



**AUSTRALIAN
ZIRCONIA LTD**

(A wholly owned subsidiary of Alkane Resources Ltd)

ABN 51 091 489 511

Dubbo Zirconia Project

Pink-tailed Worm-lizard Management Plan





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TABLE OF REVISIONS

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FOREWORD

OzArk Environmental & Heritage Management Pty Ltd (OzArk EHM) has prepared this Pink-tailed Worm-lizard (*Aprasia parapulchella*) Management Plan (PTWL MP) for the Dubbo Zirconia Project (DZP). The DZP, operated by Australian Zirconia Limited (AZL) is a subsidiary of Alkane Resources Ltd. The DZP comprises of 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 village 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.

This PTWL MP is required by *Condition 2 of Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) Approval 2015/6625, granted by the Commonwealth Department of the Environment (DoE) (now Department of the Environment and Energy), as well as Condition 3(33)(g) of SSD-5251 approved by the NSW Planning Assessment Commission under the NSW *Environmental Planning & Assessment Act 1979*.

The aim of the PTWL MP is to provide a framework for the implementation of management actions that will:

- mitigate the impact of the DZP to Pink-tailed Worm-lizard (*Aprasia parapulchella*); and
- increase the local population and area of occupancy for local viable populations of Pink-tailed Worm-lizard (*Aprasia parapulchella*).

The PTWL MP is to be read in conjunction with a *Pink-tailed Worm-lizard Biodiversity Offset Management Plan* (PTWL BOMP) and *Biodiversity Management Plan*.

Contribution to the preparation of the PTWL MP has been provided by RW Corkery & Co Pty Ltd (RWC) and AZL.

DECLARATION OF ACCURACY

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed _____

Full name (please print) _____

Organisation (please print) _____

Date _____/_____/_____



1. INTRODUCTION

1.1 Purpose

The Pink-tailed Worm-lizard (*Aprasia parapulchella*) (PTWL) is a small, legless lizard that occurs in scattered but discrete population along the western foothills of the Great Dividing Range. The Pink-tailed Worm-lizard (PTWL) is listed as vulnerable under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). EPBC Approval 2012/6625 approves the disturbance of up to 35.3ha of PTWL habitat by activities associated with the Dubbo Zirconia Project (DZP) subject to the establishment and management of an offset for this disturbance (the EPBC Offset Area) and the preparation of PTWL Management Plan (PTWL MP). These requirements are presented in **Table 1** and **Table 2**.

Table 1
Pink-tailed Worm-lizard Management Plan Requirements of EPBC 2012/6625 (Condition 2)

Condition	Reference	Summary
To mitigate the impacts of the proposal on the Pink-tailed Worm-lizard, the approval holder must prepare and submit at least 3 months prior to the commencement of the action, a mine site Pink-tailed Worm-lizard Management Plan (PTWLMP) for the Minister's approval. The PTWLMP must contain:		
a. Baseline data on the local Pink-tailed Worm-lizard population and habitat on site, in the biodiversity offset areas and release areas;	S2.2	Information on known locations of PTWL
b. Measures to mitigate and manage impacts on the Pink-tailed Worm-lizard, including progressive clearing in the project disturbance areas and detailed translocation procedures prepared in accordance with the <i>NSW National Parks and Wildlife Service Policy and Procedure Statement NO. 9 - Policy for the Translocation of Threatened Fauna in NSW</i> ;	S4.2 (staged clearing) S4.3 (translocation)	Impact mitigation and management information provided
c. Include a program to monitor: <ul style="list-style-type: none"> 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 	S5.2 S5.3 S5.2 S5.3 Refer to <i>Table 7</i> of PTWL BOMP	Sites listed Potential sites listed Sites listed
d. Include details of who would be responsible for monitoring, reviewing and implementing this plan.	Table 3, s1.6	Responsibilities listed

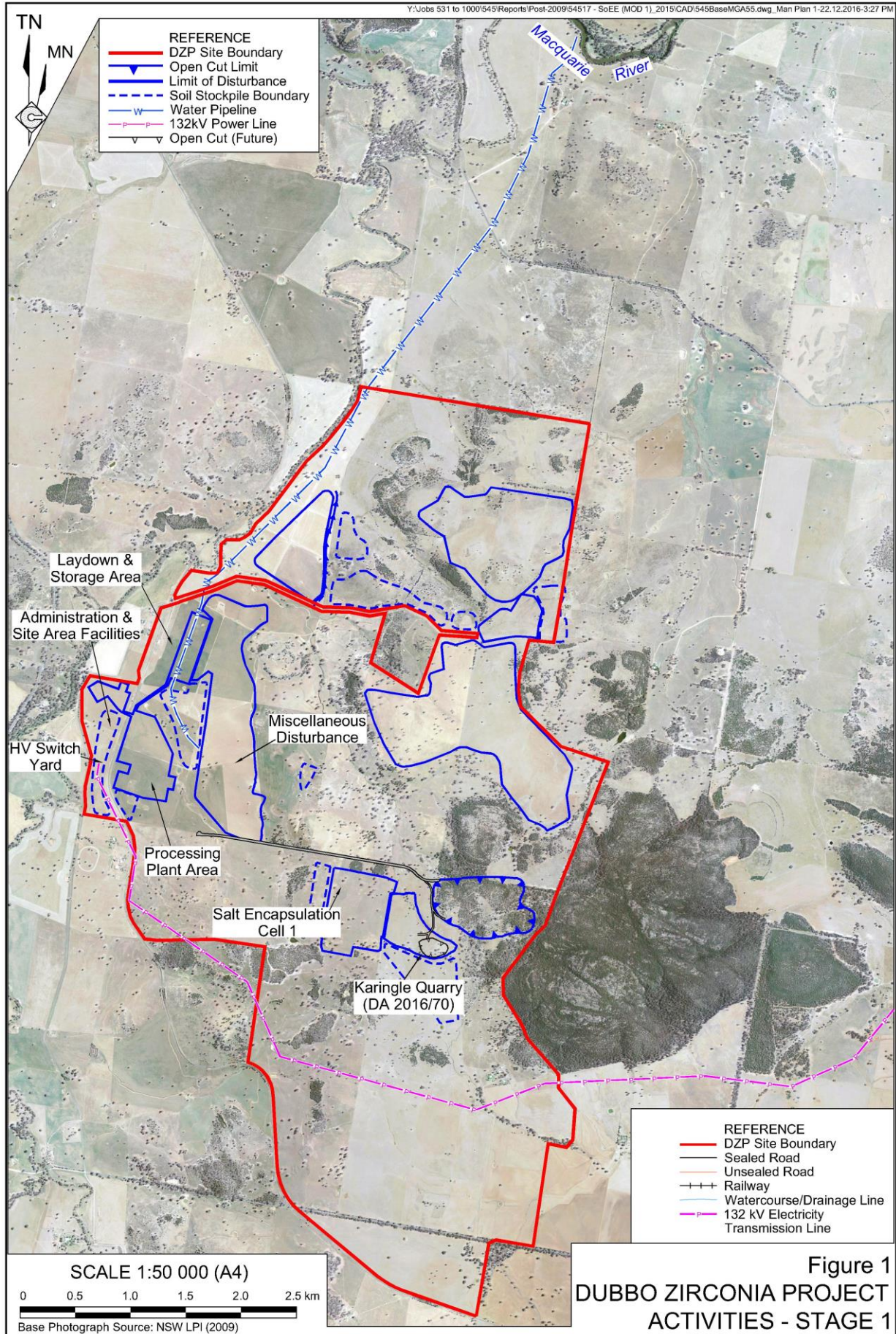
Table 2
Pink-tailed Worm-lizard Management Plan Requirements of SSD-5251 (Condition 33(g))

