surface rocks. • Presence of ants / ant nests. The habitat condition has been classed as low, moderate or high on the basis of these indicators ¹ .	205.3	<ul style="list-style-type: none"> • 56.8ha of high quality habitat (52.7% of all mapped high quality habitat); • 106.5ha of medium quality habitat (59.4% of all mapped medium quality habitat); and • 42ha of low quality habitat (11.43% of all mapped low quality habitat).
Note 1: Further information on the classification of the Pink-tailed Worm-lizard habitat is provided in the PTWL MP (refer to Appendix 3)			

3.3.4.4 Overview of Threats and Biodiversity Management

The threats to the biodiversity objectives of the Offset BMA, which are discussed in Section 4.1, and associated biodiversity management measures to be implemented, which are discussed in Sections 5, are identified in **Table 13**.

Table 13
Summary of Threats and Associated Management Measures for the Offset BMA

Management Measures	Threats									
	Vegetation Clearing (Section 4.1)	Disturbance to Habitat (Section 4.2)	Land Use Practices (Section 4.3)	Noxious and Environmental Weeds (Section 4.4)	Woody Weeds (Section 4.5)	Vertebrate Feral and overabundant native species (Section 4.6)	Erosion (Section 4.7)	Altered Fire Regimes (Section 4.18)	Land Contamination (Section 4.9)	Dryland Salinity (Section 4.10)
Rehabilitation (Section 5.2)										
Cultural Heritage Management (Section 5.3)							✓			
Fencing Gates and Signage (Section 5.4)	✓		✓							
Access Tracks (Section 5.5)	✓	✓							✓	
Vegetation Clearing, Thinning and Timber Management (Section 5.6)	✓	✓								
Vegetation Enhancement (Section 5.7)					✓					✓
Habitat Augmentation (Section 5.8)		✓			✓					
Native Species Translocation (Section 5.9)	✓	✓								
Weed Management (Section 5.10)			✓	✓	✓					
Vertebrate Pest Management (Section 5.11)			✓			✓				
Erosion and Sediment Control (Section 5.12)			✓				✓			
Fire Management (Section 5.14)								✓		
Injured Fauna Management (Section 5.15)		✓								

3.3.4.5 Biodiversity Offset Security

The Offset BMA, as defined by the Plan, will be secured by way of a Conservation Property Vegetation Plan (Conservation PVP) under the NV Act. The Conservation PVP is a legally binding contract between AZL and the Central West Local Land Services under the NV Act which is registered to land title (see **Appendix 2**)⁴.

⁴ In the event of the NV Act being repealed, responsibility for oversight of existing Conservation PVPs will revert to the NSW Conservation Trust.

The Conservation PVP defines the land parcels to which it applies, all of which are AZL owned freehold land (private property). Equivalent to a BioBanking Agreement, the Conservation PVP defines the specific management actions to be applied, units of land where these are to be applied, and the term over which these are to be applied. The implementation of the Conservation PVP management actions is further described in Section 5 of the Plan.

In accordance with the Conservation PVP, fencing will prevent uncontrolled access of personnel, the general public and livestock to the BOA. Some areas of the BOA will have complete exclusion from livestock, however, strategic periodic grazing will be used as a tool to manage the risk of catastrophic fire and manipulation of species diversity through the majority of the BOA.

Signs on gates at designated entry points to the BOA, as well as administrative controls (inductions and site maps) will deter unauthorised entry by staff or general public.

Funding of the management actions associated with the biodiversity offset, as identified within the Conservation PVP and Section 5 of the Plan, will be by AZL. To ensure sufficient funding is available to implement the management actions of the Conservation PVP, AZL will lodge a conservation bond with the DPE (within 6 months of the approval of the Plan). The quantum of this bond will be based upon the calculated costs to implement the management actions (of Section 5) through to completion

In compliance with *Condition 3(32)* of SSD-5251, with the exception of those management actions directly related to the operation of the DZP, these management actions are to be applied in perpetuity. That is, at the cessation of the DZP, the obligation to implement the management actions of the Conservation PVP, to achieve the nominated completion criteria, will remain.

4. THREATS TO BIODIVERSITY

4.1 THREAT IDENTIFICATION

4.1.1 Vegetation Clearing

OzArk (2013) determined up to 808 hectares of land within the DZP Site would be directly disturbed by the DZP⁵. **Table 14** presents the vegetation communities impacted.

Table 14
Vegetation Communities Impacted by the DZP

Veg Type ID	Veg Type Name	Total Area Mapped	Within DZP Site	Total Disturbed
CW112	Blakely's Red Gum – Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277).	127.1	3.2	0.00
CW213	White Box – White Cypress Pine – Inland Grey Box woodland on the western slopes of NSW (Benson 267) – Quality remnants.	520.5	433.0	43.70
CW213	White Box – White Cypress Pine – Inland Grey Box woodland on the western slopes of NSW (Benson 267) – Derived Grassland (>50% weedy, rotationally cropped).	674.8	532.4	414.00
CW138	Fuzzy Box – Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201).	43.3	23.4	0.10
CW143	Heathy shrublands on rocky outcrops of the western slopes.	25.5	2.6	0.00
CW121	Bullock - White Cypress Pine woodland mainly in the NSW South Western Slopes Bioregion (Benson 54).	3.9	3.9	0.00
CW212	White Box – Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270).	539.0	289.0	27.10
N/A	Cleared / Grazed Crop (remainder).	1 208.2	1 208.2	313.0
N/A	White Cypress Pine monoculture.	67.9	8.9	9.6
		3 211.3	2 215.6	807.5

The construction of the linear infrastructure would result in the disturbance of an additional 1.08 hectares of *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* (CW145) for the Obley Road realignment.

Progressive clearing and rehabilitation (in accordance with the MOP) would ensure only a proportion of the total vegetation is removed at any one time. Furthermore, tree clearing will be scheduled to minimise impact on breeding birds and roosting microbats (refer to Section 5.6.3).

⁵ This area has subsequently been reduced as a result of a reduced requirement for residue storage.

The establishment of the 1 021ha BOA (refer to Section 3.3.4) offsets the impacts whilst rehabilitation is ongoing in order to provide an overall environmental benefit as a result of the DZP.

On the basis of the above, it has been determined by OzArk (2013) that no significant impact will occur to any listed Endangered Ecological Community.

4.1.2 Disturbance to Habitat

Disturbance of habitat will be limited to the Impact BMA and of greatest significance to the Pink-tailed Worm-lizard, with assessment of impact completed by OzArk (2013) determining the nominated disturbance would not place any species, population or community at risk of local extinction. To reduce the effect of this disturbance on the local population of Pink-tailed Worm-lizard, habitat (loosely bedded surface rock) will be relocated to areas within the Offset BMA adjacent and northeast of the open cut (within BOMZ 3). This action, which is described in detail in the PTWL BOMP (see **Appendix 4**), will promote passive translocation of this species. Artificial habitats (roof tiles) have also proven successful as habitat for the Pink-tailed Worm-lizard in these areas and will continue to be used to assist in passive translocation of the species.

Disturbance of habitat within the Agriculture BMA will be no more than that which occurs as a consequence of existing routine agricultural management actions, i.e. grazing, cropping and pasture establishment.

Disturbance of habitat within the Offset BMA will be minimised through fencing and restriction of access (refer to Section 5.4). Tracks through and across the Offset BMA will be rationalised and kept to a bare minimum width and formation.

4.1.3 Land Use Practices

Encroachment of agricultural activities or inappropriate grazing strategies has the potential to effect the achievement of the following biodiversity management objectives.

- Rehabilitation to establish a safe and non-polluting landform and sustainable ecological communities for the Impact BMA.
- Implementation of sustainable agricultural activities which do not adversely impact on the objectives of the adjoining Impact and Offset BMA's within the Agriculture BMA.
- The eight common objectives and individual performance criteria of each BOMZ within the Offset BMA (the land use of which will change from agricultural production and passive biodiversity conservation to active biodiversity conservation, incorporating appropriate agricultural management).

A professionally trained farm manager will manage the agricultural enterprises according to leading practice (refer to Section 5.13).

4.1.4 Noxious and Environmental Weeds

Noxious and agricultural weeds occur within each of the three BMAs. The Offset BMA possesses the lowest diversity and density of weeds in the DZP, reflecting the non-arable

nature and reduced disturbance over Dowd's Hill. While the Dowd's Hill remnant (BOMZ 3) has a relatively low introduced weed burden, biodiversity is significantly affected by Cypress Pine (Black and White Cypress) monocultures suppressing mid and lower stratum biodiversity. Native grassy areas also have very low weed burdens, where soils are poor they have not been ploughed. Ploughed soils possessed derived native grassland communities (as mapped by OzArk, 2013) with higher weed burdens.

Areas of remnant woodland in the Offset BMA are dominated by Black and White Cypress Pine. While these species provide some habitat values for native species, they are considered as Invasive Native Species (INS) (see Section 4.1.5) whose detrimental impacts on biodiversity outweigh any such benefits.

4.1.5 Woody Weeds (Invasive Native Species)

Cypress Pine, an INS, suppress mid and ground stratum biodiversity, reducing species diversity.

An overabundance of INS also reduces the variety of habitat available. Notably, a sub-population of Pink-tailed Worm-lizard recorded in 2001 on Dowds Hill has not been re-recorded since. As is discussed in the PTWL MP (see **Appendix 3**), a native understorey, open canopy and prevalent ant (feed) species are important habitat features for this species which are removed by Cypress Pine INS.

As a consequence of a reduction in ground stratum, heavy rainfall events result in stream bed erosion.

4.1.6 Vertebrate Feral and Overabundant Native Species

Feral pigs have colonised Dowd's Hill (BOMZ 3) since the summer flood years of 2010-2011. Pigs pose a threat to PTWL habitat through their feeding habit of digging and overturning loose rock. Fox, cat, rabbit and European hare are the other key introduced vertebrate pest species.

Eastern Grey Kangaroos or wallabies can be an overabundant native species and increase total grazing pressure leading to degradation of farm and native grassland (within the three BMAs).

4.1.7 Erosion and Sedimentation

Soil erosion by wind and water has shaped and incised the existing local setting. Removal of ground stratum as part of DZP construction and operations increases the potential for sheet erosion from cleared areas, or concentrated flows leading to gully erosion. In both cases, valuable resources for rehabilitation and re-establishment of native biodiversity may be lost and the downstream ecology of watercourses adversely affected by discharge of turbid water with high sediment loads.

4.1.8 Altered Fire Regimes

Altered fire regimes (removal of Aboriginal mosaic burning since 1788) have significantly influenced the composition of vegetation communities within the local setting. Traditional firestick farming methods of the traditional land owners produced grassy woodlands. In

contrast, the vegetation of largely undisturbed vegetation displays higher than benchmark overstorey canopy densities (OzArk, 2016 - refer to **Appendix 5**).

The occurrence of Cypress Pine dominated communities and monocultures have further modified the fire regime of the local setting with manageable fire not able to be carried within these communities whilst a grassy lower stratum is absent.

4.1.9 Land Contamination

With the construction of the DZP comes the risk of contamination through spillage of hydrocarbons or other materials used in construction.

On commencement of operations, various processing reagents will be transported to and used on the DZP Site, each of which has the potential to contaminate land and affect the ability of the Company to achieve the nominated biodiversity objectives for each BMA.

Finally, various processing residues will be disposed on within structures designed to contain these. Should these structures spill or leak, it is possible for contamination of land and water surrounding these which could impact on the achievement of the nominated biodiversity objectives for each BMA (in particular the Impact BMA).

4.1.10 Dryland Salinity

A regional scale groundwater and dryland salinity investigation carried out in 2001 by the then NSW Department of Land and Water Conservation (DLWC) identified the Toongi Catchment as prone to significant salinity (Smithson, 2001). The occurrence of dryland salinity in the Toongi catchment typically occurs in the upper and mid-slopes and along drainage lines. Potential groundwater discharge and saline sites within and surrounding the DZP Site have been identified as surface drainage lines, break of slope and on the valley floors or alluvial flats (Smithson, 2001).

Areas at greatest risk of dryland salinity are those where the groundwater table is within 5m of the natural ground surface. Areas to be disturbed on the DZP Site occur where depth to groundwater is estimated to be 10m or greater suggesting the potential to accelerate existing dryland salinity as low. This notwithstanding, revegetation strategies will be implemented in the lower elevated areas of the DZP Site, adjacent to Paddys and Wambangalang Creek, which directly combat rising groundwater levels (refer to Section 5.7.2).

The change in land use from agriculture to biodiversity offsets along Cockabroo Creek, and Watercourses A & B (see **Figure 6**) should reduce dry land salinity in some one as those drainage lines will gradually regenerate with deep-rooted perennial grasses and woody vegetation which will suppress the water table (and dryland salinity).

4.1.11 DZP Infrastructure Risks

The DZP residue storage facilities (RSFs) and Process Water Dam(s) will be lined with HDPE plastic, retain water and therefore pose drowning hazard to fauna. RSFs will be contained within chainmesh 'man-proof' fencing and isolated from the Offset and Agriculture BMAs. A netting skirt will be applied to prevent smaller vertebrates accessing RSFs.

4.2 RISKS TO ACHIEVING OUTCOMES

Table 15 summarises the risk(s) posed by each of the threats identified in Section 4.1, relevant performance objectives, the management strategies to be implemented and the overall risk associated with each threat. The management measures identified and performance criteria are further defined and described in Section 5.

Table 15
Threats to Biodiversity Outcomes

Page 1 of 2

Threat	Performance Objectives	Management Strategies	Risk Level
Vegetation Clearing	Minimise or offset disturbance to native vegetation. Minimise fauna injury and death.	Rehabilitation (refer to Section 5.2). Access control (refer to Sections 5.4 and 5.5). Vegetation clearing protocols and procedures (refer to Section 5.6). Vegetation enhancement strategies (refer to Section 5.7). Injured fauna management practices (refer to Section 5.15).	Medium
Habitat disturbance	Minimise or offset reduction in native fauna habitat. Provide for net improvement in quality and quantity of PTWL habitat.	Vegetation clearing protocols and procedures (refer to Section 5.6). Vegetation enhancement strategies (refer to Section 5.7). Habitat augmentation strategies (refer to Section 5.8). Native species translocation (refer to Section 5.9).	Medium
Land use practices – Impact BMA	Establish a safe and non-polluting landform and sustainable ecological communities within the Impact BMA.	Avoid unnecessary clearing and disturbance (refer to Section 5.6.1.1). Rehabilitation of disturbed lands to agreed landform and land use (refer to Section 5.2). Access control (refer to Sections 5.4 and 5.5). Vegetation clearing protocols and procedures (refer to Section 5.6).	Low
Land use practices – Agriculture BMA	Implement of sustainable agricultural which does not adversely impact on the biodiversity values of adjoining vegetation and habitat.	Access control (refer to Sections 5.4 and 5.5). Groundcover maintenance and other land management erosion controls (refer to Section 5.12). Grazing and farm management strategies (refer to Section 5.13).	Low
Land use practices – Offset BMA	Improve and conserve biodiversity of the Offset BMA.	Access control (refer to Sections 5.4 and 5.5). Vegetation clearing protocols and procedures (refer to Section 5.6). Vegetation enhancement strategies (refer to Section 5.7). Habitat enhancement strategies (refer to Section 5.8). Native species translocation (refer to Section 5.9).	Medium
Noxious and Environmental Weeds	Decrease in number and abundance of problem species.	Vegetation clearing protocols and procedures (refer to Section 5.6). Targeted weed control programs (refer to Section 5.10).	Medium
Woody Weeds (INS)	Reduction in INS dominated communities.	Vegetation enhancement strategies (refer to Section 5.7).	Medium
Vertebrate Feral and overabundant native species	Reduction in vertebrate pest numbers. Eradicate feral pigs.	Vertebrate pest management including trapping, baiting and active culling (refer to Section 5.11).	Low

Table 15 (Cont'd)
Threats to Biodiversity Outcomes

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Threat	Performance Objectives	Management Strategies	Risk Level
Erosion and Sedimentation	Reduction in land area subject to active soil erosion and stream bed erosion.	Vegetation enhancement strategies (refer to Section 5.7). Groundcover maintenance and other land management erosion controls (refer to Section 5.12). Grazing and farm management strategies (refer to Section 5.13).	Low
Altered fire regimes	Increase in structural diversity of vegetation communities.	Vegetation enhancement strategies, including vegetation thinning and controlled burning (refer to Section 5.7).	Low
Land Contamination	Prevent contamination of land and water as a result of DZP construction and operation.	Access control (refer to Section 5.4). Avoid unnecessary clearing and disturbance (refer to Section 5.6.1.1). Land contamination management strategies (refer to Section 5.16).	Low
Dryland salinity	Decrease in area of salinity affected areas on Company Land holdings.	Consideration in selection of species used in rehabilitation (refer to Section 5.2). Avoid unnecessary clearing and disturbance (refer to Section 5.6.1.1). Vegetation enhancement strategies (refer to Section 5.7). Grazing and farm management strategies (refer to Section 5.13).	Low
DZP Infrastructure	Minimal fauna interactions with infrastructure.	Access control (refer to Section 5.4) Injured fauna management practices (refer to Section 5.15).	Medium

5. BIODIVERSITY MANAGEMENT MEASURES, PERFORMANCE INDICATORS AND CRITERIA

5.1 INTRODUCTION

The following sub-sections describe the measures to be implemented to achieve the objectives nominated in Section 1.6 (for overall biodiversity management) and Section 3.3 (for each BMA individually), and manage the threats to biodiversity identified in Section 4.

Management measures are classified as occurring in either the short-, medium- or long-term. Short-term management measures include targeted activities with an approximate duration of between 18 months and 2 years. Medium-term management measures include activities, which require longer-term duration but have a defined end point, such as managing cleared vegetation, typically have an approximate duration of between 2 and 5 years. Long-term management measures include ongoing or repeat activities over the life of the DZP or beyond, such as weed and feral pest management and bushfire risk management.

Performance targets and completion criteria are provided for each of the management measures are described with **Table 31** (of Section 7) identifying the triggers and actions, in the form of individual Trigger Action Response Plans (TARPs), to be implemented in response to these targets or criteria not being achieved.

