

MANGOOLA OPEN CUT

GLENCORE



Translocation of Threatened Flora Species

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1. Introduction and Background

Mangoola Open Cut (Mangoola) is an open cut coal mine owned and operated by Mangoola Coal Operations Pty Limited. Mangoola is located near Wybong, approximately 20 kilometres west of Muswellbrook and approximately 10 kilometres north of Denman in the Muswellbrook Local Government Area (refer to *Figure 1.1*).

Project Approval 06_0014 (PA 06_0014) was granted in June 2007 for the construction of an open cut coal mine and associated infrastructure in the Wybong area. Mangoola Coal Operations Pty. Limited is the owner/operator of the Mangoola site. The site also operates a Coal Handling and Preparation Plant (CHPP) and Train Loading Facility and since April 2014, has been approved to extract up to 13.5 Mtpa ROM coal under PA 06_0014.

As part of the PA 06_0014, Mangoola was required to provide a detailed description of measures that would be implemented over the next 3 years for:

“salvaging, transplanting and/or propagating threatened flora and native grassland, based on additional survey and research.”

This salvage and translocation process was originally documented within the Rehabilitation and Offset Management Plan for Mangoola Mine (Umwelt 2012a), and was refined as a result of PA 10_002 for the relocation of the ETL which was granted by the DP&I on 16 July 2012. With Schedule 3, Condition 40A of PA 10_002 specifically requiring the preparation of a Translocation Plan prior to construction of the 500kV power line. All works associated with the 500kV power line construction have been completed.

This current Translocation Plan amalgamates the requirements of these prior approvals. It has also been updated as an outcome of learnings from translocation works which have already been undertaken. This Translocation Plan supersedes prior translocation documents and will be utilised for all future translocation works required for threatened flora species within the Approved Project Disturbance Boundary (*Figure 1.2*).

This report draws together all relevant information and procedures relating to the salvage, translocation and monitoring of threatened species at Mangoola into one document.

1.2 Purpose

The purpose of this Translocation Plan is to:

- a) provide employees and contractors with a clear and concise description of their responsibilities in relation to the translocation of threatened flora species during activities within the Approved Project Disturbance Boundary; and
- b) address the relevant conditions of PA 06_0014 (Schedule 3, Condition 38).

This document is intended to be read in conjunction with the Mangoola Biodiversity Offset Management Plan and Strategy and the Mangoola Open Cut Environmental Management Strategy.

1.3 Related Documents

The following documents all contain information relevant to this Translocation Plan:

- a) Pre-Clearance Survey, Land Clearing and Topsoil Stripping Procedure
- b) Pre-Clearing Survey Form
- c) Tiger Orchid Translocation and Monitoring Form
- d) A strategy for the translocation of threatened terrestrial orchids at Mangoola Coal, Upper Hunter Valley (Eastcoast Flora Survey 2010)



Figure 1-1 – Locality Plan

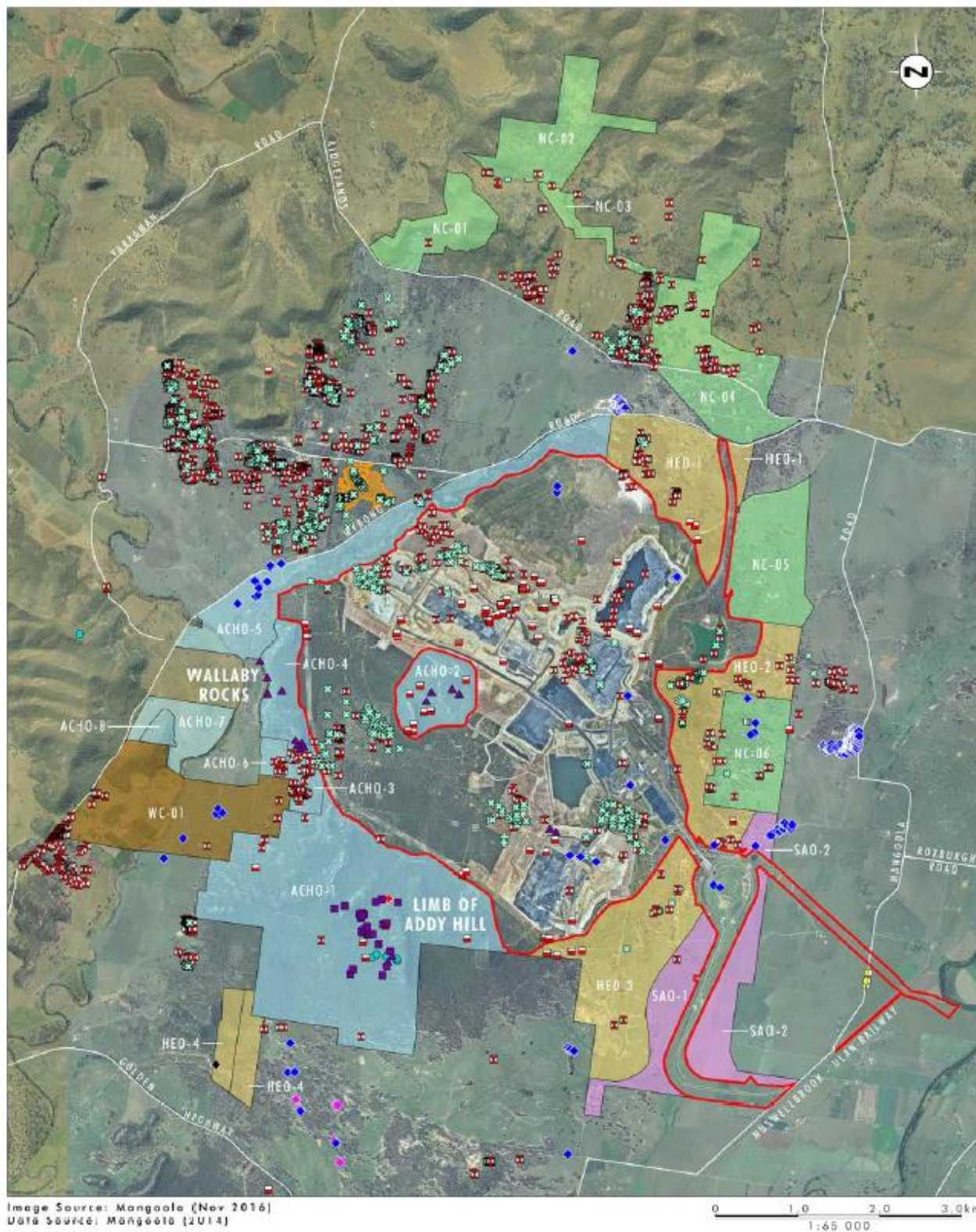


Figure 1-2 – Threatened Flora Species Locations in the Approved Project Disturbance Area and Biodiversity Offset Areas

1.4 Legislative Requirements

The requirement for this Translocation Plan arises from the following Project Approval and EA conditions in *Table 1.1*.