Condition	Reference	Summary
The Applicant shall prepare and implement a Biodiversity Management Plan for the development to the satisfaction of the Secretary. This plan must:		
(g) 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	S2.2	Information on known locations of PTWL
– measures to mitigate and manage the identified impacts on Pink-tailed worm lizard, including	S4	
○ progressive clearing in the project disturbance area; and	S4.1.2 (staged clearing)	Impact mitigation and management information provided
○ 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;	S4.3 (translocation)	Impact mitigation and management information provided
– include a program to monitor		
○ resident Pink-tailed Worm lizard distribution and population size on site and in the biodiversity offset areas;	S5.2	Sites listed
○ translocated Pink-tailed Worm lizard distribution and population size; and	S5.2	Potential sites listed
○ existing and revegetated potential distribution and population size habitat;	Refer to <i>Table 7</i> of PTWL BOMP	Sites listed

The purpose of this (PTWL MP) is to set out a program of management actions to conserve, enhance and protect the PTWL. The specific requirements of the PTWL MP are identified in *Condition 2* of EPBC Approval 2012/6625 and *Condition 33(g)* of Schedule 3 of SSD-5251.

This PTWL MP follows from a *Plan of Management* for the Pink-tailed Worm-lizard prepared by Biosphere Environmental Consultants Pty Ltd (Biosphere, 2013) to support a Terrestrial Ecology Impact Assessment and Environmental Impact Statement for the DZP (OzArk 2013).

The PTWL MP is supported by a PTWL Biodiversity Offset Management Plan (PTWL BOMP), prepared in accordance with *Conditions 3 and 4* of EPBC Approval 2012/6625. In combination, these two plans aim to ensure a viable PTWL population will remain secure in perpetuity and increase its area of occupancy within the local setting.



1.2 Overview of Pink-tailed Worm-lizard and Dubbo Zirconia Project

In 2001, a species of worm-lizard was recorded on Dowd's Hill to the immediate west of the proposed site of an open cut mine to be developed as a component of the DZP. A lizard voucher specimen was identified by the Australian Museum as Flinders Ranges Worm-lizard (*Aprasia pseudopulchella*). This species had not been previously recorded in NSW and subsequently did not have a pre-determined conservation status in NSW but was listed by the Commonwealth as vulnerable. Between 2001 and 2012, preliminary targeted assessment was completed as project development took place.

In late 2011 AZL commenced further feasibility studies and OzArk EHM, on behalf of AZL, asked the Australian Museum to reassess the type specimen lodged in 2001. As a result, the specimen was then identified as the PTWL. This was the first and only record of PTWL in the Dubbo Regional Council area (formerly Dubbo City and Wellington Shire LGAs). Additional fauna and flora surveys were subsequently commissioned.

As the PTWL is listed as a threatened species under both the TSC Act and EPBC Act, additional targeted surveys were undertaken in 2012 and 2013 by Biosphere Environmental Consultants Pty Ltd (Biosphere). The aim was to determine:

1. distribution of the species in the areas to be impacted; and
2. occurrences elsewhere in the immediate vicinity of the proposed impact footprint that could be conserved.

As a result of those surveys, 30 PTWLs (in total) were found in seven additional sites within a 5km radius of the DZP impact footprint (**Figure 2**). Each of these areas comprises a weathered trachyte outcrop. Most lizards are found in areas around the base of the outcrops where exfoliated slabs of trachyte lie loosely scattered across open woodland or grassland

The DZP will result in the loss of 35.3ha of PTWL habitat in Habitat Area 1 (**Figure 2**). Habitat Area 1 is one of the nine mapped areas of known or potential PTWL habitat on, or immediately adjoining the DZP Site.

1.3 Format

The PTWL MP has been prepared to address the requirements of *Condition 2* of EPBC Approval 2012/6625 and the suggested contents provided by the following guideline documents.

- *Guidelines for the Preparation of Biodiversity Management Plans for Major Projects* produced by NSW Office of Environment and Heritage (OEH) as a draft in August 2014 (OEH, 2014).
- *Environmental Management Plan Guidelines, Commonwealth of Australia 2014*, produced by the Commonwealth Department of the Environment (DoE, 2014).

1.4 Plan Requirements

Table 1 identifies the requirements of *Condition 2* of EPBC Approval 2012/6625 and identifies where in the PTWL MP individual requirements have been addressed.