5.2 REHABILITATION

5.2.1 Management Measures

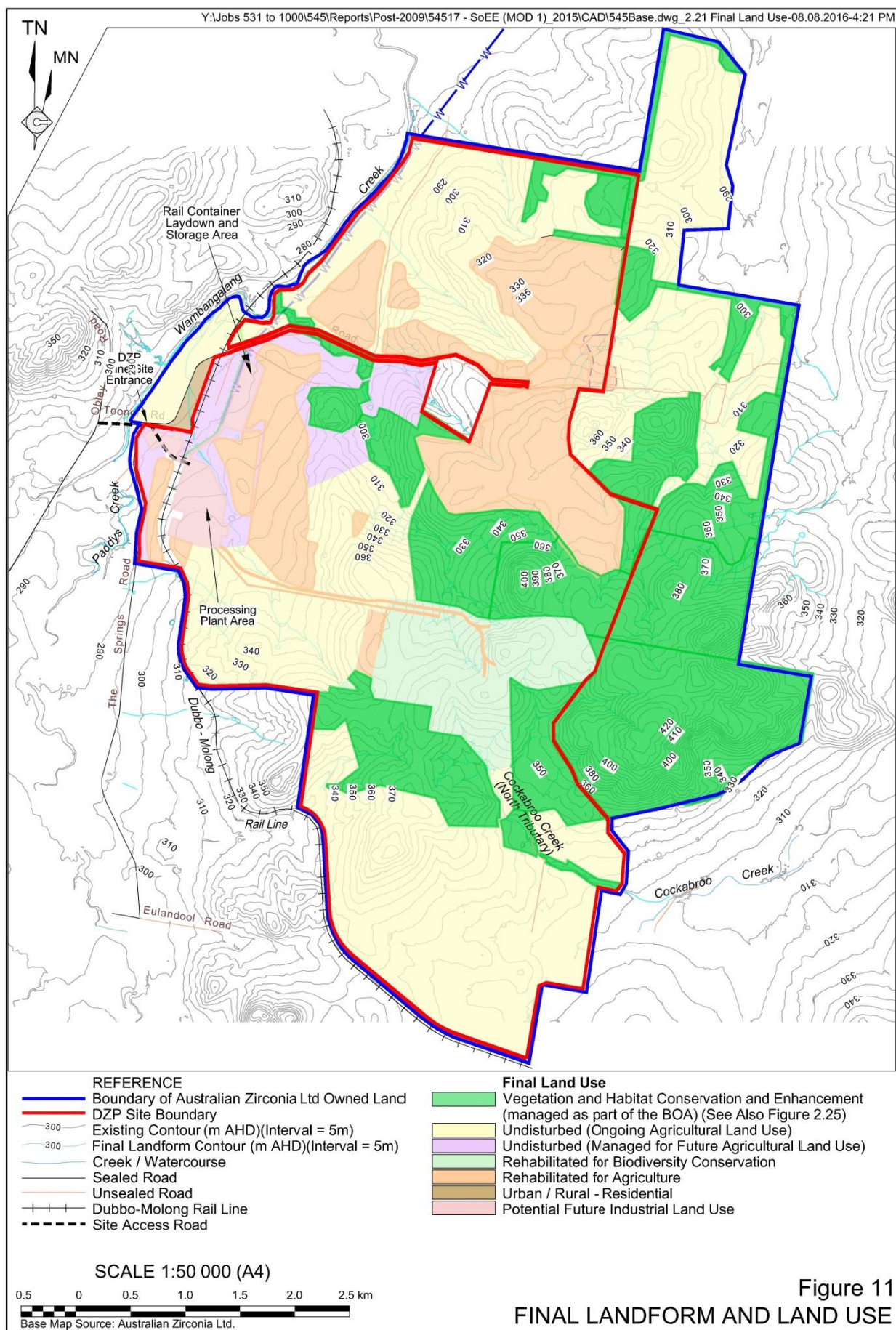
Rehabilitation objectives, procedures, performance criteria and measurement, and approach to contingency and adaptive management (of the Impact BMA) are addressed in the DZP MOP (which also provides the information required of a *Rehabilitation Management Plan* in accordance with *Condition 59* of Schedule 3 of SSD-5251).

Figure 11 provides the nominated final landform and land use of the DZP Site. In summary, rehabilitation aims to re-establish either agricultural, native woodland or native grassland vegetation over the final landform. The agricultural vegetation would include deep rooted perennial pasture species on the lower lying areas which may be susceptible to dryland salinity. The woodland and grassland would be of equivalent structure and composition to that of the BOMZ 1 or 2 (as described in Section 3.3.4.3).

The MOP, along with a *Farm Management Plan* for AZL owned land, is an integrated component of the overall biodiversity management of this land and falls under the *Integrated Land Management Plan* for the DZP (see **Figure 3**).

5.2.2 Performance and Completion Criteria

Refer to *Table 21* of the DZP MOP.



5.3 CULTURAL HERITAGE MANAGEMENT

5.3.1 Management Actions

A DZP *Cultural Heritage Management Plan* has been prepared separately to this Plan. By design the vast majority of cultural heritage sites identified in the EIS are contained within the BOA.

Having the BOA fenced (and future access restricted) will provide a higher level of protection of these sites into the future.

5.3.2 Performance and Completion Criteria

Table 16 presents the performance and completion criteria relevant to cultural heritage management on the DZP Site.

Table 16
Performance and Completion Criteria – Cultural Heritage Management

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Map known cultural heritage items to identify any potential risks from intensive management actions.	Complete		Update mapping with any new finds.	Update mapping with any new finds.	Final map providing all cultural heritage finds.
Develop cultural heritage protocols for inclusion in risk assessments for site personnel and contractors.	Complete			Review and revise protocols as necessary.	Protocols developed and implemented.

5.4 FENCING, GATES AND SIGNS

5.4.1 Management Measures

The Offset BMA will be fenced to prevent or control access of livestock and people. The Offset BMA has been designed to utilise existing fencing where possible, with approximately 20km of new fencing required. Where not required for property management purposes, fencing within the BOA will be removed (and re-used as part of the new fence installation where practicable). Barbed wire fencing will be kept to a minimum to avoid damage to wildlife.

Gates will be strategically placed to allow fire-fighting and maintenance access to BOAs.

Signs will be erected on gates at designated entry points to caution the public or AZL personnel from unauthorised entry in the BOA.

5.4.2 Performance and Completion Criteria

Table 17 presents the performance and completion criteria relevant to fencing, gates and signs within the DZP Site.

Table 17
Performance and Completion Criteria – Fencing, Gates and Signage

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Fence mapping showing fence and gate types, redundant fences and fences to be retained.		Complete			Completed
Redundant fence removal.	Complete within Agriculture BMA.	Complete within Offset BMA.	As required.	As required.	No redundant fencing preventing free movement of wildlife.
Quarterly fence inspections and any breaches rectified within 4 weeks.	To be completed quarterly and a record of maintenance kept.				All quarterly inspections completed and documented.

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 17**.

5.5 ACCESS TRACKS

5.5.1 Management Measures

Existing farm tracks will be rationalised and those kept will be maintained to provide access across the BOA. Access over Dowd's Hill is currently by foot only. A perimeter track will be maintained for security and fire control activities.

Activities such as targeted Cypress Pine thinning, feral and overabundant native herbivore animal management, and fire hazard reduction burns may require new vehicle access tracks. Where available, existing tracks will be used, however, if a new track is required, disturbance will be kept to a minimum. Approval for new access track construction will require approval by the Environment and Community Manager (or equivalent), preparation and retention of a clearing plan (including rehabilitation objectives and schedule), and implementation of all vegetation clearing protocols (refer to Section 5.6.1). Once no longer required, i.e. on completion of activities, the access track will be closed and rehabilitated.

5.5.2 Performance and Completion Criteria

Table 18 presents the performance and completion criteria relevant to access tracks within the DZP Site.

Table 18
Performance and Completion Criteria – Access Tracks

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Access track mapping.	Map all existing tracks.				Up to date maps identifying all access tracks completed and maintained.
Establish access track management strategy.	Identify tracks to be retained, tracks to be constructed and tracks to be rehabilitated.		Review access track management strategy, i.e. tracks to be retained, constructed and rehabilitated.	Review access track management strategy rehabilitated.	
Implement access track management strategy.	Commence	Establish perimeter track around the Offset BMA and hazard reduction burn tracks where advised by RFS.	Complete redundant track rehabilitation.	Complete redundant track rehabilitation.	Complete rehabilitation of all non-essential tracks.
	Quarterly inspections of tracks and issues rectified within 4 weeks.				All quarterly inspections completed and documented.

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 18**.

5.6 VEGETATION CLEARING, THINNING AND TIMBER MANAGEMENT

5.6.1 Management

5.6.1.1 Avoiding Unnecessary Impact

Disturbance of vegetation associated with mine construction and infrastructure will be restricted to the areas presented in **Figure 2**. This disturbance footprint specifically avoided native vegetation and threatened species habitat in the following order of priority.

1. Pink-tailed Worm-lizard habitat (mapped as high, mid and low quality).
2. EPBC Act listed Critically Endangered Ecological Community(ies).
3. EPBC Act or TSC Act Endangered Ecological Community.
4. Red Flag Biometric community types (greater than 70% cleared).
5. Native vegetation community in moderate to good condition.
6. Other vegetation providing habitat features utilised by native fauna.
7. Derived native grassland or native vegetation community in low condition.

Where disturbance can be avoided within the approved disturbance footprint, e.g. as a result of reduced water consumption and therefore reduced liquid residue storage requirement, this order of priority for impact avoidance will be followed (as far as practicable).

5.6.1.2 Scheduling of Clearing

Vegetation clearing associated with the development and operation of the DZP will be undertaken strictly in accordance with the Mining Operations Plan (MOP) (which addresses the conditional requirement for a Rehabilitation Management Plan as required by Condition 3(59) of SSD-5251). The existing MOP provides for the clearing and rehabilitation of available land for the initial construction phase of the DZP.

The above notwithstanding, the following measures will be implemented to ensure that vegetation clearing is restricted to approved areas and is undertaken to compliment the development sequence of the DZP.

- All employees and contract staff will be inducted and trained on environmental requirements, including vegetation clearing restrictions and procedures.
- Only clear sufficient vegetation for the subsequent 12 months operation will be cleared.
- Unless unavoidable due to revisions to development sequence or other unforeseeable circumstances, vegetation clearing operations will be restricted to between April and September to limit adverse impacts on tree dependent avifauna and microchiropteran bats.
- All vegetation will be undertaken in accordance with the DZP Vegetation Clearing Protocol (see Section 5.6.1.3).

5.6.1.3 Vegetation Clearing Protocol

Prior to and during clearing activities, the following protocol will be implemented.

Desktop Review

- The area is to be identified on a legible map, including an accurate calculation of the area to be cleared.
- The vegetation type is to be nominated along with the presence of mature trees which may include hollows, rooting habitat or nests.
- The map and accompanying information is to be provided to the Environmental Manager (or equivalent) for confirmation and/or further instruction.

Site Preparation

- The area of clearing will be clearly marked on the ground, including nominated entry / exit points and laydown areas for equipment.
- The Environmental Manager (or equivalent) will inspect and confirm the location as correct with respect to the approved maps.
- Erosion and sediment control features, e.g. diversion banks, sediment fencing, will be installed in accordance with the *Erosion and Sediment Control Plan*.

Pre-Clearance Inspections

- Potential habitat trees, i.e. trees with hollows, mature limbs or nests, will be identified and marked (using flagging tape or spray paint).
- A suitably trained employee or qualified ecologist will inspect each habitat tree for native species and relocate any identified fauna to suitable habitat. Over the life of the DZP, staff will be trained in the completion of pre-clearance surveys⁶ in order to:
 - ensure they understand the nature and extent of each stage clearing;
 - determine what habitats are to be affected, the species which could be effected and how to manage species that may be affected by the activity; and
 - orientate themselves with the location, nature and extent of unaffected habitat so that they would know the best locations to release relocated fauna.
- If threatened species are identified, and cannot be relocated, clearing will be suspended until the animal can be relocated or relocates naturally.

Clearing Operations

- Soil and groundcover will be directly transferred onto rehabilitation areas, where practicable, to maximise the opportunity for retention of the natural seed stock, and thereby maximise the revegetation of the final landform with endemic species.
- Mature trees will be cleared as follows.
 - Check all trees for the presence of nesting or roosting fauna before felling or pushing then start tree removal immediately after visual inspection.
 - When a tree with hollows requires removal, the tree is to be gradually nudged at intermittent intervals so that any animal occupying a habitat tree has the chance of vacating the area after the initial disturbance period.
 - Avoid leaving trees on ground unmanaged for more than two weeks as these would quickly become habitat for hollow dependent species.
- Vehicle speed limits will be restricted to limit the potential for vehicle trauma to wildlife.

Post-clearing Management

- A post clearing survey of the cleared vegetation will be undertaken, either by a qualified ecologist or trained personnel, to determine if further species need relocating.
- Following completion of clearing operations, fence, as appropriate, sections of the DZP Site not required for ongoing operations to limit access by non-authorised personnel.

Further measures on the management of felled timber are presented in Section 5.6.1.5.

⁶ The best seasonal timing for staff familiarisation and clearing plan preparation would be in spring when breeding hollows / nests are easier to detect.

5.6.1.4 Seed Collection and Propagation

It is unlikely seed collection and / or tree planting will be required to achieve vegetation community rehabilitation. Placing seed-laden branches to enhance natural regeneration in highly disturbed landforms is a viable rehabilitation option during tree clearing.

Once grazing is managed to achieve a biodiversity outcome, natural unassisted regeneration of the tree canopy will occur. If an area requires more intensive rehabilitation to achieve benchmark then seed collection will be considered as part of the relevant TARP (see **Table 31**).

5.6.1.5 Timber Clearing and Management

Cleared vegetation will be managed to maximise the opportunity for recycling or innovative tree removal.

- Timber will be removed using a bulldozer with its blade positioned just above the surface. In the event tree removal by this method is not possible, the tree will be chainsaw felled, with the stump then pulled from the ground by the bulldozer.
- Seed will be collected (if needed and available).
- Thinning of Cypress Pine by chainsaws / brush cutters (see Section 5.7.2.3) for 'cottage industries' such as Indigenous run business harvesting timber for Cypress Pine distillation / oil production.
- Material suitable for use as strainer posts, fencing, creek rehabilitation or increasing habitat complexity may be used as required.
- Bark may be taken from White box trees marked for removal in advance of felling for use in indigenous handicrafts. These trees for the purposes of this activity once modified are not considered to be as an Aboriginal Modified Tree under the NP&W Act.
- Additional targeted clearing of suitable tree species for material used in the preparation of cultural products, e.g. Aboriginal clapping sticks.
- A 'timber inventory' will be maintained which identifies and classifies the felled timber on the basis of type (introduced vs. native), size (mature vs. regrowth), density, habitat features, e.g. hollows, and potential for other uses (for milling, structural timber, etc.).
- Felled timber will be managed in the following order of priority.
 1. Tree management will prioritise maintaining or improving biodiversity in the BOA.
 2. Where required, high quality tree hollows will be separated for re-hanging within the (BOA) or the final landform as part of habitat enhancement activities.
 3. Where required, selected tree crowns with seed will be transferred to appropriate areas of the BOA or final landform, where regrowth of tree species will assist in achieving the final land use outcomes, and used to promote natural regeneration.

4. Where required, whole trees will be retained for future use in improving the habitat complexity of the final landform, or re-establishment or improvement of habitats surrounding the Mine Site, e.g. re-snagging watercourses.
5. Chipping of off cuts, crowns and smaller limbs, following harvest of seed for use in rehabilitation, and either use on rehabilitated land or sale.
6. Pyrolysis to charcoal and use in soil amelioration.
7. Cutting and availability to not for profit organisations to cut up and sell for firewood as firewood for community benefit/use or fundraising activity.
8. Some species such as Black Cypress Pine may be harvested for essential oil extraction.
9. Cutting and milling or sale of suitable species (White Cypress Pine, White Box, Ironbark), e.g. for fence posts, structural timber or floor boards.

The overriding principle of the timber management strategy is to avoid waste and maximise recycling. Priority will be applied to on-site environmental uses for the felled timber to ensure the biodiversity and rehabilitation performance targets of Section 5.6.2 are achieved. Other on-site uses of the timber, i.e. for property management purposes will be the next priority followed by other off-site biodiversity improvement and not-for-profit uses. If additional timber remains, and the timber inventory of the DZP confirms sufficient timber remains for Mine Site rehabilitation and enhancement of biodiversity offset areas, it will be made available for commercial uses.

This commitment to prioritising the availability of timber for rehabilitation and biodiversity enhancement activities notwithstanding, it is noted that the majority of disturbed areas on the mining lease are required to remain active for the life of the Mine. Consequently, the potential for progressive rehabilitation following disturbance is limited. Long-term stockpiling of felled timber is likely to be counter productive to rehabilitation objectives by creating habitat for vermin / pest species, especially rabbits, hares, cats and foxes, increasing fire risk and, in the case of Cypress Pine, having a detrimental effect on soils, groundcover and insect communities. Noting this, felled timber which cannot be used for rehabilitation or biodiversity enhancement purposes within 18 months, will be used for other property management or commercial activity.

Culturally modified trees will be handled with special care and attention in accordance with the DZP *Cultural Heritage Management Plan*. Priority will be to avoid impact to cultural sites and involve the Registered Aboriginal Stakeholders in there management.

5.6.2 Performance and Completion Criteria

Table 19 presents the performance and completion criteria relevant to vegetation clearing, thinning and timber management within the DZP Site.