Table 1.1 Project Approval Conditions

Project Approval Conditions	Section of this Document
Schedule 3, Condition 38 (PA 06_0014)	
The proponent must implement the mitigation and management measures for the identified orchids and other threatened flora species within the project disturbance area in accordance with the approved Translocation Plan for Orchids and Other Threatened Flora, dated September 2012 and prepared by Umwelt, to the satisfaction of the secretary.	All
EA Statement of Commitments	
All examples of the tiger orchid (<i>Cymbidium canaliculatum</i>) occurring within areas to be cleared should be included in the translocation program for the Mangoola Mine, as per the ROMP.	All

2. Relevant Threatened Flora Species and Populations

The following threatened flora species or endangered populations have been included in this Translocation Plan as they have all been recorded within the Mangoola Mine or its Biodiversity Offset Areas and Corridors, and have either known or potential habitat within Approved Project Disturbance Areas.

This version of the Translocation Plan no longer includes lobed blue-grass (*Bothriochloa biloba*), as this species has been de-listed since the previous plan was prepared and is no longer listed as threatened under either the TSC Act or the EPBC Act.

2.1 Tiger Orchid (*Cymbidium canaliculatum*)

Tiger orchids were identified within the Approved Project Disturbance Area, Biodiversity Offset Areas and Corridors prior to project approval with numerous recorded subsequently during pre-clearing surveys. This species is regularly identified in the dry sclerophyll forests present at Mangoola. The current locations of all known tiger orchids are shown on *Figure 1.2*. This species was targeted for its potential to be translocated due to its known occurrence in the Approved Project Disturbance Area as well as the relative ease with which it can be relocated as discrete units. Mangoola subsequently committed to attempt to salvage and translocate all tiger orchids identified within the Approved Project Disturbance Area, where safe to do so, into the secure habitats of the Biodiversity Offset Areas and Corridors.

2.1.1 Description and Habitat

The tiger orchid is an epiphytic orchid growing in forks and on branches of a wide variety of tree species in dry sclerophyll forest or woodland (Bishop 2000, Harden 1993). The population of the tiger orchid in the Hunter Catchment is at the south-eastern limit of the documented geographic range for this species. It occurs in central and northern parts of Australia, including the tablelands and western slopes of New South Wales (NSW), Queensland, Northern Territory and Western Australia. In NSW, the tiger orchid occurs mostly to the north of the Hunter Valley, generally favouring the drier forests and woodlands of the tablelands and western slopes (Bishop 2000).

The flowering period of this species is typically September to November; however it has been known to flower outside this time.

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The roots of this species grow into the dead/decaying tissue of the host tree, typically in the hollow centre of the trunk, however some specimens have shown root growth between the hard wood and bark in ironbarks (*Eucalyptus crebra*). The roots in larger specimens have been observed growing three to four metres down the hollow trunk of the host tree and therefore it is important to retain as much of the trunk of the host tree as possible during translocation works.



Figure 2.1 – *Cymbidium canaliculatum*

2.1.2 Conservation Status

All individuals in the population of tiger orchid in the Hunter Catchment are included as an endangered population, listed under the TSC Act (NSW Scientific Committee 2006).

This population is of significant conservation value because it is one of the few epiphytic orchids occurring at temperate latitudes. The tiger orchid is very poorly protected in conservation reserves in the Hunter Catchment (Peake 2006).

The number of tiger orchids in the Hunter Catchment is currently estimated to be very low, as few as 90 individuals (NSW Scientific Committee 2006). However based on local records, the population is estimated to be between 300 and 500 individuals, assuming an average density of about one plant per 30 km² of estimated habitat for tiger orchid population in the Hunter Catchment (T Peake pers. comm. 2011).

2.2 Pine Donkey Orchid (*Diuris tricolor*)

The Pine Donkey orchid has been identified with regularity within the Approved Project Disturbance Area as well as the Biodiversity Offset Areas and Corridors. Over the course of six flowering seasons (2009-2015), a total of 20,911 Pine Donkey orchids have been located within the Approved Project Disturbance Area, Biodiversity Offset Areas and Corridors (Bell 2016). The recorded locations of this species generally occur in grassland or on the edges of open woodland.

2.2.1 Description and Habitat

The Pine Donkey orchid is a terrestrial orchid species with between one and three leaves. The flower stalk of this species is between 20 and 40 cm high and carries between two and six flowers. Flowers are bright yellow to orange in colour with speckled white and red/purple markings.

The Pine Donkey orchid typically grows in sclerophyll forests among grasses often in association with *Callitris* spp., often on sandy soils either on flats or low rises. This species typically flowers between the months of September and November.



Figure 2.2 – *Diuris tricolor*

2.2.2 Conservation Status

The Pine Donkey orchid is listed as vulnerable under the TSC Act. Those records occurring in the Muswellbrook LGA also comprise the TSC Act listed endangered population of this species (NSW Scientific Committee 2007).

This species occurs in both NSW and in Queensland, in NSW this species is distributed across the Northern Tablelands, Central Tablelands, North Western Slopes and Central Western Slopes. The endangered population, occurring in the Muswellbrook LGA is thought to have an area of occupancy of less than 50 km², and consequently has a highly limited distribution (NSW Scientific Committee 2007).

2.3 Tarengo Leek Orchid (*Prasophyllum petilum*)

This species has been identified within the Approved Project Disturbance Area as well as the Biodiversity Offset Areas and Corridors. These records typically occur in association with *Diuris tricolor* in high quality areas dominated by native grassland areas with open tree cover or on the edges of open woodlands.

This species was formerly referred to as *Prasophyllum* sp. *Wybong* and was thought to be a previously undescribed species as it was not known to occur in the Hunter region. It has subsequently been taxonomically amalgamated with *Prasophyllum petilum*.

2.3.1 Description and Habitat

The Tarengo Leek orchid is a terrestrial orchid species that grows to approximately 30 cm high. It has a singular, cylindrical leaf and a single flower spike with numerous sweetly scented flowers (DECCW 2010).

This species is known to occur in areas of open eucalypt woodland and grassland within NSW and the ACT. In NSW it is only known to occur near Boorowa, Captains Flat, Ilford, Delegate and Wybong and in the ACT it occurs at Hall (OEH 2016a).



Figure 2.3 – *Prasophyllum petilum*

2.3.2 Conservation Status

The Tarengo Leek orchid is listed as endangered under the TSC Act and as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (as *Prasophyllum sp. Wybong*).

The Wybong occurrence is highly restricted in distribution, with an estimated area of occupancy of 1.5 km² (Threatened Species Scientific Committee 2009). Population estimates are based upon surveys undertaken in 2006 of 460 mature individuals from seven populations in areas of open eucalypt woodland and grassland (Holzinger, pers. comm. 2006, 2009; Copeland, pers. comm. 2009 in Threatened Species Scientific Committee 2009).

