Murrumbidgee to Googong Pipeline

Pre-clearance Surveys

Prepared for
Bulk Water Alliance

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Contents

1 Executive Summary

Surveys in the proposed Murrumbidgee to Googong pipeline easement for threatened species, hollow bearing trees and wombat hollows were undertaken during September – October 2010 by Eco Logical Australia. This report provides ecological and mapped information on the location of *Swainsona recta*, Pink-tailed Worm Lizard and rocky outcrops (potential habitat for the species), hollow bearing trees and wombat burrows.

A total of 3 *Swainsona recta* individuals occur within or immediately adjacent to the pipeline easement. These individuals may be directly impacted by construction, and Eco Logical Australia will continue to liaise with BWA regarding the possible avoidance of these individuals through design options. Where individual plants cannot be avoided, any impacts shall be considered in the context of a translocation, propagation and offsets strategy.

Three Pink-tailed Worm Lizards were recorded within one area of the easement, although other rocky outcrops were also mapped which contain potential habitat for the species. It is recommended that further surveys for the species be conducted immediately prior to construction works in potential habitat areas within the pipeline easement. Any lizards observed during these surveys should be relocated to nearby habitat of the same or higher habitat value away from the pipeline impact zone.

Approximately 49 hollow bearing trees occur within or near the pipeline easement. Eco Logical Australia will liaise with BWA to determine which hollow bearing trees can be conserved within the pipeline easement and which trees can be felled. A number of mitigation measures are recommended for trees to be felled in order to ensure that no fauna are injured during tree felling activities.

Numerous wombat burrows were observed within the pipeline easement, particularly adjacent to the Murrumbidgee River. Clearance of these burrows should be avoided where possible. If clearance is required, a non-invasive method should be used to deter wombats from returning to burrows before construction commences.

Swainsona sericea, which is listed as threatened under the NSW *Threatened Species Act 1995*, was identified throughout the pipeline easement where suitable habitat occurred. Areas where *Swainsona sericea* occurred in substantial numbers (>50) were recorded using GPS and mapped. No other threatened species were observed within the study area. Overall the level of impacts on threatened species is negligible.

It is understood that BWA will provide the results of this survey to relevant government agencies. Specific survey results should not be made public to provide protection to the threatened species onsite.

2 Introduction

2.1 BACKGROUND

ACTEW Corporation Pty Ltd is proposing to pump water from the Murrumbidgee River at Angle Crossing within the ACT and transfer it through an underground 12 km pipeline to Burra Creek in NSW. Burra Creek flows into the Googong Reservoir through the Commonwealth Government's Googong Foreshores. The underground pipeline would commence in the ACT heading in an easterly direction for 2.8 km and then cross the border into NSW where it will continue for a further 9.2 km.

This project is one of the preferred options for delivering improved security to the ACT's water supply. Recent drought conditions experienced in Canberra and the broader region, along with predicted climate change impacts and population growth has increased the demand for water supply and facilitated a search for a more reliable water supply.

2.1.1 Conditions of Consent/Approval

The development of the Murrumbidgee to Googong pipeline is subject to an environmental approvals process that was conducted under an agreement between the Commonwealth, NSW and ACT governments. The relevant agencies under each jurisdiction are:

- the ACT Planning and Land Authority (ACTPLA),
- the NSW Department of Planning (DoP), and
- the Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPAC).

All three jurisdictions have granted approval for the proposed pipeline (relevant approval conditions detailed below). Under the environmental approval conditions outlined by the ACT, NSW and Commonwealth regulatory agencies, pre-clearance surveys within the pipeline easement need to be undertaken for threatened species, with all three regulatory agencies making particular mention of the Small Purple-pea *Swainsona recta*.

NSW Approval

NSW approval for the project was issued 30 March 2010. Approval conditions relating to pre-clearance surveys are:

> *2.6 In regards to the Endangered Purple-pea, Swainsona recta the proponent shall:*
>
> > *a) avoid and protect the identified population of the species during construction of the crossing at the Goulburn to Cooma railway line;*
> >
> > *b) submit to the Director-General and DECCW, as part of the Construction Environmental Management Plan required under condition 6.2, a pre construction survey of all potentially suitable habitat along the pipeline easement. The survey shall be conducted during the species flowering period; and*
> >
> > *c) minimise impacts to any population identified during the surveying described in b), through detailed design and alignment refinements.*

2.7 The pipeline easement width shall be reduced to the minimum feasible width in areas along the easement that are known to contain endangered ecological communities and/or threatened species habitat. Details regarding the extent and location of these reductions shall be included in the Construction Environmental Management Plan contained in condition 6.2.