Table 19
Performance and Completion Criteria – Vegetation Clearing, Thinning and Timber Management

Page 1 of 2

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Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Avoiding Unnecessary Impact					
Vegetation Clearing and Soil Stripping.	Maps prepared to nominate areas to be cleared.	Reconcile actual vs approved clearing.	Maps prepared annually to nominate areas to be cleared. Clearing reconciled annually against maps.		All clearing undertaken within approved impact footprint.
Vegetation Clearing					
Scheduling of clearing.	Clearing of mature trees does not occur during spring (annual requirement).				No avoidable impacts on roosting or nesting native fauna.
Staff awareness of clearing protocols.	Identify administrative controls re: clearing during induction. Include and complete Tool Box training module on vegetation clearing.				All inductions and training completed and documented. Demonstrate areas to be disturbed are clearly marked. Guidelines governing tree clearing and handling of wildlife are documented.
Pre and post clearing administrative controls.	Suitably qualified and experienced staff to handle engaged to relocate and manage fauna. Procedures governing handling, relocation and management of fauna (including injured fauna) followed. Details of specific fauna management completed during (or immediately following) clearing.				All administrative controls followed and documented.
Seed Collection and Propagation					
Mapping of available seed resources.	Identify and map trees for potential seed harvest post-clearing (annual hereafter).				Inventory of available seed resource retained.
Seed collection (if required).		Review (survey) species diversity of regenerating vegetation (annual hereafter).	Collect and propagate seed (in response to relevant trigger(s)) ¹ (annual hereafter).	Provenance seed and tube stock available for vegetation enhancement (refer to Section 5.7).	Provenance seed and propagated tube stock available for rehabilitation.
Tree crowns or branches holding seed used to encourage natural regeneration of White Box (particularly along Watercourse B which drains an over cleared landscape).	Prepare a map showing areas where seed stock branches can be placed.	Update the map identifying areas for placement of seed branches (annual hereafter).			Map available to Mine personnel and updated annually.
Note 1: Unless sufficient seed stock has previously been collected					

Table 19 (Cont'd)
Performance and Completion Criteria – Vegetation Clearing, Thinning and Timber Management

Page 2 of 2

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Timber Clearing and Management					
Identify areas to be cleared and detail management required in these areas.	Maps and on site physical markers clearly delineate management zones. Sensitive environmental areas, i.e. cultural sites identified on maps and marked in the field.				Timber clearing restricted to mapped areas. No unavoidable impacts to sensitive environmental areas.
Induct workers on the nature and extent of clearing required to minimise impact to surrounding vegetation.	Establish Induction log supported by maps and plans.	Review and update induction log.	Review and update induction log.	Review and update induction log.	All personnel inducted (records maintained).
Engage a suitably qualified and experienced fauna handler when removing substantive vegetation.	Appropriate record of clearing, i.e. letter reports, clearance letters, or wildlife management logs, completed.				No avoidable impacts on sensitive vegetation of roosting / nesting native fauna.
Salvage or recycle material removed.	Prepare a map showing areas of timber resources to be cleared, locations of stockpiles and areas for reuse on site.	Update the map in response to annual review of rehabilitation / revegetation progress against objectives (annual).			Sufficient timber available for rehabilitation and vegetation enhancement works.

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 19**.

5.7 VEGETATION ENHANCEMENT

5.7.1 Overview of Strategies

Fencing and removal of continuous livestock grazing to allow natural regeneration is the primary strategy for vegetation enhancement. Twenty years of previous mine rehabilitation experience at the Peak Hill Gold Mine and Tomingley Gold Operations has clearly demonstrated natural regenerating through strategic control of grazing agriculture where a biodiversity outcome is the primary outcome, has greater biodiversity outcomes than assisted regeneration i.e. planting tube stock.

5.7.2 Management

5.7.2.1 Land Surface Preparation

Should specific areas of the BOA require additional intervention to achieve the vegetation benchmark then the land surface will be followed with Glyphosate herbicide for six months prior to planting seedlings or tube stock trees and shrubs (representative of the vegetation community being enhanced).

5.7.2.2 Vegetation Community Benchmarks

The main objective of the BOA is to establish stable, sustainable vegetation communities meeting regional or local benchmarks which emulate locally occurring native vegetation communities. The BMP has therefore been prepared to address two primary vegetation improvement objectives:

1. To provide sustainable land management regimes to facilitate natural regeneration of grassy woodland communities.
2. To detail the vegetation monitoring and maintenance requirements for the project.

In order to establish criteria against which these objectives can be measured, OzArk (2016) established five local benchmark sites and one control site representing the native vegetation community types of the BOA. Each local benchmark site was established to represent the best local remnant for each community.

This approach, which incorporated the collection of data from five 50m x 20m habitat plots and 50m x 1m transects within vegetation communities representative of those to be conserved and enhanced within the BOA and comparison to the Biometric Vegetation Type (BVT) benchmarks established for each respective community, provides a transparent way to determine:

- how the local benchmark sites compare to the regional BVT benchmarks and therefore how effective these will be as analogue sites; and
- what revegetation (and/or habitat augmentation) is required.

Table 20 provides the regional BVT benchmarks for the vegetation communities of the BOA against which the local benchmarks were compared.

Appendix 5 provides the results of the analyses of the data collected from these benchmark sites which, in summary, determined the following.

- 31.1% native over storey cover. This is 'high' for a grassy woodland environment and indicates thinning or burning may be suitable landscape management tools.
- Zero mid-storey cover. This is to be expected in a grassy woodland environment.
- 29% native (grass) ground cover. This is within benchmark for a grassy woodland environment.
- 0.5% native (shrub) ground cover. This is below benchmark. An expected benchmark for grassy woodland is between 3% to 5%.
- 18.3% native (other) ground cover. This is within benchmark for a grassy woodland environment.
- 1.8 trees per 0.1ha had hollows. This is within benchmark for a grassy woodland environment.
- 14.4m of fallen timber per 0.1ha. This is below benchmark. An expected benchmark for grassy woodland is over 45m (CW212 – White Box – Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270) community and between 66m to 75m for the rest.
- 0.46% regeneration of upper stratum species. There is no benchmark but the results show more plots do not have regenerating trees than plots which do.

Table 20
Biometric Vegetation Type Benchmarks

Vegetation Type	No. Native Plant Species	Native Over Storey Cover		Native Mid Storey Cover		Native Ground Cover Grass		Native Ground Cover Shrubs		Native Ground Cover Other		Number of Trees with Hollows per 0.1ha	Total Length of Fallen Logs m/0.1ha
		MIN %	MAX %	MIN %	MAX %	MIN %	MAX %	MIN %	MAX %	MIN %	MAX %		
CW138 - Fuzzy Box / Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion	25	12	35	1	25	15	70	3	5	3	20	0.8	66
CW213 - White Box / White Cypress Pine / Inland Grey Box woodland on the western slopes of NSW	25	12	35	1	25	15	70	3	5	3	20	0.8	66
CW112 - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion	25	12	35	1	25	15	70	3	5	3	20	0.8	66
CW143 - Heathy shrub lands on rocky outcrops of the western slopes	30	10	40	0	1	5	10	10	25	3	5	0	0
CW212 - White Box / Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes	30	8	35	3	35	3	25	3	25	3	25	2	46
CW213 - White Box / White Cypress Pine / Inland Grey Box woodland on the western slopes of NSW	25	12	35	1	25	15	70	3	5	3	20	0.8	66
CW212 - White Box / Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes	30	8	35	3	35	3	25	3	25	3	25	2	46
CW213 - White Box / White Cypress Pine / Inland Grey Box woodland on the western slopes of NSW	25	12	35	1	25	15	70	3	5	3	20	0.8	66

The condition of the local benchmark sites, when compared to regional BVT benchmarks (see **Table 20**), indicate the regional BVT benchmarks provide appropriate criteria for performance management. The results also indicate that the analogue sites may be used to account for seasonal fluctuation resultant from extreme meteorological conditions, e.g. drought, or unforeseen events, e.g. bush fire, which may affect all remnant vegetation of the local and/or regional setting.

The comparison of the local benchmark sites to the regional BVT benchmarks also demonstrates very little active management will be required. Actions such as thinning the overstorey and the addition of logs from tree clearing are likely to be the principal actions required to enhance these communities.

DZP tree hollow abundance was within the regional BVT benchmark. As tree hollows are an important habitat type in grassy woodlands, additional high quality tree hollows salvaged during clearing may be relocated and hung into targeted areas in the BOA where the vegetation patch is below benchmark.

As noted in Section 5.7.1, natural regeneration of vegetation assisted by placement of seed bearing crowns and branches (of cleared vegetation) will be relied upon to develop sustainable grassy woodland communities. Additional seeding or planting would be undertaken in response to key performance objectives with respect to vegetation community establishment not being achieved (refer to **Table 20**, Section 5.7.3).

5.7.2.3 Vegetation Thinning Strategies

While landscape scale thinning is impractical and is not proposed, targeted thinning of Cypress Pine (INS) will provide several benefits to biodiversity.

- The diversity and density of native grass understorey species will improve.
- This in turn will improve infiltration of rainfall and reduce runoff velocities and assist in preventing further gully erosion.

An improvement in the diversity and density of native grass understorey species within PTWL habitat will improve and the area of occupancy and assist in reconnecting isolated sub-populations.

AZL will consult with LLS and OEH on the most cost effective approach to thinning Cypress Pine. The primary method of thinning will use manual brush cutting. It is noted that in some circumstances, i.e. where Cypress Pine is especially thick diameter at breast height (dbh) of individual trees if too large for manual brush cutting, mechanical thinning with mulchers and/or bulldozers may be undertaken. In such circumstances, this mechanical thinning, which will result in some disturbance to soils, will aide in the recolonization and regeneration of native understorey (required by many native plant species). Such mechanical thinning will only be undertaken where impacts to existing native vegetation within and surrounding (as well as on route to) the designated area can be avoided and where it is determined this will lead to accelerated recolonization of the cleared area with native understorey species.

AZL will aim for no more than one Cypress Pine Tree will be left in 10m² in the first round of thinning. Ideally overtime the end result would see no more than one Cypress Pine in thinned areas per 30m². Areas of unthinned Cypress Pine will be retained in large patches to provide 'other' values i.e. shade and refuge.

Thinning will target mapped PTWL habitat and waterways / drainage lines to achieve an improve coverage of ground stratum species and reconnect effectively isolated PTWL populations. PTWL habitat identified as high quality and drainage lines affected by sheet erosion will be targeted first for thinning, strategic areas of medium and low quality PTWL habitat value will be targeted as a second priority.

5.7.2.4 Controlled Burns

Controlled burning may be used as a tool to increase habitat diversity, promote regeneration of native understorey species, and control the risk of catastrophic bushfire through the canopy. Cypress Pine monocultures will not carry manageable fire until a grassy lower stratum is reinstated.

Any burning will only be undertaken following consultation with NSW RFS.

Controlled burns within noted Pink-tailed Worm-lizard habitat will only be undertaken following the completion of further assessment as to appropriate fire frequency and intensity to maximise the vegetative habitat structure and floristic diversity of Pink-tailed Worm-lizard habitat (refer also to Section 5.14).

5.7.3 Performance and Completion Criteria

Table 21 presents the performance and completion criteria relevant to vegetation enhancement within the Offset BMA of the DZP Site⁷. With the exception of INS thinning activities, and as nominated in Section 5.7.1, vegetation enhancement strategies are only anticipated in response to the revegetation completion criteria not being achieved.

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 20**.

5.8 HABITAT AUGMENTATION

5.8.1 Overview of Strategies

The Pink-tailed Worm-lizard is the key vertebrate species this Plan has been prepared to conserve. However, the Plan will directly benefit a variety of vegetation communities and many other animal species.

5.8.2 Management

5.8.2.1 Pink-tailed Worm-lizard BOMZ

AZL has identified 239ha of Pink-tailed Worm-lizard habitat, of varying quality (high, medium and low), to be contained within the Offset BMA (BOA).

⁷ Revegetation and vegetation enhancement of the Impact BMA is addressed in the DZP MOP. Maintenance of vegetation of the Agricultural BMA is addressed as a component of the Farm Management Plan.

Table 21
Performance and Completion Criteria – Vegetation Enhancement

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Vegetation Community Benchmarks					
Improve native vegetation.	Reliance to be placed on natural regeneration (assisted by other biodiversity management measures) to achieve objectives. Additional actions in response to failure to achieve the nominated revegetation objectives to be implemented in accordance with Trigger Action Response Plan (TARP) 5.				Achievement of BVT Benchmarks (Table 20) or equivalence to local analogue sites.
Maintain minimum groundcover.	Reliance to be placed on natural regeneration (assisted by other biodiversity management measures) to achieve objectives. Additional actions in response to failure to achieve the groundcover objectives to be implemented in accordance with TARP 6.				
Vegetation (INS) Thinning					
Thinning of White Cypress.	Prepare plan for trial (in consultation with OEH & LLS).	Implement Phase 1 of Thinning Trial.	Extend Thinning Trial (in accordance with plan). Complete formal INS Plan.	Implement Cypress Pine thinning in accordance with INS Plan.	Cypress Pine reduced to density of between 1/10m ² and 1/30m ² within PTWL habitat and along drainage lines of Offset BMA. Complete additional thinning campaigns (TARP 5).
Retain patches of unthinned Cypress Pine dominated communities.					Retain fauna habitat values provided by Cypress Pine dominated communities (TARP 5).

Three key strategies for Pink-tailed Worm-lizard habitat augmentation will be implemented.

1. Identification, removal and repositioning of flattish 30cm to 50cm rocks, collected from the Impact BMA, to the northeast and east of the open cut (on cultivated land previously rock-picked).
2. Use of artificial habitat features such as roof tiles within the habitat augmentation area to supplement the use of the limited supply of naturally occurring habitat rocks.
3. Thinning the canopy coverage of mapped high quality habitat on the foot-slopes of Dowd's Hill, to encourage re-establishment of native grass understorey, and placement of additional rock or artificial habitat (roof tiles) (see also Section 5.6.1.4).

The detail of these management strategies, along with performance and completion criteria, are provided in **Appendix 3** (PTWL MP).

It is important to recognise that the conservation work associated with the BMP, and DZP more generally, provides the only conservation efforts undertaken for this species within this area of its known area of occupancy. The proposed habitat conservation and augmentation provides the first attempts at mitigating impact associated with previous land use activities, such as clearing, cultivation and rock removal.

5.8.2.2 Other Habitat Augmentation

Local benchmarks when compared to regional Biometric benchmarks demonstrated very little active management, apart from thinning the overstorey cover percentage and the addition of logs from tree clearing in the BOA, is needed to augment habitat (see Section 5.7.2.2).

While tree hollows occurrences were within benchmark, these are an important habitat type in grassy woodlands and additional high quality tree hollows salvaged during clearing may be relocated and hung into targeted areas in the BOA where the vegetation patch is below benchmark.

5.8.3 Performance and Completion Criteria

Table 22 presents the performance and completion criteria relevant to Habitat Augmentation Management within the DZP Site.

Table 22
Performance and Completion Criteria – Habitat Augmentation

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Extension and improvement of PTWL Habitat.	Refer to Appendix 3 .				
Over-storey thinning.	Refer to Table 20 .				
Placement of fallen timber and tree hollows.	Survey and map areas requiring augmentation for purpose of fallen timber / tree hollows.	Review percentage fallen timber and no. tree hollows against benchmarks.	Transfer (from active clearing or stockpile) timber and tree hollows (annual hereafter).		Achieve benchmark for relevant vegetation community (refer to Table 20).
Conservation, Enhancement and Management of known High-Quality Potential Habitat Areas.	Reliance to be placed on natural regeneration (assisted by habitat augmentation measures) to achieve objectives. Additional actions in response to failure to achieve the nominated species diversity objectives to be implemented in accordance with TARP 7 (refer to Table 30).				Improve native fauna species diversity.
Monitoring and Reporting.	Annual field survey.				Annual reports prepared.
Note: After each three year compliance interval a new column can be added for the last three year compliance period					

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 22**.

5.9 NATIVE SPECIES TRANSLOCATION

5.9.1 Management

5.9.1.1 Pink-tailed Worm-lizard

The habitat augmentation described in Section 5.10.2 will allow individual Pink-tailed Worm-lizards identified prior to disturbance of the open cut Impact BMA, to be relocated to suitable habitat.

Information on the proposed translocation activities is provided in the PTWL MP (**Appendix 3**).

5.9.1.2 Other Native Fauna

Native fauna that are impacted by habitat removal during the construction of the project may be translocated to similar habitat within the Impact BMA (by a suitably licenced person).

The DZP BOA (Offset BMA) may provide a suitable site in the future for translocations as authorised by OEH in consultation with DZP and Toongi Pastoral Company.

5.9.2 Performance and Completion Criteria

Table 23 presents the performance and completion criteria relevant to Native Species Translocation within the DZP Site.

Table 23
Performance and Completion Criteria – Native Species Translocation

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Translocate native species before clearing begins.	Complete pre-clearance survey prior to clearing.				No avoidable impacts on roosting or nesting native fauna.
	Engage suitably qualified (and licensed) person to oversee translocation.				
Monitoring and Reporting.	Document any translocation of native fauna.				Reports detailing species capture (habitat), translocation site (habitat) and general health data prepared and retained.

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 22**.

5.10 WEED MANAGEMENT

5.10.1 Management

All noxious weeds will be managed and controlled in accordance with the requirements of the *Noxious Weeds Act 1993*. Weed management will be implemented within the Offset Area in a similar manner to weed management within the Mine Site.

Weed control will focus upon the removal of Weeds of National Significance (WoNS), noxious weeds and reducing the risk of further weed invasion. This will be achieved by deterring the

growth of weeds in recently disturbed areas, and preventing the transportation of weeds into the DZP Site.

As cleared areas are no longer required for active operations, these will be sown with indigenous native grasses to minimise potential weed invasion. Interim pasture improve species may be used where erosion hazards are high. Achieving regional native vegetation benchmarks will remain the goal of ground stratum restoration.

Weed species present or likely to occur within the DZP Site, and the method of controlling these weeds, is presented in **Table 24**.