2.4 Other Threatened Flora Species

Other threatened flora species (or endangered populations) that may be considered for translocation (albeit minor potential only) include *Commersonia rosea*, Scant pomaderris (*Pomaderris queenslandica*), Denman pomaderris (*Pomaderris reperta*), *Lasiopetalum longistamineum*, Small purple pea (*Swainsona recta*), *Ozothamnus tessellatus*, Austral toadflax (*Thesium australe*) and the endangered population of Weeping myall (*Acacia pendula*). These species have either been recorded within the Approved Project Disturbance Area or have potential habitat present. No other species are considered to have the potential to be impacted by the project.

2.4.1 Weeping Myall (*Acacia pendula*)

This species has been identified throughout the Approved Project Disturbance Area as well as the Biodiversity Offset Areas and Corridors. Where present, this species usually occurs as clusters rather than individual trees/shrubs.

2.4.1.1 Description and Habitat

Weeping myall is an erect/spreading tree 5 to 13 m in height (Harden 2002). Phyllodes are narrowly elliptic and can be straight or curved and bark is hard and fissured (Botanic Gardens Trust 2017). This species mostly flowers between spring and autumn with bright yellow inflorescences between two and five occurring on an axillary axis 3 to 15 mm long (Botanic Gardens Trust 2017).

Within the Hunter catchment, this species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations (NSW Scientific Committee 2005).



Figure 2.4 – *Acacia pendula*

2.4.1.2 Conservation Status

Weeping myall is listed as an endangered population under the TSC Act when occurring in the Hunter catchment. The Hunter catchment population is estimated to have a size of approximately 1,000 individuals from six locations and to be near the limit of its geographic distributional range (Appletree Creek, Appletree Flat, Edderton, Jerrys Plains, Warkworth and Wybong) (NSW Scientific Committee 2005).

2.4.2 *Commersonia rosea*

A single record of this species was made during surveys for the original Anvil Hill Ecological Assessment (Umwelt 2006). This record is located within Aboriginal Cultural Heritage Offset ACHO-1 and consequently does not occur in the Approved Project Disturbance Area. However, this species has potential to occur elsewhere in suitable habitat within the Approved Project Disturbance Area.

2.4.2.1 Description and Habitat

Commersonia rosea (listed as *Androcalva rosea* under the EPBC Act) is a prostrate shrub with trailing branches up to 60 cm in length. Branches of this shrub are densely hairy on young growth and become almost hairless on older branches. Inflorescences of this species consist of one to three flowers with each flower having five pink three-lobed petals (Threatened Species Scientific Committee 2008a).

Commersonia rosea occurs on skeletal soils in scrubby/heath vegetation. It often grows in association with narrow-leaved ironbark (*Eucalyptus crebra*) and black cypress pine (*Callitris endlicheri*) (Threatened Species Scientific Committee 2008a).



Figure 2.5 – *Commersonia rosea*

2.4.2.2 Conservation Status

Commersonia rosea is listed as an endangered species under the TSC Act and EPBC Act. This plant is only known from four localities occurring in the Sandy Hollow district, all are within 8 km of Sandy Hollow. It is estimated that the total population size of this species is 200 plants (Bell and Copeland 2004 in NSW Scientific Committee 2004) and it is not known to occur within a conservation reserve.

2.4.3 Scant Pomaderris (*Pomaderris queenslandica*)

This species has been documented within Aboriginal Cultural Heritage Offset Areas ACHO-2 and ACHO-4 and in the south of the Approved Project Disturbance Area. Where present, this species has typically been identified in clusters.

There is potential that this species may occur at other locations within the Approved Project Disturbance Area.

2.4.3.1 Description and Habitat

Scant pomaderris is a shrub that grows up to 3 m in height. Its stems are whitish with narrow-elliptic to ovate leaves with an upper-glabrous surface and its lower surface covered with white curly hairs. Flowers are cream and usually occur in terminal panicles, usually with an absence of petals (Botanic Gardens Trust 2017).

This species is found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks (OEH 2016a).



Figure 2.6 – *Pomaderris queenslandica*

2.4.3.2 Conservation Status

Scant pomaderris is listed as an endangered species under the TSC Act. This species is widely scattered but not common in north-east NSW and in Queensland. It is only known from a few locations on the New England Tablelands and north-west Slopes, including near Torrington and Coolatai, and also from several locations on the NSW North Coast. It's only known area of conservation in the Hunter is in Manobalai Nature Reserve (OEH 2016b).

2.4.4 Denman Pomaderris (*Pomaderris reperta*)

The Denman pomaderris has only been documented within Aboriginal Cultural Heritage Offset Areas ACHO-1. Although it has not been identified, there is potential that this species may occur within the Approved Project Disturbance Area.

2.4.4.1 Description and Habitat

Denman pomaderris is a perennial shrub that grows to three metres in height. Younger stems are densely villous with rusty simple and stellate hairs. Leaves are ovate to broad-ovate, elliptic to broad-elliptic or obovate to broad-obovate, with upper surface green with velvet short hairs and lower surface pubescent. Flowers are creamish in colour and occur in short dense panicles with petals usually absent (NSW Scientific Committee 2010).

Denman pomaderris occurs in woodlands in association with narrow-leaved ironbark (*Eucalyptus crebra*), Blakely's red gum (*Eucalyptus blakelyi*), native olive (*Notelaea microcarpa*) and black she-oak (*Allocasuarina littoralis*). It usually grows in association with sandy loam soils on sandstone or conglomerate or colluvial soils on similar substrate (NSW Scientific Committee 2010).



Figure 2.7 – *Pomaderris reperta*

2.4.4.2 Conservation Status

Denman pomaderris is listed as a critically endangered species under both the TSC Act and the EPBC Act.

This species has a highly restricted geographic distribution and is not expected to have a total extent of occurrence of more than 12 km² (NSW Scientific Committee 2010). It is not known to occur in any conservation reserves.

2.4.5 *Lasiopetalum longistamineum*

This species has also been identified in Aboriginal Cultural Heritage Offset Areas ACHO-1, in similar habitat as the Denman pomaderris. Although it has not been identified there is potential that this species may occur within the Approved Project Disturbance Area.

2.4.5.1 Description and Habitat

This species grows to 1.5 m high with dense rusty star-shaped hairs on its branches. Leaves are rounded to heart-shaped at the base with a pointed tip. Upper leaf surface is green with hairs absent to sparse and lower surface is covered in dense white star-shaped hairs and raised rusty veins. Flowers occur on spike-like branches with egg-shaped bracteoles covered in dense star-shaped hairs (Threatened Species Scientific Committee 2008b).

Lasiopetalum longistamineum grows in woodlands and rainforests in rich alluvial deposits and is associated with *Callistemon* spp. and *Leptospermum* spp. (Harden 1990 and DECC 2005 within Threatened Species Scientific Committee 2008b).



Figure 2.8 – *Lasiopetalum longistamineum*

2.4.5.2 Conservation Status

Lasiopetalum longistamineum is listed as vulnerable under both the TSC Act and the EPBC Act.

This species is known from the Mt Dangar-Gungal area within Merriwa and Muswellbrook LGA with a small number of plants known to be conserved within Goulburn River National Park.