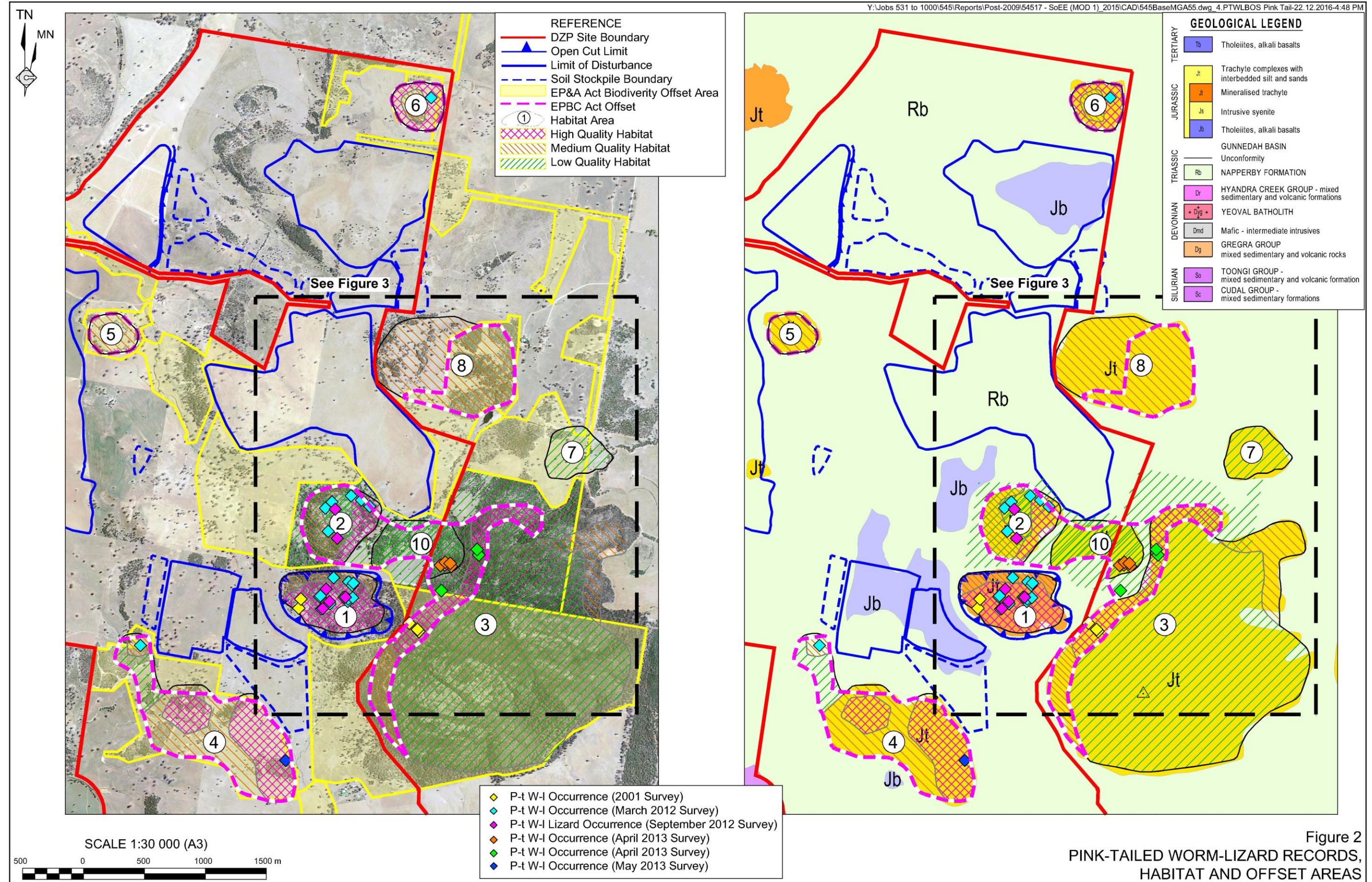


Figure 2
 PINK-TAILED WORM-LIZARD RECORDS,
 HABITAT AND OFFSET AREAS

Table 2 identifies the requirements of *Condition 33(g)* of Schedule 3 of SSD-5251 and identifies where in the PTWL MP the individual requirements have been addressed.

1.5 Objectives

The PTWL MP has been prepared to mitigate the impacts of the DZP on the local populations of PTWL around Toongi.

1.6 Environmental Management Roles and Responsibilities

The roles and responsibilities for DZP personnel in relation to the implementation of the PTWL MP and management of related biodiversity matters are listed in **Table 3**.

Table 3
Roles and Responsibilities

Role	Accountability
General Manager	Ensure the resources are available for the implementation of this PTWL MP. Accountable for the overall environmental performance of the Mine, including the outcomes of this PTWL MP.
Environment and Community Manager	Ensure that the requirements of this PTWL MP are effectively implemented. Ensure the results of all monitoring are recorded. Ensure all internal and external reporting requirements are met. Ensure all personnel undertaking works in relation to this management plan are trained and competent. Complete an annual review of the PTWL MP. Update the PTWL MP as required (in accordance with Condition 5(5) of SSD-5251). Undertake/organise, review and analyse all monitoring data.
All Personnel and Contractors	Operate in a manner that minimises risks of incidents to themselves, fellow workers and biodiversity values of the DZP Site. Fully implement the management measures within the PTWL MP. Report and incidents or events relating to native flora and fauna to the Environment and Community Manager. Follow any instructions provided by the Environment and Community Manager regarding Pink-tailed Worm-lizard and other related biodiversity management.

2. SPECIES DESCRIPTION

2.1 Characteristics and Distribution

Plate 1 provides a photo of a PTWL (recorded on the DZP Site) which is a member of the family *Pygopodidae* (flap-footed or legless lizards). Like its congeners¹, the PTWL is a small worm-like, burrowing legless lizard with poorly-developed hind-limb flaps. The snout and the tail are rounded and blunt, and it can grow to 14cm (snout – vent length). The dark brown head and nape gradually merge with the pale grey or grey-brown body. Body colour changes to pinkish/reddish-brown toward the end half of its tail, and the longitudinal dark bar within each dorsal scale gives the impression of lines of dots along the body and tail. It is whitish below, with a rounded blunt snout and no ear opening, and its tail is nearly as long as its body (Cogger 2000). The PTWL is a dietary specialist, consuming all life cycles of at least five species of small ants (Jones 1992).



Plate 1
Pink-tailed Worm-lizard

The PTWL exhibits sexual dimorphism, with females attaining longer snout-vent lengths (SVL) than males (Jones 1999). Females are oviparous with a clutch size of two (Osborne and Jones 1995).

The known distribution of the PTWL has changed dramatically over the last 20 years. For many years, the species was only known from the ACT, the southern tablelands region of NSW to Bendigo in Victoria. However, field surveys for threatened reptiles have located this species in new habitats in areas quite distant from the ACT.

¹ A thing of the same kind or category as another.

The PTWL is now known to be patchily distributed across sloping woodland areas of the western foothills of the Great Dividing Range in south-eastern Australia, where it is typically associated with abundant surface rock, including granite, basalt and sandstone outcrops (DECC 2007; Jones 1992; Osborne et al. 1991; Robertson and Heard 2008).

In Victoria, it has only been found in the general Bendigo area, though its occurrence in woodland environments in south-central New South Wales, including Albury, and the Australian Capital Territory suggests that it may occur elsewhere in Victoria (Brown 2009). To date, records of this worm-lizard have been collected from the Gunnedah, Bathurst, Tarcutta, West Wyalong, Walbundrie, Howlong, Holbrook and Albury localities of New South Wales, the general Canberra area in the Australian Capital Territory, and the general Bendigo area of central Victoria (Michael & Herring 2005; Osborne & Jones 1995; Osborne *et al.* 1991; Osborne & McKergow, 1993; Robertson and Heard, 2008).

The first PTWL recorded in the Namoi catchment was found by Ray Williams (Ecologist, Ecotone Pty Ltd) (pers comm.) at Gunnedah in September 2006. It was found in a multi-layered immature woodland/low open forest on a rocky conglomerate ridge adjoining the southern outskirts of the town. The Gunnedah records are a large range extension for the species, some 100km north of the previous limit at Wollar in the Goulburn River National Park.

2.2 Existing Population and Habitat

2.2.1 Toongi Population

In 2001, Goldney (2002) found the first example of the PTWL near Toongi, about 25km south of Dubbo. Subsequent surveys by White (2012) and OzArk (2013) have demonstrated that this population is larger than any others so far identified in NSW and occurs across a number of sites.

The Toongi (Dubbo) population is one of only two known to be present in the Central West Local Land Services (LLS) area, the other population being near Bathurst.

In terms of local species detection, the PTWL is notoriously difficult to detect and reflects the EPBC survey guidelines where about 300 suitable habitat rocks need to be turned during very narrow suitable climatic conditions to detect one individual. The PTWL appears to mimic the same 'boom and bust' detection rates as seen in many western area species of fauna (P. Cameron, pers. comm.). This observation was supported by Gerry Swan (reptile expert) who also has experience with the species (pers. comm.). In favourable seasons, i.e. not long after inundating repetitive rains, 'many' (in context with the population) PTWL will be recorded with the recommended survey effort (P. Cameron pers. comm). This may be followed by subsequent hotter and dryer seasons when few or no PTWL recorded. Evidence available suggests this pattern follows a ten year cycle related to approximately 10 year interval high rainfall events (P. Cameron and Gerry Swan pers. comm).