Table 24
Weeds of the DZP Site and Control Methods

Weed			Control Method	BMA of Occurrence
Scientific Name	Common Name	Status		
<i>Xanthanum spinosum</i>	Bathurst Burr	Noxious (Nx)	Spray/chip	Agriculture
<i>Carthamus lanatus</i>	Saffron Thistle		Spray	Agriculture
<i>Silybum marianum</i>	Variegated Thistle		Spray	Agriculture
<i>Onopordum acanthium</i>	Scotch Thistle		Spray	Agriculture
<i>Carduus tenuiflorus</i>	Winged Slender Thistle		Spray	Agriculture
<i>Cirsium vulgare</i>	Black Thistle		Spray	Agriculture
<i>Proboscidea louisianica</i>	Devil's Claw		Spray	Agriculture
<i>Datura Ferox</i>	Fierce Thornapple		Spray	Agriculture
<i>Lycium ferocissimum</i>	African Boxthorn	WoNS / Nx	Spray	Offset
<i>Opuntia stricta</i>	Prickly Pear		Spray	Offset
<i>Hypericum perforatum</i>	St John's Wort	Nx	Spray	Agriculture
<i>Conyza bonariensis</i>	Flax-leaf Fleabane		Spray	Agriculture
<i>Citrullus lanatus</i>	Camel Melon		Spray	Agriculture
<i>Cucumis myriocarpus</i>	Paddy Melon		Spray	Agriculture
<i>Echium plantagineum</i>	Patterson's Curse		Spray and graze	Agriculture
<i>Marrubium vulgare</i>	Horehound		Spray	Agriculture
<i>Heliotropium amplexicaule</i>	Blue Heliotrope		Spray	Agriculture
<i>Alternanthera pungens</i>	Khaki Weed		Spray	Agriculture
<i>Tribulus terrestris</i>	Cat-Head		Spray	Agriculture
<i>Schlerolaena burchii</i> *	Galvanised Burr		Spray	Agriculture
<i>Cassia barclayana</i>	Pepper-leaf Senna		Spray	Agriculture

*Native species considered a weed by wool producers (formerly *Bassia burchii*)

The vast majority of the weed species identified in **Table 23** were introduced by previous land use and will be managed as part of the farming operation budget.

5.10.2 Performance and Completion Criteria

Table 25 presents the performance and completion criteria relevant to Weed Management within the DZP Site.

Table 25
Performance and Completion Criteria – Weed Management

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Implement weed control / management programs.	Complete inventory of weed species and densities. Identify critical (target) species. Develop specific weed control plans for target species.	Commence weed control / management in accordance with target species weed management plans (annual hereafter).	Achieve Review success of weed management (achieve at least 5% reduction per annum). Implement TARP 8 as required (refer to Table 31) (annual hereafter).		No increase in the area of occupancy for environmental weed species. Eradication of noxious weed species.
Monitoring and Reporting.	Document any translocation of native fauna.				Reports on weed control prepared and retained.
Note: After each three year compliance interval a new column can be added for the last three year compliance period					

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 24**.

5.11 VERTEBRATE PEST MANAGEMENT

5.11.1 Management

The feral pig population on Dowd's Hill is estimated to be around 50 animals. AZL will liaise with LLS on the most efficient and appropriate control methods. Trapping at watering points will likely form part of the strategy to eliminate pigs from the BOA.

Increased site security will assist in preventing the re-establishment of pigs by game hunters.

Foxes will be targeted through the burial of 1080 laced baits (as supplied by LLS). Foxes and cats will also be shot by licenced shooters during night spotlighting surveys.

Rabbits and hares are relatively uncommon and will shot in accordance with internal protocols. With the exception of areas within Pink-tailed Worm-lizard habitat (both remnant and extension areas), identified rabbit warrens will be ripped.

Native herbivores will be managed under a NSW OEH Kangaroo Management licence.

5.11.2 Performance and Completion Criteria

Table 26 presents the performance and completion criteria relevant to Feral and Overabundant Native Fauna Management within the DZP Site.

Table 26
Performance and Completion Criteria – Feral and Overabundant Native Fauna Management

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Identify and quantify feral and overabundant native species effectively.	Survey for occurrence and density (annual hereafter).	Compare species and densities against previous results and benchmark sites (annual hereafter).			Feral and overabundant native species numbers maintained below benchmarks.
Feral species baiting and habitat destruction programs (rabbits, hare, fox, dog, cat, rodents).		Consult with LLS (as required) re: feral species control programs (annually as required).	Implement programs in conjunction with LLS.	Review results against completion criteria and implement TARP 9 (refer to Table 21) as required.	
Feral species shooting and trapping programs (cat, dogs, rabbits, hare, pigs, fox).					
Overabundant native vertebrate species shooting programs (kangaroo and wallaby).		Consult with NSW OEH Kangaroo Management Program.	Implemented program in conjunction with the NSW OEH.		
Monitoring and Reporting.					Prepare and retain annual reports.
Note: After each three year compliance interval a new column can be added for the last three year compliance period					

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 26**.

5.12 EROSION AND SEDIMENT CONTROL

An Erosion and Sediment Control Plan (ESCP) will ensure that the threat from the DZP infrastructure and construction activity is contained and managed.

Dense stands of Black and White Cypress Pines increase the risk of sheet erosion. Managing the agricultural land and BOA for 40% minimum ground cover during severe drought up to 80% groundcover in other times will minimise this ongoing threat of soil erosion.

On agricultural land, leading practise pasture establishment (direct drill/minimum till) techniques employed will limit soil disturbance and risk of erosion.

5.13 GRAZING AND AGRICULTURE MANAGEMENT

5.13.1 Management

The management of grazing and other agricultural activities within the Impact and Agriculture BMAs are described and discussed within the DZP *Mining Operations Plan* and *Farm Management Plan* respectively.

Grazing undertaken within the Offset BMA will be undertaken to satisfy the primary objective of the BOA, i.e. to achieve positive biodiversity outcomes. Section 3.3.4.3 provides specific detail on the use of grazing as a biodiversity management measures and the performance outcomes expected. In summary:

- Strategic grazing within the BOA may be utilised to manage DM levels, i.e. reduce fuel loads, where burning is not practical.
- Grazing may also be undertaken when plants are dormant in order to promote plant vigour and seed and root production during subsequent growth periods.
- Vegetation will be spelled around the time of flowering and seed production in order to allow for continual replacement and maintenance of vegetation cover.

The impact of grazing impact would be monitored during initial grazing periods in order to assess grazing intensity and risks of vegetation degradation.

The following variables will be considered when managing grazing agriculture.

- Grazing Management to maintain cover.
- Minimum tillage to preserve organic matter.
- Pasture selection and management.

5.13.2 Performance and Completion Criteria

The performance and completion criteria associated with grazing and agriculture within the Impact and Agriculture BMAs are addressed separately in the DZP MOP and *Farm Management Plans* respectively. The performance and completion criteria associated with grazing and agriculture management within the Offset BMA are assessed as part of the vegetation benchmarks of **Table 20**.

5.14 FIRE MANAGEMENT

5.14.1 Management

Rural Fire Services (RFS) will be invited to assess the DZP Site upon completion of construction and prior to the commencement of the bushfire season. RFS will advise on the nature and extent of any fire activities for native vegetation. As noted in Section 5.7.2.4, RFS will then be consulted annually for advice on vegetation burning.

As also nominated in Section 5.7.2.4, prior to any controlled burns within Pink-tailed Worm-lizard habitat, a detailed assessment of the affect of fire frequency and intensity on important vegetation community structure and floristic diversity will be completed.

5.14.2 Performance and Completion Criteria

Table 27 presents the performance and completion criteria relevant to Fire Management within the DZP Site.

Table 27
Performance and Completion Criteria – Fire Management

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Complete a Pink-tailed Worm-lizard fire frequency and intensity assessment / study	Study completed and endorsed by OEH.				Written endorsement from OEH.
Engage RFS to provide hazard reduction burn advice and bush fire risk planning.	Consult with local RFS (annual hereafter).				Written RFS advice. Achieve all practical and achievable milestones.
Undertake hazard reduction / controlled burns.		Implement RFS written advice (annual hereafter).			
Monitoring and Reporting.		Prepare report on burning (as required).			Annual progress reports.
Note: After each three year compliance interval a new column can be added for the last three year compliance period					

5.15 INJURED FAUNA MANAGEMENT

5.15.1 Management

Injured fauna may be detected during vegetation clearing or during DZP operations.

Pre-vegetation clearance surveys will continue to be conducted prior to vegetation clearing (refer to Section 5.6.1.3). The aim of the surveys will be to identify significant ecological features within areas to be cleared and make all reasonable and feasible attempts to minimise the impact of clearing. The pre-clearing surveys have previously been and will continue to be conducted by a suitably qualified and experienced person. Significant ecological features considered include, but are not limited to:

- habitat for threatened species;
- habitat for endangered populations;
- hollow-bearing trees;
- significant habitat trees;
- vegetation containing significant native seed resources;
- rocky habitat;

- hollow logs and stumps; and
- fallen timber.

Surveys will include the identification of any roosting or nesting fauna and the procedures to relocate any fauna immediately prior to clearing activities and to develop safeguards to manage those species that cannot be relocated before the work.

During the pre-clearing vegetation survey a suitably qualified and experienced person will inspect the area to be cleared, paying particular emphasis on habitat with potential to be used by a threatened or hollow dependant species. The hollow trees and any other trees with the potential to provide habitat will be marked with spray paint and will be left for the second stage of clearing to allow fauna to vacate hollows naturally. During the pre-clearing vegetation survey the ecologist will also record the intended locations for relocation (see Section 5.6.1.3).

5.15.2 Performance and Completion Criteria

Table 28 presents the performance and completion criteria relevant to Injured Fauna Management within the DZP Site.

Table 28
Performance and Completion Criteria – Injured Fauna Management

Action	Performance Criteria				Completion Criteria
	Year 1	Year 2	Year 3	Year 6	
Small animal – uninjured (e.g. bats).	On identification, remove animal from any potentially harmful location and place in a ‘safe’ area. The ‘safe’ area should be located as close as practicable to where the animal was found (approximately 100m away).				No avoidable impacts on roosting or nesting native fauna.
Small animal – injured.	Remove animal from location and place in an enclosed box. Keep in a warm, dark and quiet area. Notify Environment Advisor who will contact WIRES.				
Large animal – uninjured (e.g. kangaroo).	Allow animal(s) to find their own way out of work area. If the animal needs to be relocated they should be encouraged out of the area by staff.				
Large animal – injured.	Large animals found injured to be dealt with on a case by case basis. If the animal is dead, the pouch will be checked for surviving young which will be placed in a pillow case or similar and box, kept in a warm, safe, quiet place until it can be taken to WIRES.				
Monitoring and Reporting.	Log each occasion of animal encounter including information on species capture (habitat), translocation site (habitat) and general health data, including nature of injury or death.				Prepare and retain annual reports on animal encounters and management.

Section 7 (and **Table 31**) provides the relevant TARPs associated with the management measures nominated in **Table 28**.

5.16 LAND CONTAMINATION

The risk of land contamination on agricultural land and the BOAs is relatively small. Design of the DZP infrastructure takes into account potential risks of leakage of chemicals into

groundwater and surface water. The mineral processing plant and waste storage have stringent monitoring and reporting requirements. A large proportion of the BOAs is upslope of mining and farming activities. Portions of the BOA follow natural drainage lines linking vegetation from Dowds Hill to Wambangalang Creek. Monitoring of drainage lines is a component of the MOP.

There is some pre-existing legacy of farm rubbish (fencing wire and machinery) and building waste being dumped in drainage lines which will be inside the BOA (“Ugothery” and “Toongi Valley”). This rubbish will be removed and disposed of lawfully off site.

6. MONITORING

6.1 OBJECTIVES OF THE MONITORING PROGRAM

The objectives of the monitoring program are to:

- determine progress towards and compliance with the performance and completion criteria identified in Section 3;
- facilitate continuous improvement in rehabilitation and revegetation practices;
- record and document changes in retained vegetation within the BOA, and allow for comparison with baseline data;
- record and document fauna population changes and identify breeding and critical habitat; and
- ensure the ecological significance of the biodiversity management areas are improved as a result of ongoing management practices.

6.2 MONITORING LOCATIONS AND FREQUENCY

Figure 12 and **Table 29** present the locations and frequency of monitoring. Additional monitoring and control points will be established as required to help measure the effectiveness of on ground environmental rehabilitation work.

Table 29
Monitoring Locations and Frequency

Location	Type of Monitoring	Frequency	By Whom
All	General site inspection and verification.	Monthly or after <25mm rain	Site Personnel
Control Site and Analogue Sites 1 to 5	BioMetric Vegetation Condition Benchmark.	Annual	Ecologist
BOA (density of at least 1 monitoring point per vegetation community per 50ha)	BioMetric Vegetation Condition Benchmark.	Annual	Ecologist
Various	Fauna monitoring.	Annual	Ecologist
Various	Weeds and feral and over abundant native animals (Distance software is a preferable tool for fauna monitoring).	Six monthly (weeds) annual to once every two years (Fauna).	Ecologist/Weeds Contractor.
BOA	Dry Matter Level (refer to Section 6.4)	Annual (at least)	Farm Manager
Note 1: Fauna monitoring = ultrasonic bat call detection, bird surveys, scat and tracks, herpetofauna survey, Elliot traps and pitfall trapping, particularly focusing on PTWL			

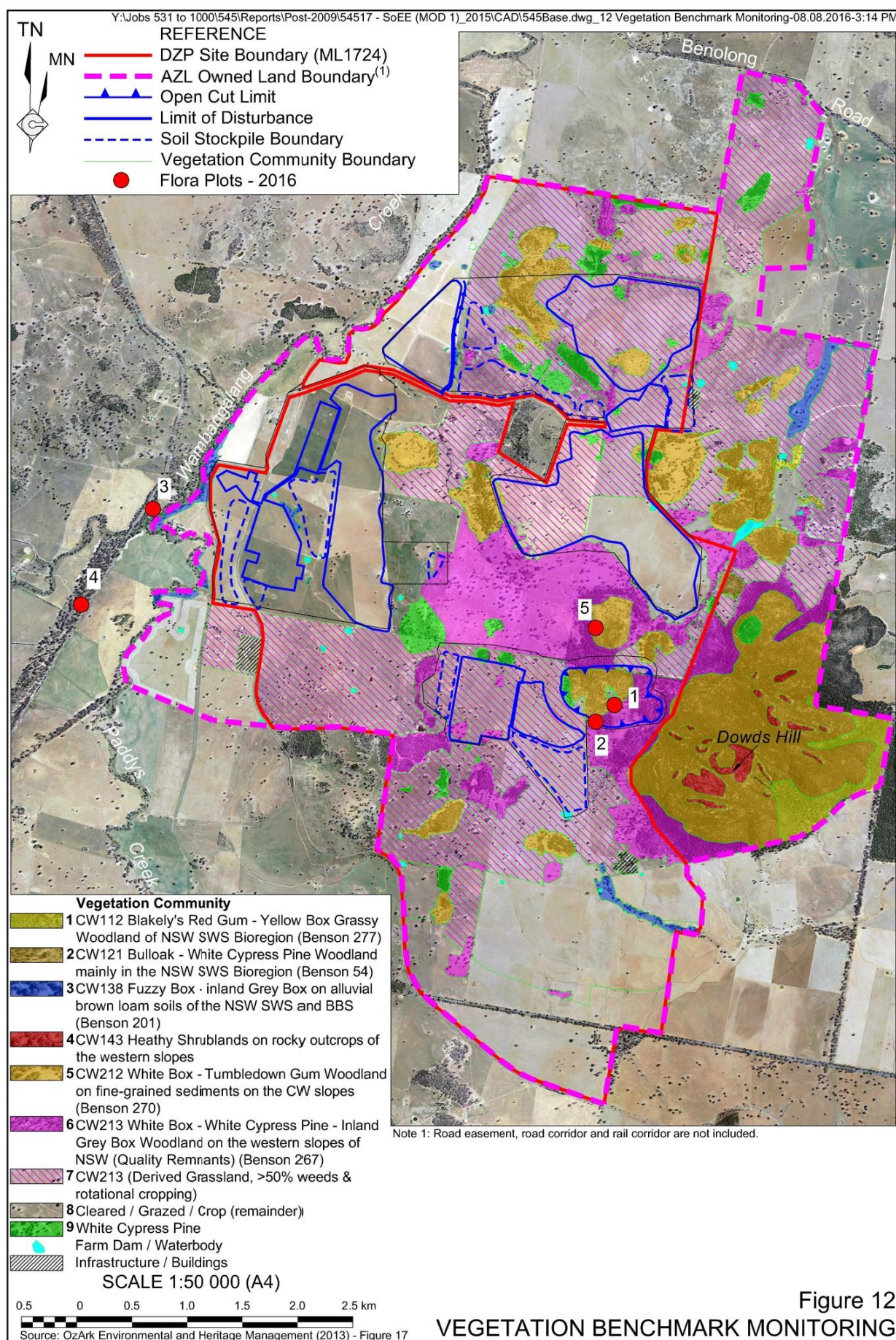


Table 30 describes the objective, methods, outcomes and frequency for the monitoring nominated in **Table 29** to measure the effectiveness of biodiversity management against performance criteria (as described in Section 5).

Table 30
Flora and Fauna Monitoring

Objective	Methods and Outcomes	Frequency
Improve native vegetation.	Establish additional vegetation plots in rehabilitated areas and control sites following BBAM (2014). Compare plots with regional and relevant local Biometric Vegetation Benchmarks. Develop recommendations to meet benchmark.	Annual
Maintain minimum groundcover.	As Per TARP 5 and 6. Take care to modify to suit grassy components of native vegetation communities. Develop recommendations to meet benchmark.	Annual
Improve native fauna species diversity.	Working Draft Threatened Species Survey and Assessment Guidelines NSW (DEC, 2004). Develop recommendations to meet vegetation (habitat) benchmark.	Annual
Manage weeds effectively.	Engage a suitably qualified individual to provide a weed map. Engage a suitably qualified individual to provide manage weeds. Develop recommendations to effectively control and reduce weed populations.	Bi-annual to annual (necessity dependant).
Manage feral and overabundant native species effectively.	Kangaroos: DISTANCE V6.x methods and software to determine macropod and feral animal population densities. All other species – Onsite staff observation logs, sand traps, remote sensing cameras. Develop recommendations to effectively control and reduce feral and overabundant native animal populations.	Kangaroo (and others opportunistically) populations using DISTANCE: Annual to one per every two years (necessity dependant). Other species every three months (fox baiting / cat trapping) to six monthly (rabbit burrow ripping / gassing / baiting).

6.3 PINK-TAILED WORM-LIZARD

Annual monitoring described in Section 5.10.2 is required to measure the effectiveness of environmental management on the Pink-Tailed Worm Lizard population at DZP. The detail of monitoring of Pink-tailed Worm-lizard, and habitat, is provided in the PTWL MP and PTWL BOMP (**Appendices 2 and 3**).