2.4.6 Small purple-pea (*Swainsona recta*)

A single record of this species is known to occur in Habitat Enhancement Offset Area HEO-4. Although it has not been identified there is potential that this species may occur within the Approved Project Disturbance Area.

2.4.6.1 Description and Habitat

The small purple-pea is a perennial herb that grows to 30 cm in height. Its leaves are divided into six pairs of 10 mm long and are very narrow with a pointed tip. A single leaflet also occurs at the end of each divided leaf. Flowers are purple and comprise either one or two sprays of between 10 to 20 pea-shaped flowers. This species flowers between late September and early December (OEH 2016a).

This species grows in association with kangaroo grass (*Themeda australis*), *Poa* spp. and spear grasses (*Austrostipa* spp.) (OEH 2016a). This species dies back in summer, surviving as a root stock until they shoot again in autumn.

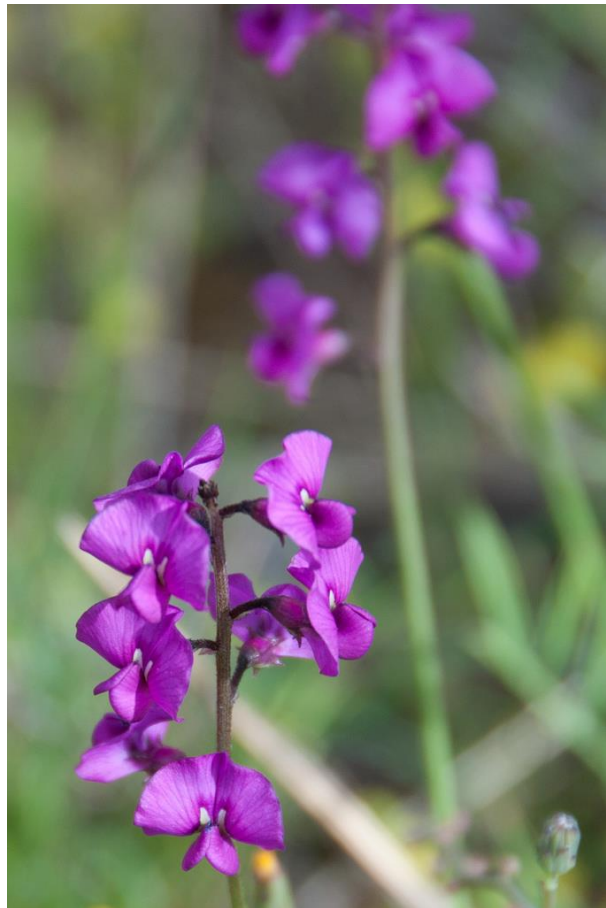


Figure 2.9 – *Swainsona recta*

2.4.6.2 Conservation Status

The small purple-pea is listed as endangered under both the TSC Act and the EPBC Act.

Currently there are approximately 9,500 plants remaining across a total of 26 sites distributed across NSW, ACT and Victoria (OEH 2012).

2.4.7 *Ozothamnus tessellatus*

Two records of this species were made in the south of the Approved Project Disturbance Area by Stephen Bell in 2013. Although these are the only known records of this species at Mangoola, there is potential that this species occurs elsewhere within the Approved Project Disturbance Area.

2.4.7.1 Description and Habitat

This species is a dense shrub with woolly branches, growing to 1 m in height. Leaves are oblong between 4 to 5 mm long, less than 1mm wide and with margins rolled backward. Upper leaf surface is green, and the lower surface is white and woolly. Flower heads are dense and grow in hemispherical corymbs each consisting of approximately 60 bisexual florets (Threatened Species Scientific Committee 2008c).

Habitat requirements of this species are poorly known and are described as occurring in eucalypt woodland (OEH 2016a).



Figure 2.10 – *Ozothamnus tessellatus* (photo: Stephen Bell)

2.4.7.2 Conservation Status

Ozothamnus tessellatus is listed as a vulnerable species under both the TSC Act and the EPBC Act and is only known to a few locations to the east and west of Bylong and between west Bylong and east Ravensworth.

This species has been collected from eight sites in a restricted area over a range of 300 km². It is known to be conserved within Goulburn River National Park and Munghorn Gap Nature Reserve (Threatened Species Scientific Committee 2008c).

2.4.8 Austral toadflax (*Thesium australe*)

A single record of this species has been made in Northern Corridor NC-O6. Although it has not been identified elsewhere throughout Mangoola, this species is highly cryptic and there is potential it occurs elsewhere within the Approved Project Disturbance Area.

2.4.8.1 Description and Habitat

This species is a root parasite and cryptic herb to 40 cm tall. Leaves are pale green to yellow-green and succulent, 1 - 4 cm long and 0.5 - 1.5 mm wide. Flowers are minute and white, emerging where the leaves meet the stems and appearing in spring. The fruit is small and nut-like, developing in summer (OEH 2016a).

Austral toadflax is found in grasslands on coastal headlands as well as grasslands and grassy woodland away from the coast (OEH 2016a).



Figure 2.11 – *Thesium australe*

2.4.8.2 Conservation Status

Austral toadflax is listed as a vulnerable species under both the TSC Act and the EPBC Act.

Austral toadflax has been recorded from several conservation reserves, including Kosciuszko, Namadgi, Crowdy Bay, Hat Head and Kwiambal National Parks. It is also known from Kattang Nature Reserve, Moonee Creek Nature Reserve and Linton Nature Reserve.

3. Translocation Plan

3.1 Licensing Approvals

Approval to remove these species from the Approved Project Disturbance Area is inherent as part of Project Approval. In addition to this, specific translocation commitments have been made as part of the approvals process, with input from the relevant agencies. As such a separate licence to remove and/or translocate these plants is not necessary. Due to the conservation status of the flora species within this translocation program however, this plan has been developed to ensure that an appropriately rigorous and reportable process is undertaken to ensure the greatest likelihood of success of this project.

3.2 Expertise Required

All threatened flora species, salvage and translocation works must be supervised/undertaken by appropriately qualified and experienced personnel. This includes either an ecologist with suitable species-based expertise and/or a horticulturalist (or similar) with experience in salvage and translocation of epiphytic and terrestrial species.

3.3 Identification of threatened flora species in approved project disturbance area

Individuals of threatened species that are required to be salvaged and translocated will be identified from pre-clearing surveys. Pre-clearing surveys will be undertaken in accordance with the Mangoola Pre Clearing Survey Procedure which must occur prior to the clearing of native vegetation and be documented on the Pre Clearing Surveys Form. Optimally, pre-clearing surveys should occur during September/October to maximise the potential for identification of Pine Donkey orchid (*Diuris tricolor*) and Tarengo Leek orchid (*Prasophyllum petilum*) which is when these species have above-ground leaves and flowers. Vegetative growth and flowering are highly dependent on suitable climatic conditions and rainfall amounts leading up to the flowering season.

3.3.1 Identification of previously undocumented threatened flora

If previously unrecorded threatened flora or endangered populations are identified within the area to be cleared, suitably qualified and experienced personnel will be consulted to provide advice on an appropriate course of action.