2.8 Any clearing of native vegetation, native grassland particularly Box-Gum Grassy Woodland and rocky outcrops during construction of the pipeline shall be limited to the minimum feasible extent.

ACT Approval

ACT approval for the Murrumbidgee to Googong pipeline was granted on 3 August 2010. Approval conditions relating to pre-clearance surveys are:

B20. During the month of October, and prior to any works commencing within the parts of the pipeline east of the Monaro Highway, the applicant must survey the area subject to works for the pipeline within Block 119 District of Tuggeranong to determine the exact location of any Swainsona recta plants.

C2. The applicant must take all reasonable steps and precautions to avoid disturbance of all Swainsona recta plants and habitat within the site.

C3. In the case it is not possible to avoid disturbing the Swainsona recta and nearby habitat the applicant shall, prior to disturbing them, develop an offset strategy to mitigate the impacts on this species. This strategy shall include research into the best methods for translocation, the translocation of the effected plants, and re-establishment of these plants within an appropriate location to the satisfaction of the Conservator.

Commonwealth Approval

Commonwealth approval was issued on 29 October 2010. Conditions relating to pre-clearance surveys are:

3. The person taking the action must submit a Biodiversity Management and Offset Plan to address impacts on listed threatened species and ecological communities for the Minister for approval prior to commencing construction. The Biodiversity Management and Offset Plan must include the following:

a) a description of the survey effort already undertaken for listed threatened species and ecological communities, and any extra surveys that may be required pre-construction as described in condition 3.b);

b) an outline of the methodology of additional flora surveys, by a botanist with expertise in surveying for the Small Purple-pea (Swainsona recta), Hoary Sunray (Leucochrysum albicans var. tricolour) and Button Wrinklewort (Rutidosis leptorrhynchoides). The surveys must be conducted at the correct time of year, and specifically target the parts of the project area that are most likely to provide habitat for the species, particularly in areas that were not surveyed for the species previously;

c) precise mapping showing the location of all known Small Purple-pea, Hoary Sunray and Button Wrinklewort plants in the protected area, the location of the areas of greatest potential for having additional plants of these species in the project area and the precise location of the pipeline easement. These maps must be provided to the Department but must not be published at a scale that indicates individual plants;

d) demonstrate how construction of the pipeline and associated activities will avoid removing any individuals of the Small Purple-pea, or, if removal is necessary, provide details of a Small Purple-pea land offset, management and planting programs to ensure no net loss to the population;

e) describe how the alignment of the pipeline easement minimises impacts on the Small Purple-pea, Hoary Sunray, Button Wrinklewort and Pink-tailed Worm Lizard (Aprasia parapulchella);

f) explain how the extent and condition of EPBC listed threatened ecological communities (TEC's) was determined;

g) detailed mapping of TEC's, including habitat condition, including the project area and other areas proposed to be used as offsets;

h) a description of how the Small Purple-pea, Hoary Sunray and Button Wrinklewort and Pink-tailed Worm Lizard will be managed during construction of the pipeline;

i) a description of how native vegetation (including TEC's) will be rehabilitated after the construction of the pipeline;

j) a description of how any threatened plants will be propagated and re-established;

k) a description of how weed management and rehabilitation of native vegetation and threatened species habitat will be undertaken and funded in the long-term; and

l) commitments to managing and protecting in perpetuity any parcel of land set aside as an offset.

Construction may not commence in any areas that contain habitat for the Small-Purple pea, Hoary Sunray, Button Wrinklewort and Pink-tailed Worm Lizard or in TEC's until the plan is approved. The approved plan must be implemented.

Other commitments

In addition to the above approval requirements for pre-clearance surveys for threatened species, a number of commitments have been made by BWA during the EIS and PER approvals process to conduct pre-clearance surveys for potential fauna habitats including hollow bearing trees and rocky outcrops. These surveys are required to be conducted within the pipeline easement prior to the start of construction.