Monitoring will follow *Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act. Department of Sustainability, Environment, Water, Population and Communities, 2011.*

6.4 DRY MATTER LEVEL

In order to monitor and measure DM levels within the BOA, so as to determine whether strategic grazing or controlled burning is required when levels exceed the objective, or vegetation enhancement when levels are below the objective, small quadrats (25cm x 25cm) will be established within paddocks and on varying landforms for sampling of vegetation and measurement.

Initially, the quadrats will be established to provide approximately one quadrat per 20ha to 30ha per landform (flat/lower slope, mid slope, hill crest). The vegetation will be stripped, dried in a microwave if damp, and weighed. The dried weight will be multiplied by 160 000 to produce an equivalent value for kg/ha.

Before sampling on each occasion, a photo will be taken of the quadrat and over time photo cards will be produced as indicative of approximate DM levels. This will remove the requirement to strip and weigh the vegetation in many cases as comparison to the photo card will confirm the DM level is within the range objective.

6.5 OTHER MONITORING

Photo points will be established at each native vegetation benchmark site or 'other' location requiring monitoring. Photographs will be taken at the same direction, location, height and time of day (during daylight hours) at commencement at recommended monitoring interval thereafter. All photographs will be dated, stating the direction in which they were taken and identified with their locations.

7. RISKS TO SUCCESSFUL IMPLEMENTATION AND CONTINGENCY MANAGEMENT

Table 31 identifies the key risks to successful achievement of biodiversity performance criteria (within the BOA) and outlines the approach to contingency management in the form of Trigger Action Response Plans (TARP). These TARPs address the requirement of Condition 3(33)(f) of SSD-5251, namely:

“identify the potential risks to the successful implementation of the biodiversity offset strategy, and include a description of the contingency measures that would be implemented to mitigate against these risks”.

Table 31
Trigger Action Response Plans

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No	Objective	Potential Adverse Outcome	Trigger	Action/ Response
1	Maintain the security and integrity of fencing of the Offset BMA.	Disturbance as a result of uncontrolled livestock access, clearing or unauthorised access.	Annual audit identifies redundant fencing not removed or required fencing not in place (by end Year 2)	Initiate immediate redundant fence removal or new fence construction.
			Identified unauthorised access or breach of fence.	Repair fence. Initiate feral pest management. Install additional signage or security measures.
2	Implement access track management strategy	Required access tracks not constructed or maintained.	Annual audit identifies progress towards implementation of strategy (by end Year 3) not sufficient.	Allocate additional funds to access track management strategy to accelerate implementation.
		Redundant access tracks not rehabilitated.		
3	All clearing undertaken within approved impact footprint.	Unauthorised impacts on native flora & fauna or agricultural land.	Clearing beyond approved impact footprint.	Notification of consent authority and other relevant agency(ies), e.g. OEH. Remediation and rehabilitation of cleared area in conjunction with other instruction provided by regulatory authorities. Review and update (as required) of vegetation clearing protocol.
4	No avoidable impacts on roosting or nesting native fauna.	Unauthorised impacts on native flora & fauna.	Observed injury/death to native fauna.	Transfer of injured wildlife to vet or wildlife rescue service, e.g. vets at Taronga Western Plains Zoo. Notification of relevant regulatory authority. Review and update (as required) of vegetation clearing protocol.
	All pre and post vegetation clearing administrative controls implemented			

Table 31 (Cont'd)
Trigger Action Response Plans

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No	Objective	Potential Adverse Outcome	Trigger	Action/ Response
5	Improve native vegetation.	Reduced vegetation diversity compare to analogue sites.	Reduction in vegetation diversity, % cover or other criteria for the specific BVT benchmark (see Table 20).	Engage a qualified ecologist to determine the cause for the reduced vegetation diversity compared to BVT Benchmark criteria and implement recommendations to reverse the trend.
			Reduction in vegetation diversity or % cover between annual monitoring periods (where similar decrease not recorded at the relevant analogue site).	Engage a qualified ecologist to determine the cause for the reduced vegetation diversity compared to analogue sites and implement recommendations to reverse the trend.
6	Maintain minimum ground cover.	Increased erosion and reduction in habitat.	Ground cover falls below minimum or exceeds maximum % for the specific BVT benchmark (see Table 20).	Engage a qualified ecologist to determine the cause for the reduced vegetation diversity compared to BVT Benchmark criteria and implement recommendations to reverse the trend.
			In the event the ground cover falls below BVT benchmark minimum, % ground cover falls below that of relevant analogue site.	Engage a qualified ecologist to determine the cause for the reduced vegetation diversity compared to analogue sites and implement recommendations to reverse the trend.
7	Improve native fauna species diversity.	Reduced fauna diversity compared to analogue sites.	Fauna monitoring on shows a reduction in native fauna diversity compared to analogue sites.	Engage a qualified ecologist to determine the cause for the reduced fauna diversity compared to analogue sites and implement recommendations to reverse the trend.
8	No increase in the area of occupancy for environmental weed species. Eradication of noxious weed species..	Weeds, including noxious weeds, become established.	Identification of weed infestation. Failure to undertake annual weed inspection and control program.	Engage a contractor to undertake a weed inspection and control program.
9	Feral and overabundant native species numbers maintained below benchmarks.	Feral and overabundant native species become established.	Identification of feral or overabundant species. Failure to undertake annual pest inspection and control program.	Engage a contractor to undertake a pest inspection and control program.

8. REPORTING AND DOCUMENTATION REQUIREMENTS

A Biodiversity Status Report will be provided annually in the AEMR.

The AEMR is a requirement under the MOP and is provided to the Environmental Sustainability Unit, NSW Department of Industry – Division of Resources & Energy (DRE). Other government agencies are also provided of a copy of the AEMR, these government agencies include but are not limited to:

- Department of Planning and Environment (DPE).
- Environment Protection Authority (EPA).
- DPI – Water.
- Dubbo Regional Council.
- NSW Office of Environment and Heritage (OEH - PTWL management).
- Australian Government Department of Environment (DoE – PTWL management).
- Any other agencies with a statutory interest in the site.

Once the AEMR is distributed to government agencies a date for site inspection is selected and the government agencies are invited to attend the site inspection.

9. COMPETENCE TRAINING AND AWARENESS

All relevant personnel shall undergo biodiversity management awareness training through the induction and re-induction process. Biodiversity management shall be a component of the competency-based induction program. The following areas shall be covered in the induction process and information available within the Mine Site such as signs and regularly updated operational maps, procedures, company guidelines and fact sheets.

- Awareness of defined areas to be cleared for operational activities.
- Pre-survey vegetation clearance requirements.
- Awareness of preserving cleared vegetation for the purpose of rehabilitation and biodiversity enhancement activities.
- Awareness of biodiversity monitoring requirements.
- Biodiversity outcomes to be achieved.
- Information on the Pink-tailed Worm-lizard locations of where it is recorded, how to identify the species, posters of species are erected at site, and to contact the OEH and/or Environment Advisor if sighted.

The Environment Advisor shall be responsible for ensuring the appropriate protection of biodiversity across the site.

10. PLAN REVIEW AND ADAPTIVE MANAGEMENT

In accordance with *Condition 5(5)* of SSD-5251, this BMP will be reviewed and, if required, revised within 3 months of:

- the submission of an annual review under *Condition 5(4)*;
- the submission of an incident report under *Condition 5(7)*;
- the submission of an independent audit report under *Condition 5(9)*; and
- any modification to the conditions of SSD-5251.

This review will include the adequacy of strategies, plans and programs as required under the SSD-5251. Recommendation for appropriate measures or action to improve the environmental performance of the Mine and or any assessment, plan or program will be incorporated into this BMP.

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Appendices

(Total No. of pages including blank pages = 116)

Appendix 1	Relevant Conditions of SSD-5251
Appendix 2	Conservation Property Vegetation Plan
Appendix 3	Pink-tailed Worm Lizard Management Plan
Appendix 4	Pink-tailed Worm Lizard Biodiversity Offset Management Plan
Appendix 5	Vegetation Community Benchmarking Study



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Appendix 1

Relevant Conditions of SSD-5251

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BIODIVERSITY

Biodiversity Offset Strategy

31. The Applicant shall implement the Biodiversity Offset Strategy described in the EIS, as summarised in Table 9 and shown conceptually in Appendix 6, to the satisfaction of the Secretary.

Table 9: Summary of the Biodiversity Offsets

Offset Name	Offset Criteria	Minimum Size hectares (ha)
Dowds Hill Offset Area	Existing vegetation to be managed and enhanced	1,021

Security of Offsets

32. Within 2 years of this consent, unless the Secretary agrees otherwise, the Applicant shall make suitable arrangements to provide appropriate long term security for the offset area, to the satisfaction of the Secretary.

Note: Mechanisms to provide appropriate long term security to the land within the Biodiversity Offset Strategy include a Biobanking Agreement, or an alternative mechanism that provides for a similar conservation outcome. Any mechanism must remain in force in perpetuity.

Biodiversity Management Plan

33. The Applicant shall prepare and implement a Biodiversity Management Plan for the development to the satisfaction of the Secretary. This plan must:
- be prepared in consultation with OEH and submitted to the Secretary for approval prior to the commencement of any development under this consent, unless the Secretary agrees otherwise;
 - a description of the short, medium, and long term measures that would be implemented to:
 - manage the remnant vegetation and fauna habitat on the site;
 - implement the biodiversity offset strategy; and
 - include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy and triggering remedial action (if necessary);
 - a detailed description of the measures that would be implemented over the next 3 years, including the procedures to be implemented for:
 - minimising clearing and avoiding unnecessary disturbance associated with the construction and operation of the development;
 - protecting vegetation and fauna habitat outside the approved disturbance areas;
 - enhancing the quality of existing vegetation and fauna habitat on the site;
 - maximising the salvage of resources within the approved disturbance area - including vegetative and soil resources – for beneficial reuse in the enhancement of the offset area or the rehabilitation of the site;
 - collecting and propagating seed;
 - minimising the impacts on fauna on site, including undertaking pre-clearance surveys;
 - managing salinity using best practice dryland salinity management revegetation measures;
 - controlling weeds and feral pests;
 - controlling erosion;
 - managing grazing and agriculture on site;
 - controlling access; and
 - managing bushfire risk;
 - include a seasonally-based program to monitor and report on the effectiveness of these measures;
 - identify the potential risks to the successful implementation of the biodiversity offset strategy, and include a description of the contingency measures that would be implemented to mitigate against these risks;
 - include a Pink-tailed Worm Lizard Management Plan, which includes detailed information on the:
 - baseline data on the local Pink-tailed Worm lizard population and habitat on site, in the biodiversity offset areas and release areas;

- measures to mitigate and manage the identified impacts on Pink-tailed Worm-lizard, including:
 - progressive clearing in the project disturbance area; and
 - a detailed translocation procedures prepared generally in accordance with the *NPWS Policy and Procedure Statement No. 9 – Policy for the Translocation of Threatened Fauna in NSW*;
 - include a program to monitor:
 - resident Pink-tailed Worm-lizard, distribution and population size on site and in the biodiversity offset areas;
 - translocated Pink-tailed Worm lizard distribution and population size; and
 - existing and revegetated potential distribution and population size habitat; and
- (h) include details of who would be responsible for monitoring, reviewing, and implementing this plan.

Conservation Bond

34. Within 6 months of the approval of the Biodiversity Management Plan, the Applicant shall lodge a conservation bond with the Department to ensure that the biodiversity offset strategy is implemented in accordance with the performance and completion criteria of the Biodiversity Management Plan.

The sum of the bond shall be determined by:

- (a) calculating the full cost of implementing the biodiversity offset strategy (other than land acquisition costs); and
- (b) employing a suitably qualified quantity surveyor to verify the calculated costs, to the satisfaction of the Secretary.

The calculation of the conservation bond must be submitted to the Department for approval at least 1 month prior to lodgement of the final bond.

If the offset strategy is completed generally in accordance with the completion criteria in the Biodiversity Management Plan to the satisfaction of the Secretary, the Secretary will release the bond.

If the offset strategy is not completed generally in accordance with the completion criteria in the Biodiversity Management Plan, the Secretary will call in all, or part of, the conservation bond, and arrange for the satisfactory completion of the relevant works.

Notes:

- *Alternative funding arrangements for long term management of the biodiversity offset strategy, such as provision of capital and management funding as agreed by OEH as part of a Biobanking Agreement or transfer to conservation reserve estate (or any other mechanism agreed with OEH) can be used to reduce the liability of the conservation bond.*
- *The sum of the bond may be reviewed in conjunction with any revision to the biodiversity offset strategy or the completion of major milestones within the approved plan.*

Appendix 2

Conservation Property Vegetation Plan

Agreement between Central West Local Land Services

and

Australian Zirconia Limited
Toongi Pastoral Company Pty Ltd

for

101R Benolong Road
Geurie NSW 2818

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Local Land
Services

**Central West
Local Land Services
Conservation**

PROPERTY VEGETATION PLAN

Native Vegetation Act 2003

**AUSTRALIAN STRATEGIC MATERIALS LTD
TOONGI PASTORAL COMPANY PTY LTD
101R BENOLONG ROAD
GEURIE NSW 2818**

This Property Vegetation Plan applies to the land described in Schedule 1, as shown on Map 7 in Schedule 4 of this agreement.

The Landholder is authorised to undertake the activities set out in Schedule 2 and agrees to carry out the management actions and management action details set out in Schedule 2. The Landholder agrees to comply with the requirements of Schedule 3.

Notes:

1. The Director-General of Department of Premier and Cabinet (or delegate) will notify the Registrar-General once all landholders and parties with a prescribed interest have consented to the registration of this PVP. Once notified by the Director-General, the Registrar-General is required to register this PVP. This PVP will then be binding on all current and future landholders.
2. This Plan does not exempt the landholder from any Council clearing consent requirements.
3. In order to carry out the works under this PVP, the Landholder may be required to obtain other approvals from other government agencies.

The Common Seal of Australian Strategic Materials Ltd (ACN 091 489 511 – formerly Australian Zirconia Limited) was hereunto affixed by authority of the Directors by:

David Ian Chalmers

Managing Director

Australian Strategic Materials Ltd (formerly Australian Zirconia Limited)



[Signature]

Signature

22/05/17

Date

Karen Elizabeth Vere Brown

Company Secretary

Australian Strategic Materials Ltd (formerly Australian Zirconia Limited)

[Signature]

Signature

22/05/17

Date

Andrew Mulligan

General Manager of Central West Local Land Services

Delegate of the Minister administering the *Native Vegetation Act 2003*

[Signature]

Signature

31/05/17


Date

LLS File Ref: VF17/124

Request No: PVP00199

SCHEDULE ONE — DESCRIPTION OF LAND TO WHICH THIS PVP APPLIES

Lot	DP	LGA	Parish	County
X	405495	DUBBO REGIONAL	BENOLONG	GORDON
A	391069	DUBBO REGIONAL	BENOLONG	GORDON
A	439352	DUBBO REGIONAL	BENOLONG	GORDON
B	439352	DUBBO REGIONAL	BENOLONG	GORDON
1	133581	DUBBO REGIONAL	BENOLONG	GORDON
35	753220	DUBBO REGIONAL	BENOLONG	GORDON
18	753252	DUBBO REGIONAL	THE SPRINGS	GORDON
19	753252	DUBBO REGIONAL	THE SPRINGS	GORDON
55	753252	DUBBO REGIONAL	THE SPRINGS	GORDON
57	753252	DUBBO REGIONAL	THE SPRINGS	GORDON
4	1201149	DUBBO REGIONAL	BENOLONG	GORDON
5	1201149	DUBBO REGIONAL	BENOLONG	GORDON
6	1201149	DUBBO REGIONAL	BENOLONG	GORDON
7	1201149	DUBBO REGIONAL	BENOLONG	GORDON
8	1201149	DUBBO REGIONAL	BENOLONG	GORDON
311	595631	DUBBO REGIONAL	BENOLONG	GORDON
283	715309	DUBBO REGIONAL	BENOLONG	GORDON
561	1217148	DUBBO REGIONAL	THE SPRINGS	GORDON
7002	1019855	DUBBO REGIONAL	THE SPRINGS	GORDON
1	1226702	DUBBO REGIONAL	THE SPRINGS	GORDON



 Initials

SCHEDULE TWO — AUTHORISED ACTIVITIES AND MANAGEMENT ACTIONS

REQUIRED CONSERVATION OFFSETS

Map Number (as per Schedule 4)	Map Unit	Offset on Map Unit	Details of Authorised Offset Type
1	4a	Community 1 – 49 hectares Riparian vegetation on alluvial soils	Clearing not allowed, Groundcover management, Permitted Routine Agricultural Management Activities (RAMAs), Strategic grazing, Weed management, Timber management – recycling, Retain naturally occurring rocks, Exclude fertilisers, Management of human disturbance, Fire management for conservation, Flora and fauna monitoring, Retain natural regeneration
1	4b	Community 2 – 320 hectares Grassy woodlands	
1	4d	Community 4 – 204 hectares Grassy woodland on rocky outcrops	
1	4c	Community 3 – 448 hectares Dowds Hill woodland complex	Clearing not allowed, Groundcover management, Permitted Routine Agricultural Management Activities (RAMAs), Grazing exclusion, Weed management, Timber management – recycling, Retain naturally occurring rocks, Exclude fertilisers, Management of human disturbance, Fire management for conservation, Flora and fauna monitoring, Retain natural regeneration, Management of Invasive Native Scrub (INS), Habitat enhancement for threatened species

MANAGEMENT ACTIONS FOR CONSERVATION

1. The management actions and management action details are to be continued for, or completed within, the duration specified in the column "Duration of Management Action".
2. The management actions and management action details set out below must be undertaken in the specified map unit as identified in Schedule 4.

Map Number (as per Schedule 4)	Map Unit	Management Action	Duration of Management Action	Management Action Details
1	4a, 4b, 4c, 4d	Clearing not allowed	In perpetuity	The clearing of native vegetation, whether remnant or regrowth, is not permitted in Map Units 4a, 4b, 4c and 4d at any time unless otherwise stated in this plan.
1	4a, 4b, 4c, 4d	Groundcover management	In perpetuity	Management of groundcover in Map Units 4a, 4b, 4c and 4d will exclude planting or spreading of non-native vegetation and farming practices that use mechanical cultivation.
1	4c	Grazing Exclusion	In perpetuity	The landholder is to exclude all livestock from Map Unit 4c within two (2) years of the commencement date of this plan. The landholder is to establish stock proof fencing along the perimeter of Map Unit 4c.