3.3.2 Demarcation of threatened species for translocation

3.3.2.1 Tiger orchid demarcation

Tiger orchids will be demarcated in the field using the following methods:

- a) the tree containing the tiger orchid will be marked with Danger tape and "TO" painted on the trunk; and
- b) the tree containing the tiger orchid will be marked with a metal tag embossed with a unique identifying number.
- c) Details recorded for individually identified tiger orchids will include the following information:
 - coordinates of the tiger orchid (including accuracy of the GPS)
 - unique identifying number
 - details on the vegetation community of the donor site
 - information on the exposure and aspect of the tiger orchid

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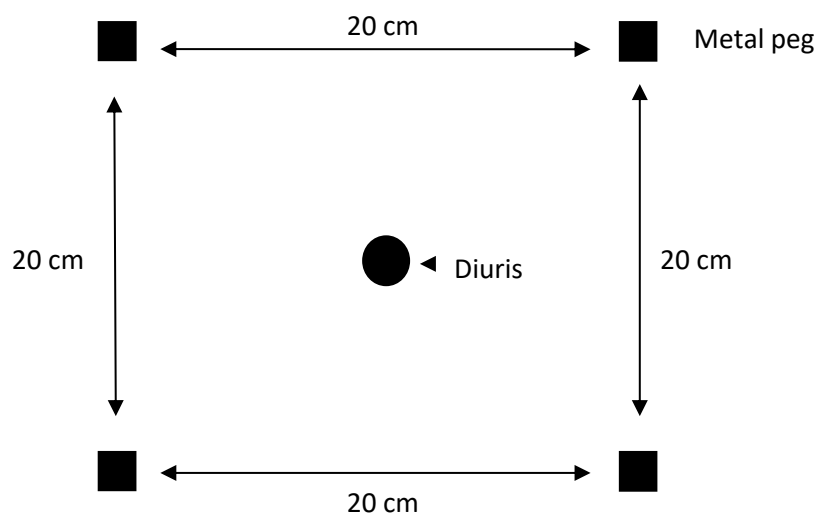
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- notes on preferred mechanisms for removal (machinery, arborist etc.)
- notes on any potential health and safety issues such as presence of beehives etc.

3.3.2.2 Terrestrial orchid demarcation

Pine Donkey and Tarengo Leek orchids will be demarcated using the following methods:

- a unique identifying number will be assigned to each plant via a metal tag embossed with the number
- metal tent pegs will be securely inserted 10 to 15 centimetres from each plant and metal ID tag attached to tent peg using wire
- three additional guide pegs will then be inserted around each orchid to form a square no smaller than 20 by 20 centimetres centred on the plant (see *Schematic 3.1* below). This will indicate the ideal dimensions of the soil to be removed to prevent damage to the orchid tubers and maintain optimal mycorrhizal association in the soil. Pink flagging tape is to be used to define the square to aid in relocation of the pegs during the salvage operations.



Schematic 3.1 – Placement of tent pegs surrounding terrestrial orchids

Details recorded for identified records of terrestrial orchid will include the following information:

- unique identifying number assigned to plant
- co-ordinates recorded and waypoint of ID number taken with handheld GPS (including accuracy of GPS)
- details on the vegetation community where it is occurring
- information on the exposure and aspect of the terrestrial orchid
- health, reproductive stage, and any other information pertinent to salvage operations noted on the proforma.

3.3.2.3 Other threatened species demarcation

If relevant, other threatened flora species identified that are proposed for translocation should be demarcated in accordance with their growth form, in this instance herbs/forbs or shrubs.

Herbs/forbs known to occur are the Small purple-pea and Austral toadflax. Herbs/forbs should be demarcated in the same way as for terrestrial orchids.

Shrubs known to occur are the Weeping myall (*Acacia pendula*), *Commersonia rosea*, Scant pomaderris (*Pomaderris queenslandica*), Denman pomaderris (*Pomaderris reperta*), *Lasiopetalum longistamineum* and *Ozothamnus tessellatus*. Shrubs should be demarcated with a single loop of caution tape as well as with survey pegs to estimate the extent of the root zone.

For all individual plants proposed for translocation, the following should be documented prior to salvage occurring:

- a) unique identifying number assigned to plant
- b) co-ordinates recorded and waypoint of ID number taken with handheld GPS (including accuracy of GPS)
- c) details on the vegetation community where it is occurring
- d) information on the exposure and aspect of the plant
- e) health, reproductive stage, and any other information pertinent to salvage operations noted on the proforma.

3.3.3 Identification of recipient sites and trees

The identification of the recipient sites should preferentially occur prior to salvage and must take the following factors into consideration:

- a) suitable recipient sites will need to be subject to due diligence surveys for both ecological and Aboriginal cultural heritage purposes if there is the potential for ground disturbance to occur (from vehicles, heavy equipment etc.). This due diligence will initially be undertaken through a constraint's analysis using GIS records followed by field verification where required. This will ensure translocation works do not impact on other issues of significance
- b) the recipient site must be located within the Biodiversity Offset Areas, Corridors or rehabilitation areas
- c) the recipient site should be located in an accessible area, close to formed vehicle tracks and should minimise disturbance to existing native vegetation and host trees
- d) recipient trees should be large enough to support the weight of proposed translocated tiger orchids
- e) The following factors should also be taken into consideration:
 - Recipient sites should aim to have environmental conditions (vegetation community, soil type and aspect) as close to host conditions as possible
 - If possible, recipient sites should be in proximity to existing records, as these will act as control sites for future monitoring works (detailed in **Section 4.0**)
 - Security and fencing of recipient sites if required

Considering that each individual plant occurs in a unique position and recipient sites and trees are required to possess similar environmental conditions to the donor site, it is not possible to determine exact recipient sites until the commencement of the translocation process. Due to the progress of the mined land rehabilitation areas, suitable recipient areas now exist within a large area of the North Pit rehabilitation and future translocation activities should focus in this area.

3.3.3.1 Control sites

Where possible, translocated species should be positioned near to naturally occurring plants of the same species in the Biodiversity Offset Areas and Corridors. These naturally occurring (control) individuals should be monitored in conjunction with the translocated individuals at these sites. The extent of dieback, growth rates or flowering events of the translocated individuals can be recorded and compared to those of the control individuals. Observing naturally occurring individuals in conjunction with translocated individuals will assist in determining if observed changes in the translocated individuals are a result of natural environmental conditions or the translocation process.

3.4 Tiger Orchid

The procedure for salvaging and relocating trees (or parts thereof) supporting the tiger orchid is in *section 3.4.2* below. The form for documenting salvage activities is the Tiger Orchid Translocation and Monitoring Form. This form provides the relevant reporting detail for the process and contains provision to record all the results obtained over the monitoring period. Each individual tiger orchid salvaged requires a separate record form.