2.2 STUDY AREA

The pipeline easement is located south and south-west of Canberra. The project area traverses 12 km, bound by the Murrumbidgee River intake location in the west (near Angle Crossing) and Burra Creek discharge site in the east (see **Figure 1**). The construction impact zone for the pipeline will generally include a 40 m corridor around the pipeline location (referred to as the pipeline easement). The actual construction impact will vary in width from 15 m to 40 m and will be determined by considering a number of drivers including occurrences of threatened species and ecological communities, construction management and safety considerations, and land form.

Land within the pipeline corridor is predominately privately held rural residential land. The majority of the pipeline easement traverses a highly modified agricultural landscape. Activities within the area include sheep and cattle grazing, small scale cropping, pasture improvement and equine farming. There are also a small number of allotments that are on Commonwealth land and Crown land.

The pipeline spans three separate jurisdictions as follows:

Australian Capital Territory (ACT)

- Intake/low lift pump station, high lift pump station and the first 2.8 km of the pipeline until the ACT/NSW border near the Monaro Highway, Williamsdale.

New South Wales (NSW)

- Remaining 9.2 km of the proposed pipeline from the ACT/NSW border near the Monaro Highway, Williamsdale to the discharge located adjacent to the Williamsdale Road – Burra Road intersection;
- Discharge location and mini-hydro infrastructure in the vicinity of the intersection of Williamsdale and Burra Roads.

Commonwealth of Australia

- Pipeline crossing in the designated land at the Monaro Highway corridor as defined under the National Capital Plan.

In addition to the defined pipeline easement, the study area also included areas within lots 1102 (201DP754889), 1104 (152DP754889) and 1106 (170DP754889) that may be impacted by a potential re-alignment of the pipeline corridor. This is known as the 'alternate option', and methods and results have been discussed separately for this option (Section 3.6 and 4.5 respectively).

Topography along the pipeline route changes considerably. Elevation in the surrounding area varies from 600 m at Angle Crossing to 1,120 m at Gibraltar Hill. The topography surrounding the western end of the pipeline corridor, around Angle Crossing, is characterised by deeply incised hills and gorges along the Murrumbidgee River Corridor. The land sharply rises towards the Monaro Highway to broad, elevated, flat to undulating plains before dropping away to the east of the Highway where the land is characterised by the broad low lying plains of the Jerrabomberra and Tuggeranong Valleys and smaller flood plains associated with Jerrabomberra Creek (ACTEW 2009).

The central part of the pipeline corridor then passes through the Gibraltar Range, which is an abruptly rising ridge line with the peak of Gibraltar Hill to the north of the proposed pipeline at an elevation of 1,120 m. The land surrounding the eastern extent of the pipeline corridor then falls back down to the broad low lying plains of the Jerrabomberra and Tuggeranong Valleys and smaller flood plains associated with Jerrabomberra Creek, Burra Creek and local drainage lines. These landforms continue to the Burra township and the conclusion of the pipeline corridor at Burra Creek (ACTEW 2009).

Remnant vegetation across the study area ranges from non-native pasture to native grasslands, grassy woodlands on the undulating lowland hills and dry grassy/shrubby sclerophyll forest on elevated rocky parts of Gibraltar Hill and Mount Burra and on the 'saddle' that links the two. Main fauna habitats include grassland, woodland, open forest, rock outcrops, tree hollows and wet areas that range from major river systems to farm dams (ACTEW 2009).

2.3 AIM OF STUDY

This study was undertaken within the pipeline easement, including an alternate route option in Lots 1102, 1104 and 1106, prior to commencement of construction, to:

- Survey for and map the location of threatened plant species including the Small Purple-pea, Silky Swainsona-pea, Hoary Sunray, and Button Wrinklewort;
- Survey for and map the location of Pink-tailed Worm Lizards and their habitat;
- Map and mark hollow-bearing trees for conservation and/or re-instatement post construction;
- Map and mark the location of wombat burrows.