Initials

1/5

Map Number (as per Schedule 4)	Map Unit	Management Action	Duration of Management Action	Management Action Details
1	4a, 4b, 4d	Strategic grazing	In perpetuity	<p>The landholder is to exclude all livestock from Map Units 4a, 4b and 4d during spring season to allow native groundcover to flower and set seed.</p> <p>The landholder is to manage grazing in Map Units 4a, 4b and 4d each year to maintain native groundcover within benchmark for the vegetation type (refer Appendix A).</p> <p>The landholder is to establish stock proof fencing along the perimeter of Map Units 4a, 4b and 4d within two (2) years of the commencement date of this plan.</p>
1	4a, 4b, 4c, 4d	Retain natural regeneration to achieve benchmark cover and species composition	In perpetuity	<p>The landholder is to retain regrowth and/or natural regeneration of native plant species in Map Units 4a, 4b, 4c and 4d at all times unless otherwise stated in this plan.</p> <p>The species composition and density of regrowth and/or regenerating native vegetation within Map Units 4a, 4b, 4c and 4d is to be established and maintained in accordance with the Dubbo Project – Biodiversity Management Plan.</p>
1	4a, 4b, 4c, 4d	Weed management	In perpetuity	<p>The landholder is to control weeds within Map Units 4a, 4b, 4c and 4d to encourage establishment of native groundcover species.</p> <p>Weeds will be monitored and managed in accordance with the Dubbo Project – Biodiversity Management Plan and managed by targeted control methods.</p> <p>The use of herbicides within Map Units 4a, 4b, 4c and 4d is excluded except to spot-spray environmental (non-native) weed species.</p>
1	4a, 4b, 4c, 4d	Timber management - recycling	In perpetuity	<p>The landholder is to recycle salvaged local timbers from Map Units 4a, 4b, 4c and 4d in accordance with the Dubbo Project – Biodiversity Management Plan.</p>
1	4a, 4b, 4c, 4d	Retain naturally occurring rocks	In perpetuity	<p>The landholder is not to remove or disturb any rocks or rock features within Map Units 4a, 4b, 4c and 4d at any time unless for the purpose of monitoring fauna species.</p>
1	4a, 4b, 4c, 4d	Exclude fertilisers	In perpetuity	<p>The landholder is to exclude the use of fertilisers within Map Units 4a, 4b, 4c and 4d at all times.</p>
1	4a, 4b, 4c, 4d	Permitted Routine Agricultural Management Activities (RAMAs)	In perpetuity	<p>The Landholder may clear native vegetation within Map Units 4a, 4b, 4c and 4d, where the clearing is a Routine Agricultural Management Activity as permitted by Part 2 Section 11 and Part 3 Division 3 Section 22 of the <i>Native Vegetation Act 2003</i> and Part 6 of the <i>Native Vegetation Regulation 2013</i>.</p>
1	4c	Habitat enhancement for threatened species Pink-tailed Worm-lizard (<i>Aprasia parapulchella</i>)	In perpetuity	<p>The landholder is to manage habitat within Map Unit 4d in accordance with the Dubbo Project – Pink-tailed Worm-lizard Management Plan.</p> <p>Management objectives are:</p>




 Initials

Map Number (as per Schedule 4)	Map Unit	Management Action	Duration of Management Action	Management Action Details									
				<ul style="list-style-type: none"> Creation and enhancement of Pink-tailed Worm-lizard (<i>Aprasia parapulchella</i>) habitat; Establishment of corridors to allow passive relocation of Pink-tailed Worm-lizard (<i>Aprasia parapulchella</i>); Assisted relocation (translocation) of Pink-tailed Worm-lizard (<i>Aprasia parapulchella</i>); Monitoring of benchmark habitat sites and establishment of additional monitoring sites to determine changes in habitat condition. 									
1	4c	Management of Invasive Native Scrub	In perpetuity	<p>Table 1: Invasive Native Scrub (INS) species allowed to be cleared</p> <table border="1"> <thead> <tr> <th>INS Species</th> <th>Max DBHOB allowed to be cleared</th> <th>Number of plants per hectare to be retained less than maximum DBHOB allowed to be cleared for individual plant clearing types</th> </tr> </thead> <tbody> <tr> <td><i>Callitris endlicheri</i> (Black Cypress)</td> <td>30 cm</td> <td>20</td> </tr> <tr> <td><i>Callitris glaucophylla</i> (White Cypress)</td> <td>30 cm</td> <td>20</td> </tr> </tbody> </table> <p>General management actions in Map Unit 4c</p> <ol style="list-style-type: none"> Clearing provisions end fifteen (15) years from the commencement date of this plan. Clearing carried out this PVP must not result in a change of land use from a grazing system to a cropping system. After the clearing provisions end, the landholder is to ensure that all native groundcover, retained individuals of INS, and all non-INS is maintained in perpetuity unless clearing is permitted by another PVP or other legal instrument. Clearing within the duration of the PVP is for the purpose of re-establishing native vegetation or allowing natural regeneration of native vegetation in order to maintain or create a mosaic of native vegetation states across the landscape. Clearing of non-INS must be limited to the minimum extent necessary to clear the invasive native species listed in Table 1 (see above). Total clearing by any individual clearing method or combination of clearing methods is to be no more than 448 hectares. <p>Management actions specific to treatment methods in Map Unit 4c</p> <ol style="list-style-type: none"> If clearing by Management Burning (Clearing Type A) the land holder is to ensure that: 	INS Species	Max DBHOB allowed to be cleared	Number of plants per hectare to be retained less than maximum DBHOB allowed to be cleared for individual plant clearing types	<i>Callitris endlicheri</i> (Black Cypress)	30 cm	20	<i>Callitris glaucophylla</i> (White Cypress)	30 cm	20
INS Species	Max DBHOB allowed to be cleared	Number of plants per hectare to be retained less than maximum DBHOB allowed to be cleared for individual plant clearing types											
<i>Callitris endlicheri</i> (Black Cypress)	30 cm	20											
<i>Callitris glaucophylla</i> (White Cypress)	30 cm	20											

Map Number (as per Schedule 4)	Map Unit	Management Action	Duration of Management Action	Management Action Details
				<p>a) the clearing does not result in soil surface disturbance; and</p> <p>b) clearing does not result in the introduction into the cleared area of any non-native vegetation; and</p> <p>8. If clearing individual plants with nil to minimal disturbance to soil and ground cover (Clearing Type B) the landholder is to ensure that:</p> <p>a) the clearing is limited to clearing of individual plants of INS species listed in Table 1 (see above); and</p> <p>b) clearing of groundcover and disturbance to the soil surface is to the minimum extent necessary to control the invasive native species; and</p> <p>c) plants of the species listed in Table 1 (see above) as requiring retention are to be retained at the densities specified in Table 1, except where more than one species of INS is present in the area to be cleared; and</p> <p>d) where more than one species of INS is present on the area to be cleared, the total stems required to be retained does not exceed 20 stems per hectare for stems under the maximum diameter at breast height over bark (DBHOB) allowed to be cleared; and</p> <p>e) stems retained as set out in Table 1 (see above) must reflect the proportion of total individuals for each species present; and</p> <p>f) where an individual tree or shrub retained in accordance with management actions 8c, 8d and/or 8e above has multiple stems, then that tree or shrub is counted as one stem for the purposes of calculating the retention requirements; and</p> <p>g) Individual plants of INS with a DBHOB greater than the 'maximum DBHOB allowed to be cleared' listed for the corresponding species in Table 1 (see above) must not be cleared; and</p> <p>h) clearing does not result in the introduction of any non-native vegetation to the cleared area.</p>
1	4a, 4b, 4d	Fire management for conservation	Term of project	The landholder is to use best management practice for the use of fire to conserve threatened species and threatened species habitat within Map Units 4a, 4b and 4d at all times.
1	4a, 4b, 4c, 4d	Management of human disturbance	Term of project	<p>The landholder must take all reasonable measures to exclude unauthorised human activities from Map Units 4a, 4b, 4c and 4d at all times.</p> <p>Within Map Units 4a, 4b, 4c and 4d, the landholder must:</p> <ul style="list-style-type: none"> Install signage clearly stating the land use as a biodiversity conservation area. The installation of signage must be completed within twelve (12) months of the commencement date of this plan; and

Map Number (as per Schedule 4)	Map Unit	Management Action	Duration of Management Action	Management Action Details
				<ul style="list-style-type: none"> Exclude recreational activities that involve the use of motorised vehicles, horse riding and exercising of domestic pets; and Exclude dumping of garbage; and Exclude fire wood collection.
1	4a, 4b, 4c, 4d	Flora and fauna monitoring	Term of project	<p>The landholder is to monitor flora and fauna within Map Units 4a, 4b, 4c and 4d in accordance with the Dubbo Project – Biodiversity Management Plan.</p> <p>Monitoring objectives are:</p> <ul style="list-style-type: none"> Maintain and improve native vegetation; and Maintain minimum groundcover; and Maintain or improve native fauna species diversity; and Manage weeds effectively; and Manage feral and overabundant native species. <p>The evaluation and reporting of the monitoring data must lead to improvement of the native vegetation condition and habitat complexity relative to the baseline conditions stated in the Dubbo Project – Biodiversity Management Plan.</p>


 Initials

Definitions

Clearing Type A) means clearing by management burning.

Clearing Type B) means clearing individual plants with nil to minimal disturbance to soil and groundcover.

DBHOB means Diameter at Breast Height Over Bark which is the diameter over the bark of the stem at 1.3 metres above the ground. If there are multiple stems on a tree then the diameter is measured on the largest stem;

Density or densities means the number of plants per hectare.

Dubbo Project – Biodiversity Management Plan means a plan approved under Section 89E of the *Environmental Planning & Assessment Act 1979* (Application No.: SSD-5251);

Dubbo Project – Pink-tailed Worm-lizard Management Plan means a plan approved under Section 89E of the *Environmental Planning & Assessment Act 1979* (Application No.: SSD-5251); and

Term of project means the management action must be complied with until 31 December 2037;

Groundcover means any type of herbaceous vegetation, native and non-native, living or dead;

Landholding has the same meaning as it has in the *Native Vegetation Regulation 2013*.

Invasive Native Scrub (INS) means plants that satisfy the following criteria:

- a) the plants to be cleared are of a species identified in Table 1 of this PVP, and
- b) the plants to be cleared are regenerating densely or are invading plant communities, causing decline in the structure or composition of the vegetation community on the land to be cleared.

Management burning is planned and controlled use of fire for the purpose of managing INS.

Minimal disturbance means there has been no greater than 30% of the soil surface and existing groundcover disturbed (total area) as a result of the clearing.

Native groundcover means living, native herbaceous vegetation.

Nil disturbance means there has been no greater than 5% of the soil surface and existing groundcover disturbed (total area) as a result of the clearing.

Non-native vegetation means vegetation that is not native vegetation, as defined by section 6 of the *Native Vegetation Act 2003*.

Non-INS means any plants that are not INS, as identified in the 'Specifications for clearing Invasive Native Species'.

Soil disturbance means the turning, digging or disrupting of the soil surface, usually by an implement or machinery or by the pushing or pulling of trees or shrubs.

Initials

SCHEDULE THREE - STANDARD CONDITIONS

Commencement

1. This PVP will commence from the date at which it is signed by the Minister administering the *Native Vegetation Act 2003* (or delegate).

Words and phrases used

2. In this Schedule:

"LLS" means Local Land Services constituted under section 8 of the *Local Land Services Act 2013*;

"Central West Local Land Services" means Local Land Services in the Central West region;

"Landholder" means the landholder who is a party to this PVP and once this PVP is registered all future landholders;

"the works under this PVP" means the clearing, the management actions, the mitigating actions and all other works that the Landholder is authorised or required to take under this PVP;

"the Land" means the land to which this PVP applies;

"OEH" means the Office of Environment and Heritage within the Department of Premier and Cabinet and includes its successor departments or agencies;

"PVP" means this property vegetation plan.

Monitoring and auditing

3. The carrying out of any works under this PVP may be subject to auditing by members of staff of LLS or officers of OEH who are authorised officers under the *Native Vegetation Act 2003*, as set out in sections 34 and 35.
4. Subject to reasonable notice, the Landholder will allow authorised officers of LLS or OEH access to the Land and allow those officers to do all things reasonably necessary for the purpose of monitoring or auditing compliance with this PVP.
5. Clauses 3 and 4 do not affect the powers of authorised officers of LLS, OEH or other government agencies to carry out investigations under the *Native Vegetation Act 2003*.

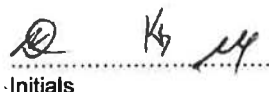
Registration of PVP on Title

6. For the purpose of sections 31(1) and 31(2) of the *Native Vegetation Act 2003*, the Landholder consents to the registration of this PVP in accordance with section 31 of the *Native Vegetation Act 2003*.

Dispute resolution

7. The Landholder and Minister (or delegate) agrees to attempt to resolve any dispute in relation to this PVP by negotiation in the first instance. Such negotiation may involve agreeing on a variation to the PVP. However, this clause does not apply to a dispute relating to a possible breach of the *Native Vegetation Act 2003*.
8. Where appropriate, if negotiations are not successful, the Minister (or delegate) agrees to provide a written notice to the Landholder setting out the nature of any contravention and requesting the Landholder to take the steps specified in that notice, in the time specified in that notice, to rectify that contravention. This clause does not apply to a possible breach of the *Native Vegetation Act 2003*.
9. The Landholder agrees to comply with that notice in the time specified in the notice. Failure to comply with that notice is a breach of this plan. If the Landholder does not comply with the notice, the Minister (or delegate) may consider terminating this plan, in accordance with the procedure set out in section 30 of the *Native Vegetation Act 2003*. LLS or OEH may also take other action under that Act.
10. The landholder also agrees to provide access to the property to officers of LLS and OEH.

Note: The procedure for varying or terminating a PVP is set out in section 30 of the *Native Vegetation Act 2003* and clause 11 of the *Native Vegetation Regulation 2013*.


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Initials

Subdivision

11. The Landholder agrees to notify LLS of any proposal to subdivide the Land.
12. The Landholder agrees to submit to LLS an application to vary this PVP to divide it into separate PVPs relating to the Land as subdivided in the same or similar terms to this PVP, if so requested by LLS.

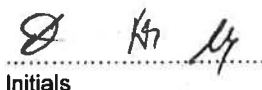
Apportionment of risk/indemnity

13. LLS and the Landholder agree to apportion risk as follows:

- (i) LLS accepts the risk for the actions of LLS staff in entering the Land and carrying out functions associated with this PVP and for the actions of other visitors to the Land as organised by LLS.
- (ii) All other risks associated with this PVP and the works under this PVP rest with the Landholder.

Disclosure of Information

14. Subject to clause 15, personal information contained in this PVP will be treated in accordance with the *Privacy and Personal Information Protection Act 1998*, under which you have rights of access and correction.
15. Information contained in this PVP may be disclosed:
 - (i) In the case of a PVP that specifies a date for the definition of "regrowth", certain information from the PVP will be included on the register of PVPs and development consents, which will be publicly available on the Internet and available for inspection at the office of LLS in the Central West region.
 - (ii) to OEH for compliance and statistical purposes.
 - (iii) in circumstances where disclosure is otherwise required or authorised by law, including the *Government Information (Public Access) Act 2009*.


.....
Initials

SCHEDULE FOUR — MAPS

Map 1	PVP Area and Activities authorised by this PVP.
Map 2	Not applicable.
Map 3	Not applicable.
Map 4	Not applicable.
Map 5	Not applicable.
Map 6	Not applicable.
Map 7	Cadastral map of lots associated with this PVP.

All maps must be printed for each PVP, unless it is not applicable to this PVP


.....
Initials

Appendix A

Biometric benchmarks for vegetation communities associated with this PVP.