2.2.2 DZP Site

Sections 2 and 3 of the *Biodiversity Management Plan* (RW Corkery, 2016) provide a detailed description of the environmental setting and biodiversity (ecological) values of the DZP Site.

The preferred habitat for the PTWL is open native vegetation with a sunny aspect. Biosphere (2013) typically identified PTWL underneath and surrounding slabs of trachyte that provide the lizards with shelter. An example of this habitat is presented in **Plate 2**.



Plate 2
Typical Natural Habitat for the Pink-tailed Worm-lizard

Targeted surveys for the PTWL in 2012 and 2013 identified nine areas of potential PTWL habitat and occurrence. Following confirmation of its occurrence across the DZP Site, additional analysis was undertaken to further classify the land with respect to the quality of habitat. The quality of habitat was determined through consideration of various factors known to influence the occurrence of the species such as:

- previous record(s) / known occurrence of the species;
- occurrence of surface rocks of appropriate dimensions;
- base geology and soil permeability;
- topography and aspect
- occurrence and quality of native groundcover;
- openness of canopy; and
- presence of ants (feed).

To provide a transparent and robust scoring system to measure habitat quality a 25 point scoring system was developed by a team of local and other relevant experts (Mr M. Sutherland - AZL's NSW General Manager; Mr P. Cameron - OzArk Principal Ecologist; Dr A. White - Herpetologist; Dr G. Whyte – Entomologist; and Mr A. Irwin - RWC Senior Environmental Consultant). As identified in **Appendix A**, the template considers the quality and quantity of critical habitat elements in the study area to measure its current value and indicate a future value with site management.

Across the DZP Site, five areas were identified as possessing **low** quality (367.3ha), 10 **moderate** quality (179.2ha) and six **high** quality (107.8ha) PTWL habitat. **Table 2** provides the results of this habitat assessment and identifies these individual areas and scores, along with whether they are to be impacted or included in the EPBC Offset. **Figure 2** identifies these areas over a geological map (to illustrate the importance of base geology to habitat). **Plates 3 to 7** provide examples of high, moderate and low quality habitat as mapped on the DZP Site.



Plate 3
**PTWL HA 2b (within EPBC
Offset Area A) - High Quality
PTWL Habitat**

Plate 3 illustrates an area with an open tree canopy, healthy native grass understory and many suitable PTWL habitat rocks. Minimal management actions are needed in this area to maintain and improve PTWL habitat quality.



Plate 4
**PTWL HA 1b (of the impact
footprint) - High Quality PTWL
Habitat**

Plate 4 shows an ideal PTWL habitat rock.



Plate 5
PTWL HA 3b (within EPBC
Offset Area A) - Moderate
Quality PTWL Habitat

Plate 5 illustrates a dense Cypress Pine Canopy with a low density native grass understory with many suitable PTWL habitat rocks.

Management actions (Cypress Pine thinning) are needed in this area to improve PTWL habitat quality.



Plate 6
PTWL HA 3a (not within the
EPBC Offset Area) - Low
Quality PTWL Habitat.

Plate 6 identifies an area with no soil, hence limited or no ant activity, but has many suitable PTWL habitat rocks.



Plate 7 illustrates an area with suitable soils and a healthy grass layer but no surface no suitable PTWL habitat rocks.

The ore body targeted for extraction occurs over PTWL Habitat Area (HA) 1 with disturbance to the following unavoidable.

- (a) 25.5ha of high quality habitat.
- (b) 9.8ha of medium quality habitat.

A staged open cut development plan will ensure that approximately 50% of this habitat will remain undisturbed for at least 10 years (refer to Section 4.4.5.2). Based on consideration of PTWL habitat during the DZP planning stage, no further impact to PTWL habitat will occur.

2.2.3 Offset Areas

A Biodiversity Offset Area (BOA)², incorporating 1 021ha of remnant native vegetation, derived native grasslands (which, until 2016, was grazed and cropped), cleared agricultural land and important habitat for threatened species, has been established to satisfy Condition 3(31) of SSD-5251 (see Figure 2). Notably, the area of native vegetation contained within the BOA is greater than required for achieving offsetting requirements. In particular, the BOA contains more NSW Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions (an Endangered Ecological Community) than required to meet the offsetting requirements calculated using the OEH endorsed BioBanking methodology.

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 Wambangalang Creek which itself provides a corridor to the Macquarie River;

² The BOA is also identified as the Biodiversity Offset Management Zone within the Biodiversity Management Plan (RWC/AZL, 2016).

- 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 PTWL, to the west, northwest and north of Dowds Hill.

The BOA comprises 959.9ha (94%) native vegetation communities, 306.8ha (32%) is associated derived grassland communities and 61.1ha (6%) cleared land (without derived native grassland) or white cypress pine monoculture.

Within the larger BOA, 224.5ha of PTWL habitat has been identified as the EPBC Offset Area (see PTWL BOMP). This is to be managed with a specific focus on the protection and enhancement of PTWL habitat (see **Figure 2**). This habitat has been categorised as in either low (30ha), moderate (113.6ha) or good (80.9ha) quality habitat based on the factors described in Section 2.2.2. The PTWL BOMP provides further information on the categorisation of habitat quality and targets for overall habitat quality.

Minor variations to the BOA may arise when final on-ground identification and fencing occurs. Variations resulting in significant alteration to the overall offset size (e.g. >1% or >10ha) will trigger a review of the BOA and the PTWL MP.

3. THREATS

A summary of potential threats (risks) to PTWL habitat associated with the approved activity (mine development) and land management more generally have been summarised in **Tables 4** and **5** (referencing the DoE *Environmental Management Plan Guidelines* - Department of the Environment, 2014). Risks to PTWL were considered as an action caused by developing the DZP (**Table 4**) and an action caused by managing the EPBC Offset Area (**Table 5**).

Table 4
DZP Development Related Risks to PTWL

Risk	Qualitative measure of likelihood	Qualitative measure of consequence	Risk rating	Trigger Value	Corrective Action
Habitat destruction	Highly likely	Critical	Severe	Impacts to PTWL habitat about 2 years after project construction starts	Passive translocation Physical translocation (as required)
Removal of rock habitat	Highly likely	Critical	Severe	8 weeks prior to clearing the deposit for mining	6 men over 5 days to lift and translocate surface rock into EPBC Offset Areas

Table 5
Land Management Risks to PTWL

Page 1 of 2

Risk	Qualitative measure of likelihood	Qualitative measure of consequence	Risk rating	Trigger Value	Corrective Action
Removal of rock habitat	Unlikely	Minor	Low	Annual monitoring shows habitat rocks are being removed without approval	Investigate cause. Replace habitat at the same ratio.
Habitat destruction	Unlikely	Minor	Low	Annual monitoring demonstrates habitat destroyed.	Investigate cause. Restore destroyed habitat at the same ratio.
Grazing to reduce fuel loads (where required)	Likely (in some areas of the Offset Area)	Minor	Low	Annual monitoring demonstrates evidence of livestock destroying PTWL habitat i.e. rocks, man-made habitat or quality or density of grassland vegetation. Grassland has less than 40% cover density or falls below the lower benchmark for the community.	Frequency of vegetation monitoring is increased until issue is resolved. Controlled burns (cool burns) may be used where grazing is an issue.
Fire management	Likely	Minor	Low	Annual monitoring demonstrates evidence of fire destroying PTWL habitat.	Livestock maybe used where fire is an issue. Methodology of burns will be reviewed to ensure cool mosaic burns.
Feral animals	Highly likely	Minor	Low	Feral animals (pigs) destroying habitat	Increase pig control program.