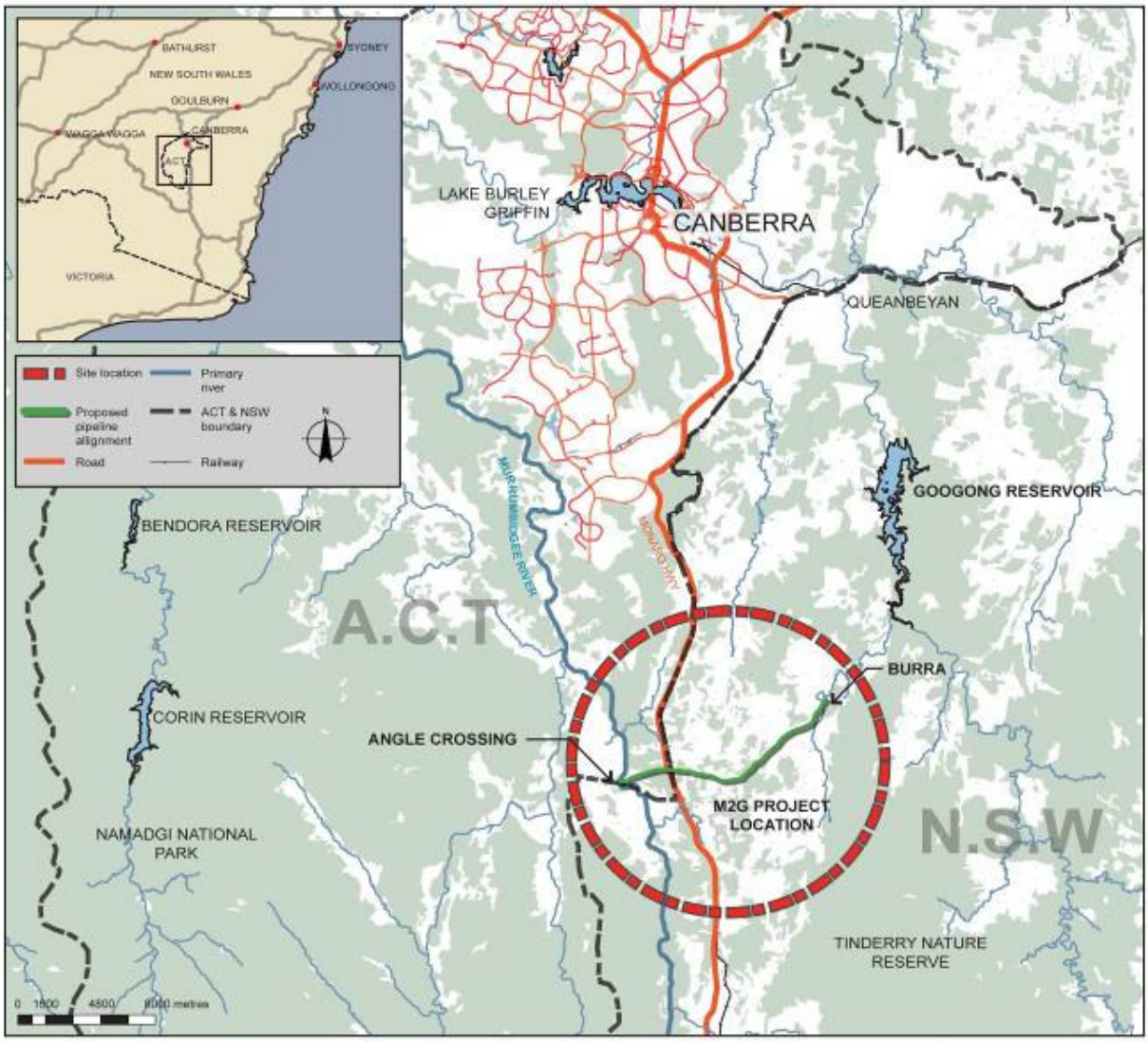

Figure 1: Regional overview of study location (source: ACTEW 2010)

3 Methodology

Prior to surveys being undertaken, Eco Logical Australia conducted a desktop review using previous mapping data (prepared by Biosis, in ACTEW 2009) and a site verification to determine the extent and scope of the area that required surveys. A detailed plan for conducting pre-clearance surveys was then developed in consultation with BWA. Key components of the survey methodology were the timing of surveys to coincide with optimum seasonal conditions but also within a reasonable time frame of construction starting.

Eco Logical Australia undertook ecological surveys during September and October 2010 along the pipeline easement. The survey methodology was designed to identify species and habitats of conservation value that may be directly impacted by construction of the proposed pipeline.