3.4.1 Equipment required for Tiger Orchid salvage

The equipment required for the salvage and translocation of tiger orchids will vary for each orchid. The position, height, host species, soil type and landscape position of each tiger orchid will determine the complexity of the salvage and translocation works required. Equipment required may include:

- a) chainsaw
- b) excavator with grab
- c) flat deck truck
- d) hessian cloth
- e) ratchet straps
- f) wire
- g) wire strainers.

The most appropriate equipment will be determined when the tiger orchid to be salvaged is assessed by suitably qualified personnel. See *figure 3.1* below.



Figure 3.1 – salvage of tiger orchid ensuring maximum amount of original host tree maintained

3.4.2 Salvage procedure

The procedure for salvaging and relocating trees (or parts thereof) supporting the tiger orchid is as follows.

- a) The salvage and translocation of the tiger orchid must be supervised by suitably qualified and experienced personnel.
- b) Ensure risk assessment has been carried out prior to removal of tiger orchid and ensure Identify and mark tree containing the tiger orchid (from known records and pre-clearing surveys – MANOC-1772150304-4329 Pre-Clearing Survey Form).
- c) Photograph each tiger orchid and record assigned identification number per photograph.
- d) Identify host site, prior to removing the tiger orchid. This will include identification of the appropriate attachment method. For entire trees (or large sections thereof), excavation and burying into the ground may be required, whereas smaller trunk sections may be securely fastened into existing trees, providing they are deemed able to support the additional weight, without causing damage.
- e) Assess the need to secure the tiger orchid in place within the tree to be felled, prior to salvage. This may include wiring the tiger orchid into place or wrapping it securely in hessian.
- f) Carefully remove the tree (or part thereof) with a chainsaw, without disturbing the orchid.
- g) The tree (or part thereof) and/or tiger orchid should be very carefully moved to the host site with minimal delay, and without causing disturbance or damage to the tiger orchid.
- h) The tiger orchid should be re-attached in the selected host position (existing tree) or buried into the ground for larger sections (similar to stag tree installations).
- i) Record the new location of the tiger orchid and assign to its identification number. Ensure new location is recorded and communicated for management purposes.
- j) Take a photographic record of the new location of the tiger orchid.
- k) Complete regular monitoring of the health of the tiger orchid as per BOMPS, including the integrity of the attachment to the new host tree.

3.4.3 Stockpiling of salvaged Tiger Orchids

Each tiger orchid is to be carefully moved to the recipient site with minimal delay following salvage, however this is not always possible. If necessary, salvaged tiger orchids can be carefully stockpiled for future translocation providing that the tiger orchid is stored outside, in an area safe from impacts (such as sunburn, grazing or accidental damage), and in areas subject to a similar array of environmental conditions as the host tree.

Stockpiling should occur for as briefly as possible and only translocated during suitable environmental conditions, i.e. preferably cooler months, and life cycle stage, i.e. not during the flowering period.

3.4.4 Translocation Procedure

The translocation of salvaged tiger orchids will be undertaken in accordance with the Tiger Orchid Salvage and Translocation Procedure.

The specific translocation techniques used will depend on the size and nature of the salvaged tiger orchid. When commencing translocation activities, the suitability of the procedure will need to be considered, and if required, refined according to the needs of each individual case. The process will need to incorporate the techniques that have been found to be most successful from previous translocations and include any additional requirements to suit the individual situation.

Most translocations will involve transferring a section of the salvaged tiger orchid in its original host tree. The translocation will often involve supporting the salvaged tiger orchid in a section of salvaged timber, against an

existing tree fork. In such cases, the tiger orchid should be greater than 1.5 metres off the ground wherever possible, to reduce potential grazing impacts. Due to the size and shape of the salvaged tree host, or due to equipment access restrictions some orchids will not be able to be elevated above potential grazing height. See *figures 3.2 and 3.3*.

Translocated tiger orchids will be issued a unique identification number then be subject to regular monitoring to determine the success of the operation, and to refine and advise the salvage/translocation process for future use. The tiger orchid monitoring program is detailed in *section 4.1*.



Figure 3.2 – translocated orchid in original section of host tree leaning up against support tree above grazing height



Figure 3.3 – translocated orchid in original section of host tree lower to the ground

3.4.4.1 Recipient areas

All biodiversity offsets, corridors and establishing mine rehabilitation areas are suitable recipient areas for the translocation of tiger orchids.

For biodiversity offset areas and corridors, the Ground Disturbance Permit (GDP) process shall be followed for translocations of tiger orchids which require the use of machinery and are unable to be transported to the recipient site by hand. This will ensure appropriate due diligence for archaeological and environmental impacts where machinery is required to be used. In any case, only rubber tired or tracked vehicles shall be used in the biodiversity offset and corridor areas.

3.5 Threatened terrestrial orchids

The procedure for salvaging and relocating threatened terrestrial orchids is outlined in *A Strategy for the Translocation of Threatened Terrestrial Orchids at Mangoola Coal, Upper Hunter Valley* (Eastcoast Flora Surveys 2010). The overall aim of this strategy is the successful translocation of at least 1000 plants of each Pine Donkey and Tarengo leek orchid in secure areas over the life of mining operations (Eastcoast Flora Surveys 2010). As at November 2017, 1360 Pine Donkey and 2454 Tarengo Leek orchids have been translocated into recipient plots.

3.5.1 Equipment required for terrestrial orchid translocation

The equipment required for the salvage and translocation of threatened terrestrial orchids is limited to that required for hand removal and translocation of soil containing tubers and to move that soil to the recipient site. Equipment used to undertake threatened terrestrial orchids salvage operations will include:

- a) metal tags
- b) metal tent pegs
- c) flagging tape

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- d) shovel or spade
- e) buckets or containers
- f) utility vehicle or truck (for transporting salvaged orchids to recipient locations).

The equipment required for the salvage and translocation of threatened terrestrial orchids will not be restricted to the above, as challenging salvage and translocation works may require additional assistance (particularly based on hardness of soil surface). The most appropriate equipment will be determined when the salvage and translocation technique has been refined post field inspection of both the donor and recipient sites.

3.5.2 Timing

Wherever possible, salvage and translocation of terrestrial orchids should occur during either summer or autumn, outside of the peak growing period (i.e. not in spring) to ensure minimal distress is caused to plants. Vallee *et al.* (2004), recommends staggered translocations of individuals over time to increase the potential for success.

3.5.3 Ongoing maintenance

The following ongoing maintenance measures will be undertaken at fenced translocated terrestrial orchid locations to enhance the potential for long term survival:

- a) all recipient sites are to have competing grasses cut to ankle height annually, prior to orchid emergence (generally around April)
- b) fencing maintenance to ensure macropod exclusion
- c) weed management.

4. Monitoring

4.1 Tiger orchid monitoring program

Tiger orchid monitoring is undertaken in accordance with standard internal document *Tiger Orchid Translocation and Monitoring Form*. For translocated tiger orchids, they are monitored biannually for the first year while the chances of translocation of failure are higher, then every second year until five years after translocation (i.e. four times in total for each translocated orchid). Monitoring frequency is increased if identified as needed during monitoring events. Monitoring is to occur during spring and autumn.