Table 5 (Cont'd)
Land Management Risks to PTWL

Page 2 of 2

Risk	Qualitative measure of likelihood	Qualitative measure of consequence	Risk rating	Trigger Value	Corrective Action
Over abundant native species	Possible	Minor	Low	Grassland has less than 40% cover density or falls below the lower benchmark for the community.	Increase overabundant native species control program.
Weed control	Likely	Minor	Low	New populations of weeds are observed in EPBC Offset Areas. Existing weed burdens are increasing (demonstrated via monitoring).	Increase frequency of weed control program until weed occupancy is reduced.
PTWL poaching	Unlikely	Minor	Low	Unauthorised access into EPBC Offset Area	Review of security Review of fencing Review of signs Review of inductions for work crews and visitors

These risks are managed within the PTWL BOMP. The PTWL BOMP provides the measures to be implemented to conserve and enhance the population of PTWL by restoring native habitat to a local established benchmark standard. Without active management of feral animals, particularly pigs (which invaded Dowds Hill in 2011), the Toongi population remains at risk of decline.

Conservation and enhancement of the EPBC Act Offset Area will reduce these threats and risks to the PTWL.

4. MANAGEMENT ACTIONS

4.1 PROGRESSIVE CLEARING

AZL has committed to developing the open cut (over PTWL HA 1) in two stages such that only half the open cut is impacted within the first 10 years. This allows for both passive and active relocation / translocation of Pink-tailed Worm-lizards (refer to Section 4.4) from the open cut to adjoining and conserved habitat (PTWL HA's 2, 3 and 10 - see **Figure 2**).

4.2 TRANSLOCATION

4.2.1 Introduction

Assisted relocation (or translocation) refers to the physical capture and movement of animals from one habitat area to another. There are three types of translocation:

1. introducing a species into an area where it has not previously been found;
2. re-introducing a species into an area where it used to live but has become locally extinct; and / or
3. supplementing an existing population, by adding new individuals of that species from another area.

This PTWL MP will focus on 2. and 3. above in the short term. Investigation into introduction of PTWL beyond its current known habitat (1. above) may be investigated in the long term depending on the success of low quality habitat rehabilitation.

4.2.2 Passive Relocation

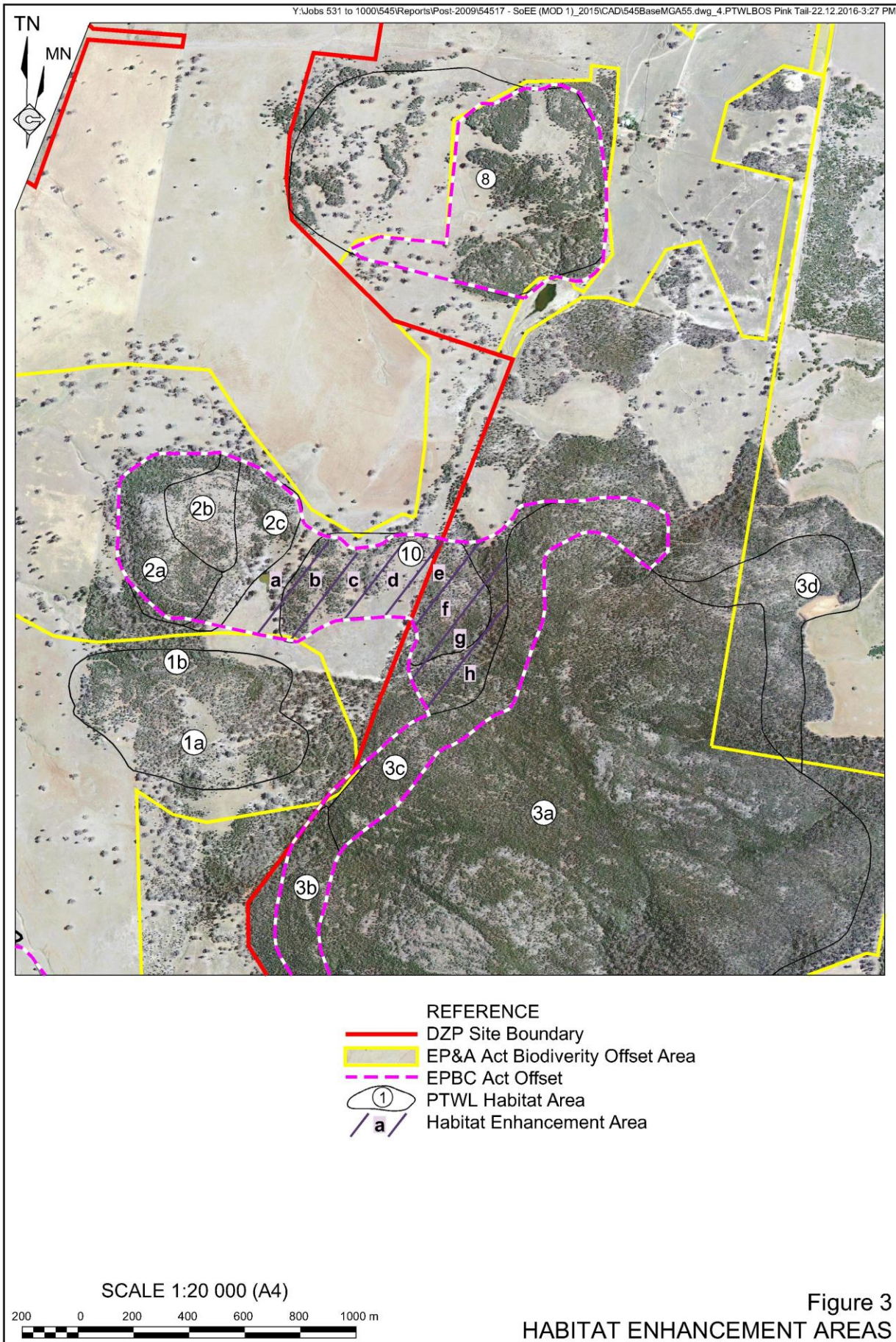
Passive relocation refers to the natural movement of animals from one area of habitat to another. This process requires the establishment of corridors for the safe passage of animals. Restoration, as a top priority, in PTWL HA 10 reflects reinstating habitat connectivity as an immediate goal.

PTWL HA 3 will be enhanced through Cypress Pine thinning (refer to *Section 4.4.3* of the PTWL BOMP) to enhance the connection to PTWL HA 1 (the impact footprint) for passive relocation of the Pink-tailed Worm-lizard.

By staging the development and mining of the open cut at PTWL HA 1, a period of 10 years will be provided for PTWL HA's 10, 3 and 2 to establish and function as habitat corridors for passive relocation.