Community	Vegetation Type	No. Native Plant Species	Native Over Storey Cover		Native Mid Storey Cover		Native Ground Cover Grass		Native Ground Cover Shrubs		Native Ground Cover Other		Number of Trees with Hollows per 0.1 ha	Total Length of Fallen Logs m/0.1ha
			MIN %	MAX %	MIN %	MAX %	MIN %	MAX %	MIN %	MAX %	MIN %	MAX %		
1 (Map Unit 4a)	CW138 - Fuzzy Box / Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion (Benson 201)	25	12	35	1	25	15	70	3	5	3	20	0.8	66
2 (Map Unit 4b)	CW213 - White Box / White Cypress Pine / Inland Grey Box woodland on the western slopes of NSW (Benson 267)	25	12	35	1	25	15	70	3	5	3	20	0.8	66
3 (Map Unit 4c)	CW112 - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277)	25	12	35	1	25	15	70	3	5	3	20	0.8	66
4 (Map Unit 4d)	CW143 - Healthy shrub lands on rocky outcrops of the western slopes	30	10	40	0	1	5	10	10	25	3	5	0	0
	CW212 - White Box / Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270)	30	8	35	3	35	3	25	3	25	3	25	2	46
	CW213 - White Box / White Cypress Pine / Inland Grey Box woodland on the western slopes of NSW (Benson 267)	25	12	35	1	25	15	70	3	5	3	20	0.8	66
	CW212 - White Box / Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270)	30	8	35	3	35	3	25	3	25	3	25	2	46
	CW213 - White Box / White Cypress Pine / Inland Grey Box woodland on the western slopes of NSW (Benson 267)	25	12	35	1	25	15	70	3	5	3	20	0.8	66


Initials



Legend

- Property Boundary
- Conservation Area (Map Unit 4a = 49 ha)
- Conservation Area (Map Unit 4b = 320 ha)
- Conservation Area (Map Unit 4c = 448 ha)
- Conservation Area (Map Unit 4d = 204 ha)
- Drainage Line

Initials: *OK HB*



Local Land Services

Native Vegetation Act 2003
Property Vegetation Plan

Map 1 PVP Area and Activities

Request No: PVP00199

Name: Australian Strategic Materials Ltd
(formerly Australian Zirconia Limited)
Property: Dubbo Project, Geurie NSW

1:30,000

0 200 400 600 800 1,000 1,500 Metres

1 centimetre = 300 metres

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Data Sources

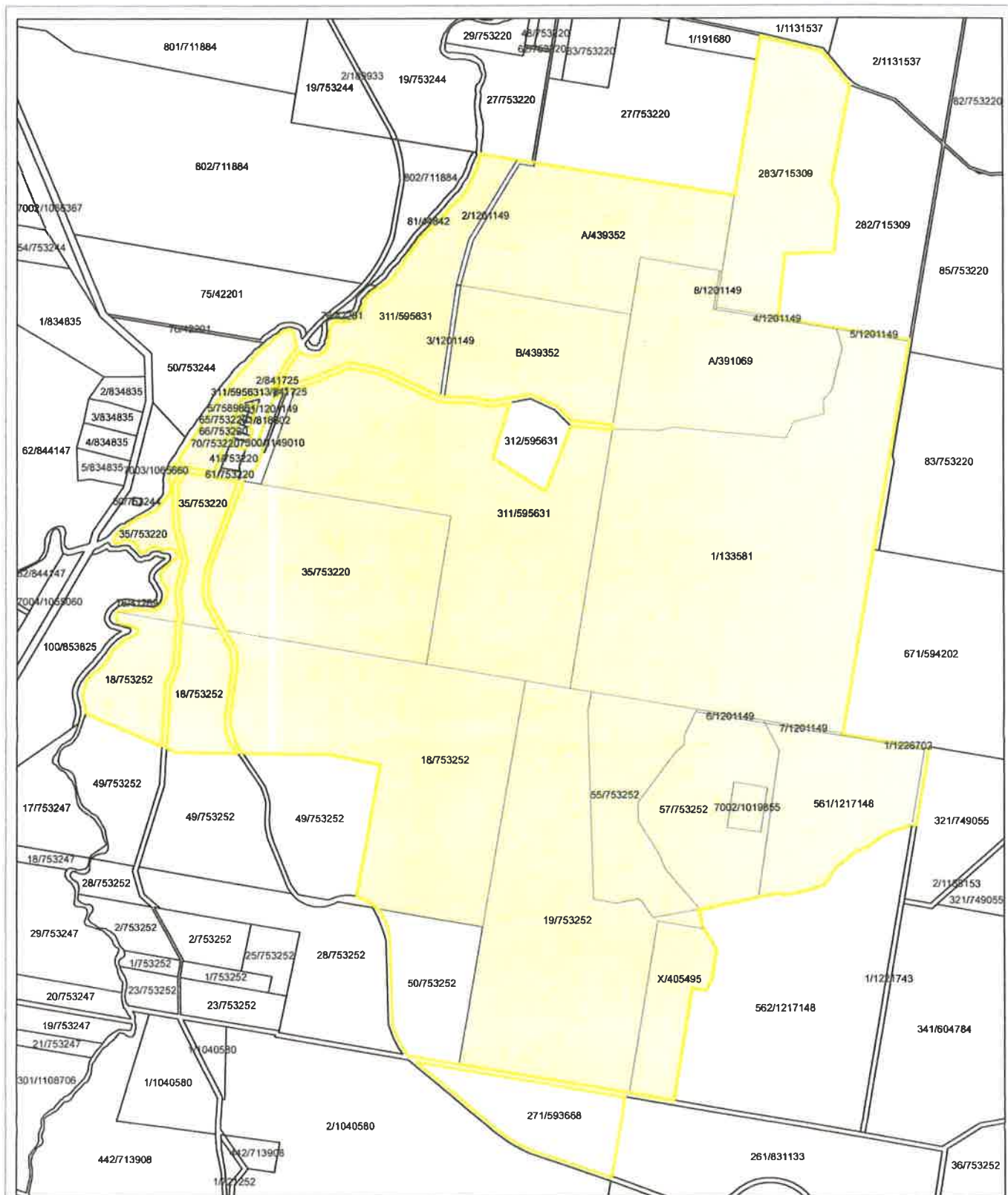
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Reference data © Office of Environment and Heritage, NSW Department of Premier and Cabinet
Data of Imagery: DUBBO (ADS40 - 13 December 2012)

Disclaimer

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Prepared by: Paul Nicholls
Date: 21 November 2016



Legend

- Property boundary
- Lots associated with PVP
- Other Lots



Local Land Services

Native Vegetation Act 2003

Property Vegetation Plan

Map 7

Cadastral Map

Request No: PVP00199

Name: Australian Strategic Materials Ltd
(formerly Australian Zirconia Limited)

Property: Dubbo Project, Geurie NSW

1:30,000

0 300 600 900 1,200 1,500 Metres

1 centimetre = 300 metres

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Data Sources

Base cadastral data supplied by © NSW Department of Finance and Services, Panorama Avenue, Bathurst
Reference data © Office of Environment and Heritage, NSW Department of Premier and Cabinet

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The coordinate system on this map is the Map Grid of Australia Zone 55 using the Geocentric Datum of Australia 1984 (GDA84). Some published topographic maps will use the mean datum AGD86. Coordinates on this map (GDA84) will be in a different location on a published AGD86 topographic map.

Prepared by: Paul Nicholls

Date: 21 November 2016

Initials: *[Signature]*

Appendix 3

Pink-tailed Worm Lizard Management Plan

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Appendix 4

Pink-tailed Worm Lizard Biodiversity Offset Management Plan

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Appendix 5

Vegetation Community Benchmarking Study

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OzArk Environmental & Heritage Management Pty Ltd

ABN: 59 104 582 354

08 June 2016

Michael Sutherland
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Level 2, 21 Church Street, Dubbo, NSW 2830
Phone: 02 6882 2866
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Mobile: 0427 691 733
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Re: Dubbo Zirconia Project 2016 flora survey results

Dear Michael,

OzArk Environmental & Heritage Management Pty Ltd (OzArk) was commissioned by Australian Zirconia Limited (AZL) to establish vegetation monitoring points for the Dubbo Zirconia Project (DZP), located at Toongi, NSW. The purpose of this survey was to record baseline species diversity and abundance across the DZP or on neighbouring land at five pre-determined locations. These areas represented four local benchmarks and one control site to measure success of unassisted (other than exclusion fencing) on-site native vegetation rehabilitation. These results will inform a Biodiversity Management Plan which will outline environmental management practices throughout the lifespan of the DZP.

1 SURVEY METHOD

The survey was conducted on 5 May 2016 by OzArk ecology staff Phil Cameron and Nikki Allen. Weather was cool to fine, with temperatures ranging from 13.8 to 22.9 degrees Celsius. No rain impacted the survey, therefore, no constraints were experienced.

1.1 Floristic Survey Methods

The location of four local benchmarks and one control plot was determined by the Proponent. The proponent has in-depth knowledge of vegetation in, and surrounding the DZP. OzArk had the opportunity change the predetermined locations but did not as all were considered well placed.

Survey of DZP followed the NSW Office of Environment and Heritage *BioBanking Assessment Methods 2014* (BBAM) (OEH, 2014) and the "Random Meander Technique" described by Cropper (Cropper, 1993).

Formal 20m x 20m vegetation plots, 50m x 1m transects and 20m x 50m habitat plots following BBAM were used to assess each plot. Five plots, of which four are hereafter called the 'local benchmark' and one 'the control plot' were completed across DZP. The local benchmarks have been evaluated against the regional Benson benchmark database for each corresponding community. Plot one (the control plot) establishes base line data to measure changes in biodiversity in response to a proposed change in grazing management practices.

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Cover-abundance following Braun-Blanquet Density Scores was used as a measure of plant cover in each plot. It is based on percentages at the top end, but uses abundance estimates for species with a low cover plant cover. Several scales of cover-abundance are used, in this case a 5-point cover scale of Braun-Blanquet or the Domin scale, with finer subdivisions have been used (**Appendix A**).

1.2 Plant Identification

Plant identification followed nomenclature in (Harden, 1990-2002), (Cunningham, et al., 1992) and Royal Botanic Gardens (RBG, 2015). The national conservation significance of flora was determined by referencing Rare or Threatened Australian Plants (ROTAP) (Briggs & Leigh, 1996) and the schedules associated with the NSW *Threatened Species Conservation Act* and the Commonwealth *Environmental Protection Biodiversity Conservation Act 1999*.

2 RESULTS

Each plot represents the different vegetation types previously recorded within the DZP boundary (**Figure 2-1**). The vegetation types included:

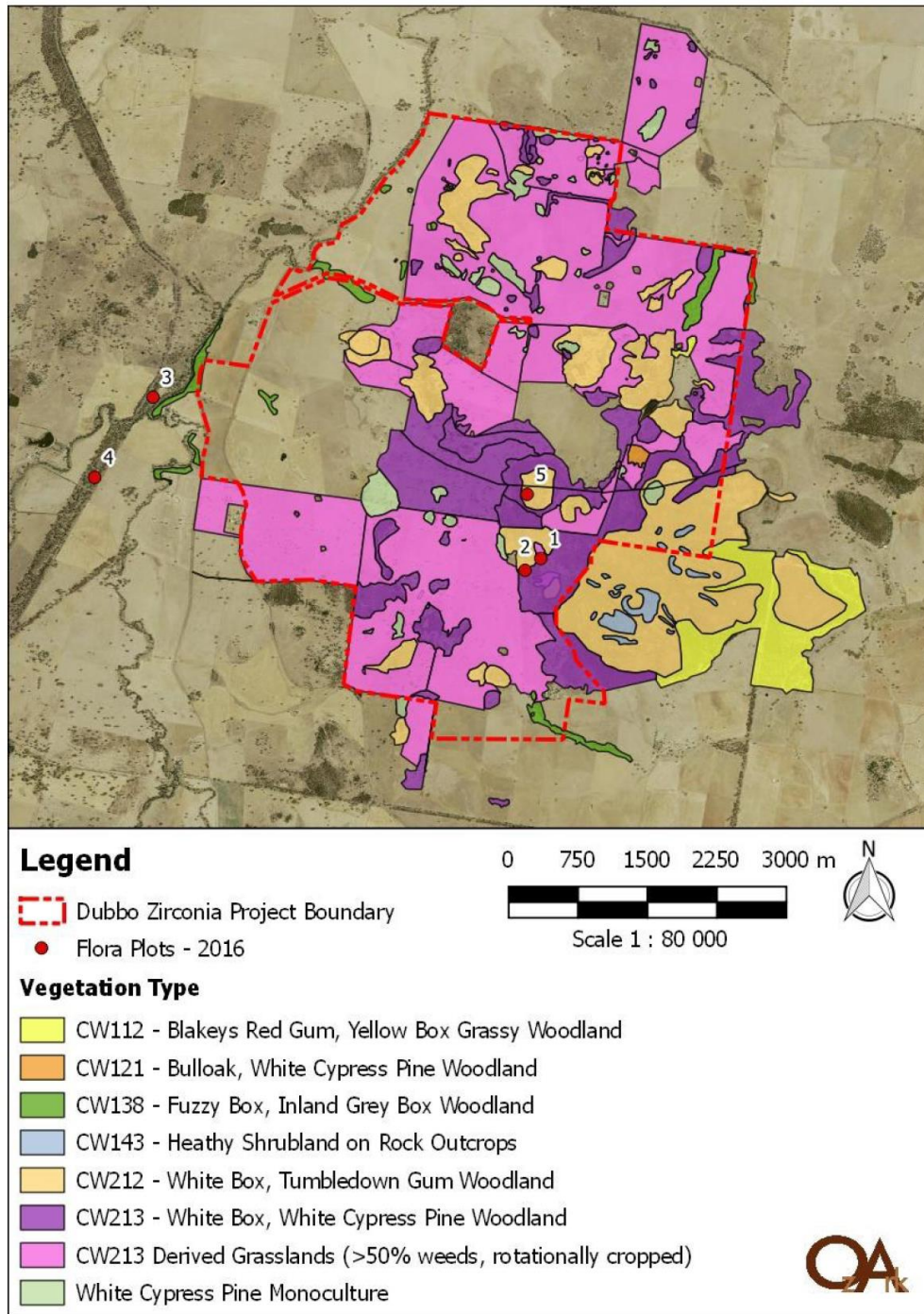
- Plot 1: White Cypress Pine monoculture (the control plot)
- Plot 2: CW213 – White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267)
- Plot 3: CW138 – Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201)
- Plot 4: CW145 – Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76)
- Plot 5: CW212 – White Box - Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270).

All plots are located in a 'grassy woodland' environment. In total 54 flora species were recorded across the five plots within DZP (**Appendix A**). Rough Spear Grass (*Austrostipa scabra subs scabra*) was recorded in every plot and overall was the most abundant species. Weed burden at most plots was low at less than 10 percent, except for Plot 3 (CW138), which had a 21 percent weed burden. This increase in weed burden is due to a combination of factors including, proximity to a major rural road and an area of recreation, soil fertility and moisture, infrequent slashing and soil surface disturbance.

Cumulatively the habitat plot transects (50m x 1m) showed there were no mid-stratum species, however, shrubs are present in the landscape as there were a few mid-stratum species recorded in the 20m x 20m vegetation plots (e.g. Eastern Cotton Bush (*Maireana microphylla*)). A low shrub count is to be expected in a grassy woodland communities. The five 50m x 20m habitat plots and 50m x 1m transects found on average:

- 31.1 percent native over storey cover. This is 'high' for a grassy woodland environment and indicates thinning or burning may be suitable landscape management tools
 - Zero percent mid-storey cover. This is to be expected in a grassy woodland environment
 - 29 percent native (grass) ground cover. This is within benchmark for a grassy woodland environment
 - 0.5 percent native (shrub) ground cover. This is below benchmark. An expected benchmark for a grassy woodland is between three to five percent.
 - 18.3 percent native (other) ground cover. This is within benchmark for a grassy woodland environment
 - 1.8 trees had hollows. This is within benchmark for a grassy woodland environment
 - 14.4m of fallen timber. This is below benchmark. An expected benchmark for a grassy woodland is over 45m for one community (CW212 – White Box - Tumbledown Gum woodland) and between 66m to 75m for the rest. Firewood collection is the likely cause of paucity of fallen timber.
-
- 0.46 percent regeneration of upper stratum species. There is no benchmark but the results show more plots do not have regenerating trees than plots which do.

FIGURE 2-1: VEGETATION COMMUNITIES AND FLORA PLOTS



2.1 Dubbo Weather

Weather conditions can affect the composition of vegetation communities and bias survey results. Periods of above average rain will suppress growth of drought tolerant flora and promote the growth and diversity of flora with high water requirements and vice versa. Unusual or extreme climate conditions can change the way the vegetation, density and quality is classified. Analysis of recent weather is important to determine if the survey was completed at a time to be 'representative' as a realistic benchmark.

Table 2-1 shows the average weather statistics for Dubbo compared with recent weather from 2015 and 2016. The mean upper and lower temperature is fairly consistent with the mean temperature range for Dubbo since 1993 (this date represents the time period since when BoM started collecting statistics on Dubbo).

The mean maximum temperature from March to April 2016 was approximately two degrees Celsius above the average. This is combined with noticeably lower rainfall from February to April 2016.

In summary, weather in 2015 matched the typical temperature range for Dubbo with slightly higher rainfall. The three months leading up to the survey were hotter and dryer than normal which may have reduced species richness at the DZP site. It can be concluded the assessment occurred at a representative time and was not influenced by a significant climate spike or trough.

Table 2-1: Recent Dubbo Weather (red = highest, blue = lowest)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Rainfall													
2015	130.6	31.8	8.4	81.8	47.8	72.2	60.2	39.4	6.8	46.4	66.6	59.6	651.6
2016	122.8	3.2	16.2	25	55.4								
1994-2016	59.9	45.5	55.3	35.1	42.9	49.2	41.9	35.2	40.8	43.2	62.8	59.2	570.6
Mean Maximum Temperature													
2015	31	33.3	31.6	23.3	19.4	16.4	14.1	16.7	20.8	29.9	30.4	32.2	24.9
2016	32.3	33.3	31.3	27.8	20.3								
1993-2016	33.1	31.9	28.9	24.8	20	16.3	15.4	17.5	21.2	25.1	28.7	31.2	24.5
Mean Minimum Temperature													
2015	17.1	17.8	14.3	11.4	7.4	4.1	2.5	3.4	4.1	13	14.1	15.9	10.4
2016	17.9	16.8	16.5	12.6	7.3								
1993-2016	18.1	17.6	14.5	10.3	6.5	4.4	3	3.3	6	9.3	13.6	15.8	10.2

2.2 Benson's Biometric Vegetation Type Benchmarks

Benson's biometric vegetation type benchmarks were developed by the NSW Office of Environment and Heritage for described vegetation communities in different Catchment Management Areas across NSW. Benson's regional benchmarks underpin each community by providing established quality parameters. By

quantifying the baseline vegetation quality, the rehabilitation progression of DZP vegetation can be monitored over time against an accepted standard. The downside of regional benchmarks is they may not truly reflect a local community and be an unrealistic rehabilitation goal or in some instances underrepresent the outstanding quality of the local benchmark.

To determine if the 2016 local benchmark results can be used for future monitoring they were compared to Benson's regional benchmarks. Red fill used in results tables in this document provide a quick visual reference to indicate the attribute is **not within** the Benson regional benchmark, green fill indicates the attribute **is within** the Benson regional benchmark.

2.2.1 PLOT 1: WHITE CYPRESS PINE MONOCULTURE

Plate 2-1: Photo of plot one showing the White Cypress Pine monoculture (10 cm bands on the scale are used. There is evidence of disturbance of dead timber in lower photo and a weeping pittosporum and Kurrajong in foreground / background of the pine monoculture)



White Cypress Pine monoculture (**Table 2-2, Plate 2-1**) was recorded at flora plot one (**Figure 2-2**). This plot is not an intended benchmark, it is a control plot to measure biodiversity response with a change of land management in a short period of time. It is likely this area, after natural unassisted rehabilitation, and possibly minor habitat manipulation, will later be reclassified as a Benson community and will become a local benchmark.

There are no Benson's regional benchmarks to compare to this vegetation type. The existing values have been provided on **Table 2-2**.