The following aspects are documented for translocated tiger orchids:

- Orchid reference number
- Date and personnel undertaking monitoring
- Photos of condition
- Health of plant
- Attachment to tree.

Three naturally occurring tiger orchids (reference plants) are also monitored for each of the above (with the exception of tree attachment) to identify whether changes to translocated tiger orchid health are a likely consequence of being translocated or natural fluctuations.

A register of the locations of these records is maintained onsite at Mangoola Coal.

4.2 Terrestrial orchid monitoring program

In accordance with *A Strategy for the Translocation of Threatened Terrestrial Orchids at Mangoola Coal, Upper Hunter Valley* (Eastcoast Flora Surveys 2010), the monitoring of translocated plants should occur in late September to early October each year, and will inform the basis of a brief scientific publication at a later date to disseminate research findings.

The terrestrial translocated orchid monitoring program comprises the following:

- a) Annual monitoring over repeated visits during September/October
- b) Monitoring at seven translocation locations (comprising 27 plots)
- c) Monitoring at four reference plots of non-translocated plants
- d) Plants have been tagged with metal ground 'U' pegs and plastic plant tags for ease of identification.
- e) Soil sampling and analysis (pH, EC, moisture content, major cations, TSS, exchangeable cations, organic matter, organic carbon, total nitrogen, total phosphorus, arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury) from four sampling locations in each recipient site (approximately 100cm³ from each plot corner). *Now only required for new plot establishment.*
- f) Counts of emerged individuals/cores of each species (relocated individuals are marked with flagging tape to prevent recounting)
- g) Documentation of successful pollination outcomes
- h) To date the terrestrial orchid translocation program has resulted in the translocation of 3814 individual orchids into 25 different sites within the mine rehabilitation and biodiversity offset areas. Upon collection of sufficient data, it is the intention of the supervising consultant to prepare a scientific paper on the terrestrial orchid translocation process.

4.3 Monitoring of other translocated species

The outcomes of salvaging and translocating any other threatened species will be subject to detailed ongoing monitoring to determine the success (or otherwise) of the activities. Monitoring forms and procedures will be developed as part of any research required prior to salvaging and translocating each species. These forms will ensure consistent monitoring and recording of data.

The results of the monitoring will include any recommendations to improve the condition of the translocated species to ensure the ongoing health and viability of the species in question. Results will be fed back into the continual improvement of the program and will be provided within the Annual Review.

5. Adaptive management

The salvage and translocation of the above threatened flora species and endangered flora populations has not been practiced widely, particularly in the Hunter Valley, and as such the procedures developed are largely new and untested (except for onsite works). Therefore it is important that the process remains flexible, allowing for new innovations to be incorporated as experience is developed over time. The results of the monitoring will be important in determining the most successful techniques for salvage and translocation and the procedures should adapt accordingly to reflect these outcomes. Documentation of information throughout the entire process is essential.

5.1 Potential risks and corrective actions

Some examples of triggers that may indicate the need for remedial action may include (but not be limited to) those provided in *Table 5.1*.

Table 5.1 Biodiversity Trigger, Action and Response Plan

Management Aspect	Key Element	Trigger	Potential Corrective Action
Translocated tiger orchid health	Translocated tiger orchids have stable health	Browning or loss of foliage inconsistent with control plants	Reposition translocated orchid in same tree with a better aspect with less exposure.
		Evidence of sunburn, windburn or other unsuitable environmental conditions of recipient tree	Relocate translocated orchid to a different host tree.
Translocated tiger orchid attachment	Tiger orchids are securely located within host	Dis-attachment of tiger orchid roots from translocated section of original host tree is occurring	Re-secure roots to translocated section of original host tree.
		Attachment mechanism to host tree is loose	Re-enforce attachment mechanism to host tree
		Translocated tiger orchid has fallen off host tree	Reattach tiger orchid to host tree using more secure means
Translocated tiger orchid protection	Tiger orchids protected from grazing	Grazing is occurring to translocated tiger orchid	Reposition higher within host tree
			If grazing is by cattle - assess fence lines to ensure no access can occur.

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Management Aspect	Key Element	Trigger	Potential Corrective Action
	Tiger orchids protected from access by people	Tiger orchids cannot be identified on host tree and are presumed stolen	Assess fence lines to ensure no unwarranted access can occur.
			Consider installation of remote cameras
	Tiger orchids protected from insect attack	Insect attack leading to decline in plant health inconsistent with control plants	Consider use of pesticide application under the direction of suitably qualified personnel.
Translocated terrestrial orchid emergence	Emergence of translocated terrestrial orchids occurs	Emergence of translocated terrestrial orchids is substantially lower than reference populations	Re-evaluate procedures undertaken and recipient locations as well as weather conditions at the time of translocation. Identify areas for procedural improvement and implement in future translocation works.
Translocated terrestrial orchid protection	Terrestrial orchids protected from grazing	Grazing is occurring within terrestrial orchid plot	Assess condition of fence lines for security and undertake repairs as necessary
	Terrestrial orchids protected from people access	Terrestrial orchids cannot be identified and are presumed stolen	Assess fence lines to ensure no unwarranted access can occur.
			Consider installation of remote cameras
Terrestrial orchids protected from weed infestation	Weed levels inconsistent with reference populations inhibiting terrestrial orchid growth	Consider hand weeding regime within translocation areas Undertake slashing prior to March/April to reduce competition during growing season	

In some situations, expert advice may be required to determine the most appropriate remedial action.

6. Accountabilities

Responsibility for the implementation of this plan lies with Mangoola Coal, with input from external specialists and contractors as required. Key roles and responsibilities for implementing this plan are:

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Environment and Community Manager	<ul style="list-style-type: none"> a) providing advice to operations personnel to meet the requirements of this plan b) consulting with relevant government departments as required c) report non compliances and hazards regarding this plan d) complete external reporting requirements associated with this plan e) oversee the implementation of this plan.
Environment and Community Coordinator	<ul style="list-style-type: none"> a) providing advice to operations personnel to meet the requirements of this plan b) monitoring corrective actions from inspections or non-compliances and ensuring they are closed out and effective.
Environment and Community Officer	<ul style="list-style-type: none"> a) schedule pre-clearance surveys to identify locations of orchids and other threatened flora b) develop and implement an inspection schedule which assesses compliance against this plan c) schedule translocation of orchids and other threatened flora d) monitor translocated plants as per this plan e) maintain records associated with this plan f) assist with inspections to ensure compliance with this plan.
All employees and contractors	<ul style="list-style-type: none"> a) undertaking all activities in accordance with this plan b) reporting all non-compliances with this plan as per the procedures.

7. Document information

7.1 Related documents

Related documents, listed in *Table 7.1* below, are internal documents directly related to or referenced from this document.