The stages of passive relocation are as follows:

1. Fence the BOA and re-establish a grassy ground stratum in Pink-tailed Worm-lizard habitat (commenced June 2016).
2. Implement feral and overabundant native animal controls in accordance with this plan.
3. Establish artificial and relocated habitat in PTWL HA 10 linking the impact footprint (PTWL HA 1) to high quality Pink-tailed Worm-lizard habitat (PTWL HAs 2 and 3).
4. Relocate Pink-tailed Worm-lizard habitat rocks from the deposit (PTWL HA 1) to the habitat enhancement areas (of PTWL HA 10) before mining begins (see **Figure 3**) (refer to the PTWL BOMP for further detail on habitat enhancement).



Osborn (pers.comm) in Biosphere Environmental Consultants P/L (2013) notes that similar passive relocations have been used successfully in the ACT, with Pink-tailed Worm-lizard occupying new habitat areas within 12 months of creation.

4.2.3 Assisted Relocation (Translocation)

Physical capture and relocation of Pink-tailed Worm-lizards is a last resort as passive relocation is the preferred option. However, assisted relocation will occur at HA 1 during the removal of habitat rocks. If a PTWL is found and captured, it will be relocated following the *NSW OEH Policy for the translocation of threatened fauna in NSW*.

Briefly, when a PTWL is captured, the following process is undertaken:

- Specimen is photographed, weighed and measurements taken.
- If possible, sex (male/female) determined.
- Location of capture recorded.
- Transported to new location in a breathable cotton bag.
- Location of release and habitat quality recorded.

A licence to undertake translocation will be required under the National Parks and Wildlife Act.

In the twelve month period leading up to the commencement of mining works in the western half of the open cut searches of HA 1 will be carried out. The exact timing of these searches will be weather dependent with local ecologists to carry out searches at weekly during ideal weather conditions. Searches will not be undertaken during the cooler months when the PTWL are not likely to be observable at surface (under rocks). Any Pink-tailed Worm-lizards found will be collected, measured and relocated to areas of existing good quality habitat. HA 3 will be the destination of choice if the grassy layer has been established, followed by HAs 2 and 10 as required. The rock beneath which the lizard was found will also be relocated to the new habitat area to discourage other Pink-tailed Worm-lizards migration to the open cut area.

It is intended that the passive relocation, and to a lesser degree manual relocation process, will relocate as many as possible PTWL before HA 1 is subject to major earthworks. However, it is acknowledged that it will not be possible to collect all PTWL from this area.

Stages of assisted relocation are as follows:

1. Relocate any individual PTWL recorded during annual monitoring on HA 1 to HAs 3, 2 and 10 (readiness of receiving habitat to be evaluated first) before mining begins.
2. Relocate any individual PTWL recorded during targeted monitoring on the deposit to Habitat Area 1 to Habitat Areas 3, 2 and 10 (readiness of receiving habitat to be evaluated first) before vegetation clearing begins.

4.3 BIODIVERSITY OFFSET AREA AND EPBC OFFSET AREA

Information relating to these specific management actions for the Biodiversity Offset Area and EPBC Offset Area are found in the Biodiversity Management Plan (RWC) and PTWL BOMP (OzArk) respectively. **Table 6** provides a guide as to the management actions required for the

improvement of the natural habitat. The results will be reported in both the PTWL MP and the PTWL BOMP.





Table 6
Environmental Attributes and Management Goals

PTWL HA / Offset Area / Monitoring Location	GDA z55		Depth of Soil (mm)	Underlying Geology	Soil Type (Dubbo Soils map)	Current Mapped Habitat Quality	Proposed Habitat Quality (5 years)	Community	Management Action	5-year completion criteria
	Easting	Northing								
PTWL HA 2b / Offset Area A / Ugothery North Artificial Habitat Monitoring Point	652845	6407800	25	Jurassic - Trachyte complexes with interbedded silt and sands	Bald Hill Euchrozems	Medium (7/10)	High (9/10)	3	Grazing removed. Pig management started.	Vegetation thinning to 1:30m ² . Monitoring point in managed area. Monitor vegetation community and review data against local benchmark.
PTWL HA 2a / Offset Area A / Ugothery East Lower Artificial Habitat Monitoring Point	652929	6407563	135	Jurassic - Trachyte complexes with interbedded silt and sands	Bald Hill Euchrozems	Low (4/10)	Medium (6/10)	3	Grazing removed. Pig management started.	As above
PTWL HA 2c / Offset Area A / Ugothery East Upper Artificial Habitat Monitoring Point	652836	6407637	160	Jurassic - Trachyte complexes with interbedded silt and sands	Bald Hill Euchrozems	Low (4/10)	Medium (6/10)	3	Grazing removed. Pig management started.	As above
PTWL HA 6a and 6b / Offset Area C / Grandale Artificial Habitat Monitoring Point	653547	6410880	>150	Jurassic - Trachyte complexes with interbedded silt and sands	Ballimore Red-Brown Earths	Medium (7/10)	High (9/10)	4	Grazing reduced.	As above
PTWL HA 3c / Offset Area A / Ugothery Dowds Hill Artificial Habitat Monitoring Point	653525	6406962		Triassic Napperby Formation	Dowd Shallow Soils	Tile location High (8/10)	High (10/10)	3	Pig management started.	As above
PTWL HA 1a and 1b / Impact Footprint / Glen Idol Artificial Habitat Monitoring Point	652877	6406944	36	Jurassic - Mineralised trachyte	Belowrie Red Podzolic Soils	High (9/10)	High (10/10)	2	Grazing removed. Pig management started.	As above
PTWL HA 7 / Offset Area B / Ugothery Dam Site Artificial Habitat Monitoring Point	653894	6407990		Triassic Napperby Formation	Belowrie Red Podzolic Soils	Low (4/10)	Medium (6/10)	2	Pig management started.	Monitoring has not occurred in this area to date

5. MONITORING PROGRAM

5.1 Overview

Monitoring of PTWL is challenging due to its cryptic nature. However, an annual monitoring program, run in conjunction with habitat quality monitoring (refer to *Section 5* of the PTWL BOMP) will be undertaken.

Weather conditions, and the natural boom/bust population dynamics of the species (see *Section 2.2*), also plays a role in detection of the PTWL. When prevailing conditions are too hot and dry, as recorded since the establishment of the roof tiles in 2014, detection rates are low. Furthermore, the noted window of opportunity for species detection is also limited to seasonal overlap periods of March and October / November. Given the constraints on detection posed by these factors, a true reflection of population density and distribution will be provided when monitoring occurs when favourable climatic conditions (preceding inundating rains and mild temperatures) overlap with the known periods of detection.

The survey method follows the accepted *Clearing Procedure: Pink-tailed Worm Lizard* issued by OzArk (2013). This involves ‘flipping’ either natural rocks or artificial habitat (roof tiles) to ascertain what lies beneath. Data collected includes: presence and abundance of the PTWL; food sources and other indicator species such as skinks; soil temperature and moisture; rock/tile temperature. Ambient weather conditions are also recorded.

Timing of the survey needs to be flexible to ensure that appropriate weather conditions exist.