Table 2-2: Benson benchmark template for White Cypress Pine monoculture

Benson Benchmark	Native plant species richness	Native over-storey cover (%)	Native mid-storey cover (%)	Native ground cover (grasses) (%)	Native ground cover (shrubs) (%)	Native ground cover (other) (%)	Number of trees with hollows	Total length of fallen logs (m)
Plot 1	9	40.5	0	21.5	0	15	0	33

The DZP proposed Biodiversity Offset Area has substantive areas of dense Cypress Pine which require thinning. Thinning will occur in strategic locations to improve habitat for the Commonwealth and NSW vulnerable Pink-tailed Worm-lizard under an approved Plan of Management. This plan does not need Cypress Pine thinning across the entire landscape.

Nine native species of flora were recorded in plot one, this is directly comparable with plot five CW212 White Box, Tumbledown Gum Woodland but is nonetheless considered to be low.

The native overstorey was dense. Given the DZP site is in a grassy woodland landscape, the canopy is above density thresholds indicating additional thinning is required. Only one of the tree upper stratum species was observed as regenerating (White Cypress Pine). The remaining two species were old, hence regarded as 'hanging on, not yet strangled by the pine community' representing a former grassy community.

Absence of shrubs is not surprising nor concerning for rehabilitation goals. It is highly likely once thinning occurs pioneer shrub species will colonise the area.

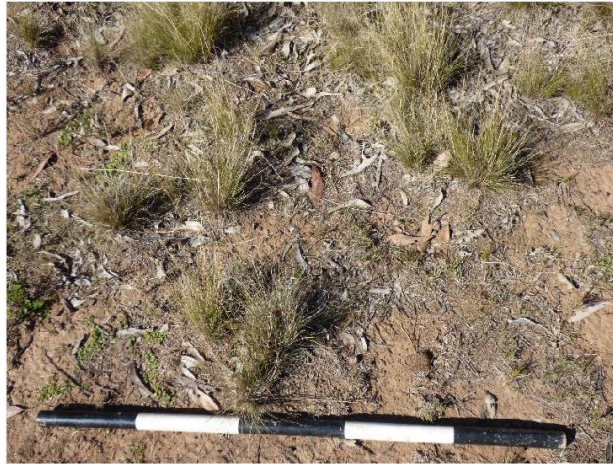
This community does not have the lowest percentage of native grass ground cover (plot three the Fuzzy Box community does). While **Plate 2-1** looks bare, with closer inspection many tufts of grass indicate the density is good but the plants are just heavily grazed. If similar levels of grazing occurred in the Fuzzy Box community the grass ground cover would be very sparse and the space between tussocks much greater. This demonstrates once grazing is managed at plot one, unassisted rehabilitation will be quick and successful.

White Cypress Pine does not form tree hollows and as such as none were recorded. This is not surprising nor does the community require remediation.

Plot one has the highest number of metres of fallen logs (a log greater than 10cm diameter), presumably from previous thinning and harvesting activities. From experience thinned White Cypress Pines once fallen provide seedling protection from herbivores and over time will break down.

2.2.2 PLOT 2: CW213 – WHITE BOX, WHITE CYPRESS PINE WOODLAND

Plate 2-2: Photo of typical vegetation at plot two (10 cm bands on the scale are used)



CW213 – White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267) (**Table 2-3, Pate 2-2**) was recorded at flora plot two (**Figure 2-1**).

Table 2-3: Benson benchmark comparison for CW213

Benson Benchmark	Native plant species richness	Native over-storey cover (%)	Native mid-storey cover (%)	Native ground cover (grasses) (%)	Native ground cover (shrubs) (%)	Native ground cover (other) (%)	Number of trees with hollows	Total length of fallen logs (m)
CW213	25	12-35	1-25	15-70	3-5	3-20	0.8	66
Plot 2	16	21	0	27.5	2.5	15	1	16

Regenerating White Box were observed in the plot and the density of the canopy was within benchmark. As shown in **Table 2-3**, native plant species richness is nine species below the CW212 benchmark. A number of factors may have influenced this with most likely the levels of grazing agriculture over a prolonged period and to a lesser degree preceding months of dry and hot weather. This area was not in a Cypress Pine canopy thus it was not affected by an associated lower level of ground stratum biodiversity.

At plot two there is no mid-stratum species but there are shrubs. Given more rainfall and time, the shrubs will grow to meet the mid-stratum benchmark. Fallen logs are below benchmark, this is characteristic of open grassy woodlands on thin and dry soils.

Plot two is almost completely on par with the CW213 benchmark. The main difference is the reduced native plant species richness.

The total length of fallen logs can be increased by placement of logs from components of trees from other areas of clearing.

Plot two indicates unassisted natural regeneration for this vegetation type is feasible to reach the Benson regional benchmark. Therefore, the CW213 benchmark is a realistic goal for rehabilitation of CW213 vegetation to be impacted or rehabilitated within the DZP site.

2.2.3 PLOT 3: CW138 – FUZZY BOX, INLAND GREY BOX WOODLAND

Plate 2-3: Photo of typical vegetation at plot three (10 cm bands on the scale are used)



CW138 – Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201) (**Table 2-4, Plate 2-3**) was recorded at flora plot three (**Figure 2-1**).

Table 2-4: Benson benchmark comparison for CW138

Benson Benchmark	Native plant species richness	Native over-storey cover (%)	Native mid-storey cover (%)	Native ground cover (grasses) (%)	Native ground cover (shrubs) (%)	Native ground cover (other) (%)	Number of trees with hollows	Total length of fallen logs (m)
CW138	25	12-35	1-25	15-70	3-5	3-20	0.8	66
Plot 3	24	41	0	18.5	0	9.7	6	11

Native plant species richness is only one species under the benchmark. With more rainfall, it is likely more species will colonise the area to meet this benchmark.

The over-storey percentage of cover demonstrates it is too dense. This may be reducing the native plant species richness as grasslands communities are not shade tolerant, e.g. Yellow Rush-lily (*Tricoryne elatior*) and Slender Sun Orchid (*Thelymitra pauciflora*) both not recorded but were expected, are unlikely to be recorded under a substantive tree canopy. No regenerating trees were observed in the plot.

With respect to mid-storey cover and shrubs, CW138 is a grassy woodland formation and it is not uncommon for mid-storey or shrubs to be absent in grassy woodlands. Fallen logs are below benchmark, which is common for all woodland communities near urbanised areas due to firewood collection and hazard reduction burns.

Plot three the local benchmark, when reviewed against the Benson regional CW138 benchmark, is more or less comparable. The only notable and concerning difference is the over-storey cover density (**Plate 2-1**). In this instance it can be rectified through thinning of the canopy however as noted a regional benchmark may not truly reflect a local environment. In this case all trees recorded were old growth and as such the density recorded truly represented a natural pre European local canopy density. The total length of fallen logs can be increased by placement of logs from components of trees from other areas of clearing.

The CW138 Benson regional benchmark is a goal for rehabilitation of this vegetation community. Plot three local benchmark shows a slightly lower rehabilitation threshold milestone. This lower threshold provides a realistic short to medium term rehabilitation goal for other areas of CW138 to be impacted within the DZP boundary with the Benson regional benchmark a long term goal. Given the status of CW 138 as an EEC, any future clearing or 'thinning' is unlikely to be supported. The regional benchmark for all parameters accept Native Overstorey Cover is acceptable. An increase in the range 12-45 percent would be appropriate for the benchmark.

2.2.4 PLOT 4: CW145 – INLAND GREY BOX TALL GRASSY WOODLAND

Plate 2-4: Photo of typical vegetation at plot four (10 cm bands on the scale are used)



CW145 – Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (Benson 76) (**Table 2-5 plate 2-4**) was recorded at flora plot four (**Figure 2-1**).

Table 2-5: Benson benchmark comparison for CW145

Benson Benchmark	Native plant species richness	Native over-storey cover (%)	Native mid-storey cover (%)	Native ground cover (grasses) (%)	Native ground cover (shrubs) (%)	Native ground cover (other) (%)	Number of trees with hollows	Total length of fallen logs (m)
CW145	25	8-35	3-10	13-50	3-5	3-15	1	75
Plot 4	15	34	0	39	0	38	2	12

Plot four is substantially below the benchmark for native plant species richness. Only one weed species was present in the 20mx20m plot and no weeds were recorded in the 50m transect. Possibly intermittent grazing pressure and a canopy on the higher side of density may play a role in this result where more palatable species have been predated and shading overtime have lowered ground stratum biodiversity.

The over-storey percentage of cover demonstrates it is at the higher end of the benchmark. This may be affecting native plant species richness. No regenerating trees were observed in the plot.

With respect to mid-storey cover and shrubs, CW145 is a grassy tall woodland formation where it is common for mid-storey or shrubs to be absent.

Percentage of 'native ground cover' other is more than twice the upper limit for the CW145 benchmark. This indicates there was a dense layer of native species such as Winter Apple and Kidney Weed and other similar species that were not grasses. In several instances both 'native ground cover other' species noted earlier favour shady environments this is consistent with a tree canopy at its upper density threshold.

Fallen logs is below benchmark, which is common for all woodland communities near urbanised areas and along roadsides due to firewood collection and hazard reduction burns.

Plot four is an example of a healthy CW145 vegetation type (**Plate 2-2**) as shown from regeneration of the upper stratum, low weed burden and high percentages of over-storey, grass and other flora. However, the dominance of a few flora species and possibly absence of fire in the landscape has lowered the native plant species richness of the area.

The total length of fallen logs can be increased by placement of logs from components of trees from other areas of clearing.

The CW145 Benson regional benchmark is a goal for rehabilitation of this vegetation community.

2.2.5 PLOT 5: CW212 – WHITE BOX, TUMBLEDOWN GUM WOODLAND

Plate 2-5: Photo of typical vegetation at plot five (1cm scale is used)



CW212 – White Box - Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270) (**Table 2-6, Plate 2-5**) was recorded at flora plot five (**Figure 2-1**).

Table 2-6: Benson benchmark comparison for CW212

Benson Benchmark	Native plant species richness	Native over-storey cover (%)	Native mid-storey cover (%)	Native ground cover (grasses) (%)	Native ground cover (shrubs) (%)	Native ground cover (other) (%)	Number of trees with hollows	Total length of fallen logs (m)
CW212	30	8-35	3-35	3-25	3-25	3-25	2	46
Plot 5	9	19	0	38.5	0	14	0	0

Native plant species richness for plot five is significantly lower than the CW212 benchmark. This is likely due to the thin (less than 15 cm) skeletal soils on top of the hill and to a lesser degree proceeding months of increased temperature and lower rainfall. These abiotic factors are also a factor for the above benchmark grass percentage at this plot as these conditions are suitable for the growth of grasses as opposed to other types of flora.

The over-storey percentage of cover is within benchmark and regenerating trees were observed in the plot.

With respect to mid-storey cover and shrubs, CW145 is a grassy tall woodland formation and it is not uncommon for mid-storey or shrubs to be absent in grassy woodlands.

As shown in **Plate 2-3** the typical upper stratum is mainly immature Tumbledown Gum and Cypress Pine, therefore there are no trees with hollows or fallen timber large enough to be classified as a log in the area. The total length of fallen logs can be increased by placement of logs from components of trees from other areas of clearing.

Plot five can be used as a realistic local benchmark for the medium term rehabilitation goal for CW145 areas impacted by the DZP. It is unlikely the regional Benson benchmark would be an achievable goal due to abiotic factors on similar landforms.

3 CONCLUSION

OzArk completed a flora survey of five locations near or within the DZP boundary on 05 May 2016. The purpose of this flora point was to gather baseline vegetation quality data to be used in the Plan of Management for rehabilitation of the DZP site. The results were compared against the relevant Benson benchmark to determine if the current vegetation quality would provide a realistic short to medium term rehabilitation goal for the DZP site and in once case to gather data at a control site to measure the speed of natural recovery with a change in grazing pressure.

The ultimate goal of rehabilitation will be to restore any impacted vegetation to Benson's regional benchmarks. The only exceptions are:

- CW212 – White Box - Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270). The local benchmark provides a realistic goal.
- CW138 – Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201). The Native Overstorey Cover local benchmark provides as realistic goal.

The comparison found that at each local plot (except for plot one which is a control site) the current vegetation quality could be used as a benchmark once some minor rehabilitation work was undertaken. At all plots, this involved the addition of logs from tree clearing in other locations.

A review of weather patterns showed the 2016 assessment of the plots was undertaken at a time to be representative i.e. the plots do not over or under document the expected levels of biodiversity.

The local benchmarks provide realistic short to medium term milestones and the regional Benson benchmark provide a realistic long term goal.

If you wish to discuss this letter or any other associated requirements further, please contact me on (02) 6882 0118 or at phil@ozarkehm.com.au.

Regards,



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OzArk and staff acknowledge Traditional Owners and Custodians on the country on which we work

APPENDIX A: FLORA SURVEY RESULTS

Table A-1: Results of the flora survey using Braun-Blanquet Density Scores in plots one to five

Common Name	Scientific Name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Cobblers Pegs	<i>Bidens pilosa</i> *			2		
Argentine Peppergrass	<i>Lepidium africanum</i> *			2	1	
White Horehound	<i>Marrubium vulgare</i> *			1		
Box Grass	<i>Paspalum constrictum</i>	1				
Soft Brome	<i>Bromus molliformis</i> *	1				
Small Quaker Grass	<i>Briza minor</i> *			2		
Couch Grass	<i>Cynodon dactylon</i> *			2		
Cats head	<i>Emex australis</i> *			1		
	<i>Pomax umbellata</i>				1	
Purple Burr-daisy	<i>Calotis cuneifolia</i>		2	2		
Yellow Burr-daisy	<i>Calotis lappulacea</i>			1	2	
Common Sneezeweed	<i>Centipeda cunninghamii</i>			1		
Bears Ear	<i>Cymbonotus preissianus</i>			1		
Woolly New Holland Daisy	<i>Vittadinia gracilis</i>		2			
Golden Everlasting	<i>Xerochrysum bracteata</i>		1			
Small crumbweed	<i>Dysphania pumilio</i>	1		1		
Hill Oak	<i>Allocasuarina verticillata</i>					1
Climbing Saltbush	<i>Einadia hastata</i>				3	
Creeping Saltbush	<i>Einadia nutans</i> subs. <i>Nutans</i>	1		1	3	
	<i>Enchylaena tomentosa</i>			1		
Eastern Cotton Bush	<i>Maireana microphylla</i> .		r			
Kidney Weed	<i>Dichondra repens</i>	2	2			
White Cypress Pine	<i>Callitris endlicheri</i>	4	r			
Caustic Weed	<i>Euphorbia drummondii</i>	1		1		
Small Poranthera	<i>Poranthera microphylla</i>			1		
Slender Tick-trefoil	<i>Desmodium varians</i>	1		2		
Knead Swainson-pea	<i>Swainsona reticulata</i>					1
Twining Glycine	<i>Glycine clandestina</i>	1		1	1	
Pepper leaf senna	<i>Senna barclayana</i>			1		
Forest Goodenia	<i>Goodenia hederacea</i> ssp. <i>hederacea</i>		2			
Corrugated Sida	<i>Sida corrugata</i>	2		2	2	
White Box	<i>Eucalyptus albens</i>		2			
Fuzzy Box	<i>Eucalyptus conica</i>			1		
Tumbledown Red Gum	<i>Eucalyptus dealbata</i>					2
Kurrajong	<i>Brachychiton populneus</i>	r				
Winter Apple	<i>Eremophila debilis</i>				1	
Purple Wiregrass	<i>Aristida jerichoensis</i>	1	4			4
Cane Speargrass	<i>Aristida ramosa</i>			5		
Wallaby Grass	<i>Austrodanthonia eriantha</i>				2	

Common Name	Scientific Name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Common Wallaby Grass	<i>Austrodanthonia caespitosa</i>	1	1		2	1
Wallaby Grass	<i>Austrodanthonia bipartita</i>				2	
Rough Spear Grass	<i>Austrostipa scabra subs scabra</i>	1	5	2	1	2
Stout Bamboo Grass	<i>Austrostipa ramosissima</i>					1
Yangabill	<i>Austristioa bigeniculata</i>				5	
Red-Leg Grass	<i>Bothriochloa macra</i>	2	1	2		
Windmill Grass	<i>Chloris truncata</i>	1			2	
Tall Chloris	<i>Chloris ventricosa</i>			2		
Common Wheatgrass	<i>Elymus scaber</i>		1		1	
Curly Windmill Grass	<i>Enteropogon acicularis</i>			2	3	
Elastic Grass	<i>Eragrostis tenuifolia</i>		1			1
Hairy Panic	<i>Panicum effusum</i>	1	1	2		
Western Rat's Tail Grass	<i>Sporobolus crebra</i>			1		
Mulga Mitchell Grass	<i>Thyridolepis mitchelliana</i>			1		
Rock Fern	<i>Cheilanthes austrotenuifolia</i>	2	2	1		3
Total Native Species		17	16	24	15	9
Total Weed Species		1	0	5	1	0
Percentage Weed Species		6%	0%	21%	7%	0%

* = Weed species

Braun-Blanquet Density Scores

Score	Cover
0	Absent from quadrant
0.1	Represented by a solitary item (<5% cover)
0.5	Represented by a few (<5) items (<5% cover)
1	Represented by >5 items (<5% cover)
2	Represented by many (>5) items (5-25% cover)
3	Represented by many items (25 - 50% cover)
4	Represented by many items (50-75% cover)
5	Represented by many items (75-100% cover)

Biobanking Plot Summary 20x50 and 50 x 1m habitat plots and transect

Transect number	1	2	3	4	5	Average
Native over-storey cover (%)	40.5	21	41	34	19	31.10
Native mid-storey cover (%)	0	0	0	0	0	0.00
Native ground cover (grasses) (%)	21.5	27.5	18.5	39	38.5	29.00
Native ground cover (shrubs) (%)	0	2.5	0	0	0	0.50
Native ground cover (other) (%)	15	15	9.7	38	14	18.34
Exotic plant cover (%)	1.9	0	24.5	0	0.5	5.38
No of tree with hollows (20x50m)	0	1	6	2	0	1.8
Length of fallen timber, meters (20x50m)	33	16	11	12	0	14.4
% regeneration of Upper Stratum species	0.3	1	0	0	1	0.46

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