Table 7.1 Related Internal Documents

Reference	Title
MANOC-1772150304-4722	<i>Tiger Orchid Translocation and Monitoring Form</i>
MANOC-1772150304-4110	<i>Habitat Tree Felling Form</i>
MANOC-1772150304-4329	<i>Pre-clearing Survey Form</i>
MANOC-1772150304-4725	<i>Pre-clearing Survey, Land Clearing and Topsoil Stripping</i>

7.2 Reference information

Table 7.2 below lists information that is directly related to the development of this document or referenced from within this document.

Table 7.2 References

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Reference	Title
Documents	
Bell SAJ, Copeland LM (2004)	<i>Commersonia rosea</i> (Malvaceae s.l.: Lasiopetaleae): a new, rare fire-ephemeral species from the upper Hunter Valley of New South Wales. <i>Telopea</i> 10: 581-587.
Bell, S.A.J. (2016)	<i>Surveys for the threatened Diuris tricolor and Prasopphyllum petilum (Orchidaceae) on Glencore-owned, non-approved mining area lands at Wybong, Upper Hunter Valley.</i> April 2016. Eastcoast Flora Survey.
Bishop, A. (2000)	<i>Field guide to the orchids of New South Wales and Victoria.</i> Second Edition. University of New South Wales Press, Sydney.
Botanic Gardens Trust (2017)	PlantNET – The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2.0). < http://plantnet.rbg Syd.nsw.gov.au > accessed May 2017.
Department of Environment & Climate Change (DECC) New South Wales (2005)	<i>Lasiopetalum longistamineum</i> – Priority actions (New South Wales Threatened Species Priority Action Statement), viewed 6 May 2008, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/pas_profile.aspx?id=10452 .
Department of the Environment, Climate Change and Water (DECCW) (2010)	National Recovery Plan for <i>Prasopphyllum petilum</i> , Department of Environment, Climate Change and Water (NSW), Hurstville.
Eastcoast Flora Survey (2010)	A strategy for the translocation of threatened terrestrial orchids at Mangoola Coal, Upper Hunter Valley.
Harden, GJ (ed.) 1990,	' <i>Lasiopetalum</i> ' in <i>Flora of New South Wales</i> , vol.1, University of New South Wales Press, Sydney.
Harden, G. J. (ed.) (1993)	<i>Flora of NSW</i> Volume 4. (NSW University Press: Sydney).
Harden, G.J. (ed) (2002)	<i>Flora of New South Wales. Volume 2</i> , revised edition. University of New South Wales Press and Royal Botanic Gardens, Sydney.
Mangoola Open Cut – Glencore 2014	Mangoola Coal Environmental Management Strategy
NSW Scientific Committee (2004)	<i>Commersonia rosea</i> (a shrub) – endangered species listing, November 2004.
NSW Scientific Committee (2005)	Final Determination: <i>Acacia pendula</i> (a tree) in the Hunter Catchment – endangered population listing, June 2005.
NSW Scientific Committee (2006)	Final Determination: <i>Cymbidium canaliculatum</i> : Endangered Population Listing, April 2006.
NSW Scientific Committee (2007)	Final Determination: <i>Diuris tricolor</i> : Endangered Population Listing, April 2007.
NSW Scientific Committee (2010).	Final Determinations: <i>Pomaderris reperta</i> : critically endangered species listing, July 2010

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Reference	Title
Office of Environment and Heritage 2012.	National Recovery Plan for small purple-pea (<i>Swainsona recta</i>). Hurstville, NSW
Office of Environment and Heritage 2016a.	Threatened Species Profile Search. Accessed July 2016 from < http://www.environment.nsw.gov.au/threatenedSpeciesApp
Office of Environment and Heritage 2016b.	BioNet – the website for the Atlas of NSW Wildlife. Accessed July 2016 from < http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/atlasreport.aspx >.
Peake, T. (2006)	The Vegetation of the Central Hunter Valley, New South Wales.' A Report on the Findings of the Hunter Remnant Vegetation Project. Final Draft Version 2.2. Hunter - Central Rivers Catchment Management Authority, Paterson.
Threatened Species Scientific Committee (2008a)	Approved Conservation Advice for <i>Commersonia rosea</i> (a shrub).
Threatened Species Scientific Committee (2008b)	Approved Conservation Advice for <i>Lasiopetalum longistamineum</i> .
Threatened Species Scientific Committee (2008c)	Approved Conservation Advice for <i>Ozothamnus tessellatus</i> .
Threatened Species Scientific Committee (2009)	Approved Conservation Advice for <i>Prasophyllum sp. Wybong</i> (C. Phelps ORG 5269) (a leek orchid).
Umwelt (Australia) Pty Limited (2006).	Anvil Hill Project Environmental Assessment. Prepared for Centennial Hunter Pty Limited.
Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M., and Rossetto M. (2004).	Guidelines for the Translocation of threatened plants in Australia. Second Edition. Australian Network for Plant Conservation, Canberra
Personal Communications	
Copeland L (2009).	Personal communication, January 2009, Department of Botany, University of New England.
Holzinger B (2006).	Independent expert. Personal communication, July and October 2006.
Holzinger B (2009).	Independent expert. Personal communication, January 2009.
Peake, T. (2011).	Ecology Manager (now Ecology Practice Leader), Umwelt (Australia) Pty Limited.

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7.3 Change information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in *Table 7.3* below.

Table 7.3 – Change Information

Version	Date	Review team (consultation)	Change Summary
1.0	18 February 2013	DP&I	Document developed in accordance with Schedule 3, Condition 40A and approved by DP&I
2.0	15 May 2018	Umwelt (Australia Pty Limited) Damien Ryba (Mangoola Open Cut)	Amalgamated from being an ETL specific document to a whole site relevant document. Includes all threatened flora identified at Mangoola. Added photos of species. Updated listing information. Referenced translocations of terrestrial orchids completed to date.
3.0	5 November 2018	DP&E	Translocation Management Plan approved by DPE.
4.0	29 October 2021	Damien Ryba (Mangoola Open Cut)	Document reviewed and changed to updated template. Minor spelling and grammatical changes. Photo of <i>Ozothamnus tessellatus</i> added. Change issue of unique Cymbidium identification number from section 3.4.2 to 3.4.4.
5.0	08 November 2021		Final Version Approved by DPIE

Appendix A - Regulatory Consultation



Planning,
Industry &
Environment

Mitchell Green
Acting Environment and Community Manager
Mangoola Coal Operations Pty Limited
Wybong Road
Muswellbrook, NSW, 2333

08/11/2021

Dear Mr. Green

Mangoola Coal (MP06_0014) Translocation Management Plan

I refer to the Translocation Management Plan which was submitted in accordance with Condition 38 of Schedule 3 of the Project Approval for Mangoola Coal (MP06_0014).

The Department has carefully reviewed the document and is satisfied that it meets the requirements of the relevant Conditions of Approval.

Accordingly, the Secretary has approved the Translocation Management Plan (Version 4, dated 29 October 2021). Please ensure that the approved plan is placed on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Wayne Jones on (02) 6575 3406.

Yours sincerely

A handwritten signature in black ink, appearing to be 'S O'Donoghue'.

Stephen O'Donoghue
Director Resource Assessments
Resource Assessments
As nominee of the Secretary

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