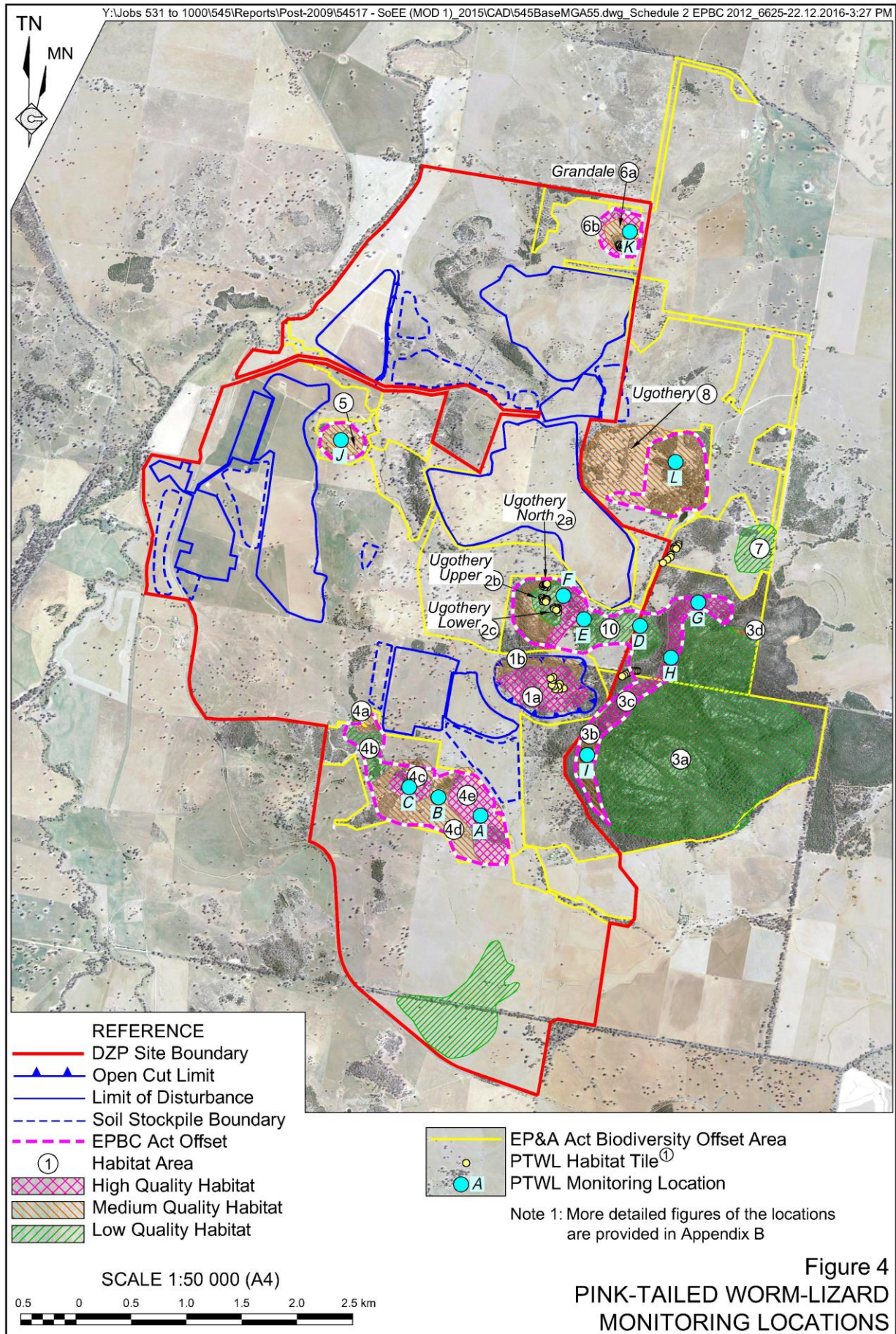
Pink-tailed Worm-lizard Occurrences

The monitoring program will focus on the monitoring of the PTWL HA's of the EPBC Act Offset. The monitoring will include general searches over each area, as well as targeted searches of artificial habitats established as part of habitat enhancement activities (refer to **Figure 3** and *Section 4.4* of the PTWL BOMP). A ‘search’ involves turning over rocks that meet the criteria of suitable habitat (i.e. dinner plate sized, between 10mm and 20mm thick) and recording what is found. Targeted search is undertaken on the artificial habitat, where the tile is flipped, and parameters listed in *Section 5.2* recorded.

The timing, frequency, number and location of monitoring will ideally be twice per year (autumn and spring). However, climatic conditions are a limiting factor. Decisions will be based on preceding weather conditions which will provide an indication of likelihood of observation. Other factors will include previous years monitoring, recorded improvements in habitat quality (see *Table 7* of the PTWL BOMP) and recent DZP Site activities, e.g. location of disturbance, recent relocation of surface rocks, recent translocation of individual lizards. As a result, there will be new monitoring points established once habitat quality improvement and placement of relocated and artificial habitat has been completed.

General Search Locations

Broadly, monitoring will focus on the locations where the PTWL populations have been recorded, i.e. the PTWL HAs (see **Figure 4**) which primarily occur within the BOA.



Targeted Artificial Habitat Monitoring

The existing roof tile monitoring programme was commenced in 2013 (see **Figure 4** and **Appendix B**). Annual roof tile monitoring is occurring in three of the four locations where ten sets (where a 'set' is one individual tile and a group of four joined tiles) are inspected. These artificial habitats are used to increase habitat options of PTWL. These locations are named after the pre-mining property name.

1. PTWL HA 6 'Grandale'. Is monitored every three years.
2. PTWL HA 2 'Ugothery' (annually monitored).
 - PTWL HA 2a 'Ugothery North'.
 - PTWL HA 2b Ugothery East Upper'.
 - PTWL HA 2c 'Ugothery East Lower'.
3. PTWL HA 8 'Ugothery'. This is where Pink-tailed Worm-lizard has been recorded under the tiles on two occasions, 2014 and 2016.
4. PTWL HA 1 'Glen Idol'. Two sets of tiles are on the deposit (western half and eastern half) and in an area of passive and to a lesser degree active relocation. Tiles located over the open cut will be progressively relocated to PTWL HA 10, as will targeted artificial habitat monitoring.

As the amount of data collected increases, it will be analysed for any trends relating to location and climatic conditions associated with the presence/absence of the PTWL.

5.2 Methodology

5.2.1 Pink-tailed Worm-lizard Monitoring

The following is taken from Clearing Procedure: Pink-tailed Worm-lizard (OzArk EHM, 2016).

5.2.2 Activity Period

The PTWL can be found throughout the year by searching under rocks, however, it appears to be more difficult to detect during hot dry periods (Osborne et al. 1991). If conditions are too hot or too cold the PTWL is likely to be below the ground surface taking refuge in ant burrows beneath rocks. Peak activity is likely to be late spring and early summer under warm, but not overly dry, conditions. It is not active on the ground surface by day and would only be active between sheltering sites at night.

5.2.3 Survey Methods

The following survey methodology will be implemented.

- Locate tiles (see **Figure 4** and **Appendix B**) and record ambient climatic conditions parameters
- Overturn rock/tile and look for presence/absence of PTWL. Record parameters listed below. Take photograph where possible.
 - Coordinates (in GDA zone 55).
 - Date and time of assessment.

- Air and soil temperature.
- Presence of ant nests / burrows or other insects (type / abundance).
- Other reptiles (species / abundance).
- Underlying geology.
- Soil type / depth / moisture.
- Mapped habitat quality (High / Med / Low / NA).
- Vegetation community (Biometric).
- Management action since last assessment.
- Comments.

5.2.4 Areas Containing Natural Rock Habitat

Areas possessing natural rock habitat (PTWL HAs 2 to 8) will be monitored in accordance with *Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act* (DSEWPAC, 2011).

5.2.5 Habitat Enhancement

Habitat enhancement monitoring is a key component of the PTWL BOMP (refer to *Section 4.4* of the PTWL BOMP).

5.3 Frequency of Monitoring

5.3.1 Pink-tailed Worm-lizard Occurrence

Monitoring of PTWL at DZP will occur annually, around March. If weather conditions are suitable, another survey will occur in October/November. As monitoring is highly dependent on weather conditions, it is difficult to be more prescriptive.

5.3.2 Habitat Quality

Assessment of habitat values as they relate to PTWL using the template will occur at each monitored site annually until completion criteria is attained (see PTWL BOMP).

5.4 Evaluation of Monitoring Results

Monitoring will determine location and quantity of PTWL and changes to habitat. These results will be compared against pre-mining data at DZP data. This comparison will enable trends of detection or detectability.

Habitat scores will be evaluated to determine changes in PTWL habitat values over time. A change in a score will be reviewed to see if additional management actions are required (refer to *Table 7* of the PTWL BOMP).

6. PERFORMANCE TARGETS

The overarching performance target is to increase the area of occupancy for PTWL by restoring native vegetation, connecting adjoining populations through rehabilitated corridors (PTWL HA 1, 2, 3 and 10) and providing natural or artificial rock/tile habitat (PTWL HA 10). This is a surrogate measurement of success due to the cryptic nature of the species. It is not practical nor achievable to list a 'target' number of species to be recorded on site as a measure of success.

The quality of PTWL habitat in DZP was assessed on the EPBC Offset Calculator as:

- 30ha of low condition habitat (quality score = 4/10).
- 113.6ha of moderate condition habitat (quality score = 7/10).
- 80.9ha of good condition habitat (quality score = 9/10).

In practical terms the goal will be to achieve a quality score of 8 or higher in all PTWL HA's within 5 years. These performance targets and corrective actions are detailed in *Section 5.7* of the DZP Biodiversity Management Plan and *Section 4* of the PTWL BOMP.

7. REPORTING

Progress reports will be prepared for AZL after each survey and collection period, i.e. at the end of spring and/or autumn. These reports will detail the areas surveyed, the animals collected and their relocation positions. It will also suggest management actions that should be implemented.

An annual report will be prepared by AZL in June of each year to be submitted to both DEE and OEH. This will contain the results of the survey and collection periods for the year and recommend any changes to habitat modifications that may be required.

The report will provide comment on PTWL population or detectability trends and if habitat quality has met or is trending towards a condition score of 8/10 or greater (shown in the 25pt survey sheet results – refer to **Appendix A**).

8. ENVIRONMENTAL TRAINING

All 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 DZP 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.

9. AUDIT AND REVIEW

9.1 Auditing

A PTWL Status Report will be provided annually in the Annual Review for the DZP.

The Annual Review is a requirement of Condition 4 of Schedule 5 of SSD-5251 and will be submitted to the DPE. Other government agencies are also provided a copy of the Annual Review, these government agencies include but are not limited to:

- Department of Industry – Division of Resources & Energy (DRE).
- Dubbo Regional Council (DRC).
- NSW Office of Environment and Heritage (OEH).
- Australian Government Department of the Environment and Energy (DEE).

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

9.2 Plan Review

This PTWL MP will be reviewed and, if required, revised within three months of:

- The submission of an annual review.
- The submission of an incident report.
- The submission of an independent audit report.
- Any modification to the conditions of approvals.

This review will include the adequacy of strategies, plans and programs as required under the conditions of approvals. 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 PTWL MP.

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Appendix A

Pink-tailed Work-lizard Habitat Quality Assessment Template

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Pink-tailed Worm-Lizard Habitat Scoring Template

Habitat Indicators	Weighting Method		Overall Weighting
Although the habitat of <i>A. parapulchella</i> is thought to be relatively specific, individuals have been collected in habitats considered less than ideal. <i>Record of Presence</i> are therefore the most important indicator of habitat quality and is therefore given the greatest weighting.	History of Identification	Record <50 years = 1	/5
		Record <20 years = 2	
		Record <10 years = 3	
		Record <5 years = 4	
		Record <2 years = 5	
	Well-Draining Soil	Moderate Slope Present = 1	/1
Sandy Loam = 2		/2	
Sandy Clay Loam = 1			
<i>A. parapulchella</i> prefers a grassy ground layer with little to no leaf litter, and relatively low tree and shrub cover (Osborne et al 1991; Osborne and McKergow 1993; Michael and Herring 2005; Robertson and Heard 2008).	Absence of Dense Canopy Coverage	<60% Canopy Coverage = 1	/3
		<40% Canopy Coverage = 2	
		<20% Canopy Coverage = 3	
A high diversity and abundance of native grasses such as Kangaroo Grass (<i>Themeda australis</i>) is also an indicator of habitat quality (Osborne and McKergow 1993; Jones 1999; Osborne 1991).	Diverse Grassy Groundcover	>25% Coverage or > 3 grass species (20 x 20 Area) = 1	/3
		>50% Coverage or > 6 grass species (20 x 20 Area) = 2	
		>75% Coverage or > 10 grass species (20 x 20 Area) = 3	
Surface rocks are believed to be important for thermoregulation of <i>A. parapulchella</i> (thigmothermy: gaining heat from contact within the underside of surface rocks) (Jones 1992).	Loose Surface Rock ¹	No suitable rocks present = 0	/5
		Occasional suitable rocks present = 1	
		<6 or >10 suitable rocks present (per 10m ²) = 3	
		6-10 suitable rocks present (per 10m ²) = 5	
The occurrence of <i>A. parapulchella</i> appears to be correlated to the underlying geology with most occurrences on intermediate volcanics. Records suggest that <i>A. parapulchella</i> is sometimes found where the underlying geology is basalt, almost never on sedimentary rocks and never on alluvial soils.	Underlying Geology	Alluvial = 0	/5
		Sedimentary = 1	
		Basalt = 3	
		Intermediate Volcanics (trachyte) = 5	
The diet of <i>A. parapulchella</i> consists almost exclusively of ant broods (Web and Shine 1994; Wong 2011).	Presence of ant nests ²	Ant nests absent = 0	/1
		Ant nests present = 1	
Total			/25
Note 1: Suitable surface rocks are those roughly dinner plate in size which are readily turned over by hand			
Note 2: The importance of ants as a feed source for the <i>A. parapulchella</i> is acknowledged; however, as the relative importance of ant species or density of ants is unknown, further detailed scoring is not able to be completed at this time. In any event, it is considered likely that the factors influencing the occurrence of <i>A. parapulchella</i> are likely to similarly influence the ant species or collection of ant species on which <i>A. parapulchella</i> feeds, hence to attribute any further weighting to the occurrence of ants could be a form of double counting			



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Appendix B

Survey and Tile Site Locations