The methodology was based around accepted general survey principles (vegetation surveys and rock-rolling) and aimed to specifically determine the presence of a number of threatened species and habitat features of conservation value, including:

- Small Purple Pea (*Swainsona recta*);
- Hoary Sunray (*Leucochrysum albicans var. Tricolor*);
- Button Wrinklewort (*Rutidosis leptorrhynchoides*);
- Silky Swainson-pea (*Swainsona sericea*);
- Pink-tailed Worm Lizard (*Aprasia parapulchella*);
- Hollow bearing trees; and
- Wombat burrows.

These pre-clearance surveys, in particular those for *Swainsona recta*, were designed to meet the requirements of the NSW, ACT and Commonwealth government approval conditions.

Pre-clearance surveys for species and habitats were conducted over 8 days from 28 September to 26 October 2010. Climate conditions (taken from BOM: Tidbinbilla, ACT) during these times ranged from 10°C to 24°C maximum. There was 174 mm of rainfall during the survey period. Approximately 19 mm of rain had fallen in the 2 weeks prior to surveys commencing. The timing and climatic conditions were considered ideal for flora and fauna surveys.

The entire 12 km, 40 m wide pipeline easement and the alternative alignment (refer to section 3.6) were surveyed by walking traverses. Specific areas were targeted for specific flora and fauna surveys based on the presence of suitable habitat, and are discussed below.

3.1 SWAINSONA RECTA

Swainsona recta is listed as an Endangered species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), NSW *Threatened Species Conservation Act 1995* (TSC Act) and ACT *Nature Conservation Act 1980* (NC Act).

Swainsona recta surveys were designed to most effectively meet the requirements of the conditions of approval (NSW, ACT and Commonwealth) as they relate to *Swainsona recta*. Prior to surveys commencing, endorsement of the survey methodology was sought and gained from DECCW (NSW), TAMS (ACT) and DEWHA (Commonwealth) to ensure surveys meet all regulator expectations.

Surveys for *Swainsona recta* involved 4 steps:

a. Determine potential habitat

Prior to conducting pre-clearance surveys, potential habitat within the pipeline easement was identified by desktop review, using previous mapping data (Biosis 2009), and a site verification visit to determine the extent and scope of the area that will require *Swainsona recta* surveys.

Previous vegetation mapping conducted during the project's EIS (ACTEW 2009) was used to guide the determination of potential habitat. Habitat for *Swainsona recta* is considered to be the grassy understorey of woodlands and open-forests. It is known to grow in association with understorey dominants that include Kangaroo Grass (*Themeda australis*), poa tussocks (*Poa spp.*) and spear-grasses (*Austrostipa spp.*).

Vegetation communities that would provide suitable habitat are:

- Apple Box Woodland
- Apple Box/Broad-leaved Peppermint Open Forest/Woodland
- Box Gum Grassy Woodland EEC
- Broad-leaved Peppermint Open Forest/Woodland
- Broad-leaved Peppermint/Brittle Gum Open Forest
- Natural Temperate Grassland or Secondary Grassland
- Peppermint/Brittle Gum/Bundy/Yellow Box Shrubby Woodland
- Peppermint/Snow Gum Grassy Woodland
- Secondary Grassland – Box Gum Grassy Woodland
- Snow Gum Grassy Woodland.

Potential habitat for *Swainsona recta* includes the list of vegetation communities identified above that contain a dominant native understorey. The determination of a native understorey was conducted whilst on location during an initial reconnaissance and surveys. The vegetation communities were mapped during the EIS and were used in these pre-clearance studies to determine the location of likely habitat.

b. Establish local flowering periods

Before *Swainsona recta* pre-clearance surveys were conducted within the pipeline easement, Eco Logical Australia established the local flowering conditions and occurrences to ensure surveys were conducted at the most appropriate time. *Swainsona recta* are known to flower from September to December with the optimal flowering period considered to be October (dependent on climatic conditions such as recent rain events and warmer temperatures).

The locations of previously recorded *Swainsona recta* individuals / populations were identified in the EIS. Prior to pre-clearance surveys, weekly spot checks of these known individual and population locations were conducted from early September to determine the onset of the local flowering period. Once the local flowering period was determined, targeted pre-clearance surveys were then conducted within the pipeline easement.

c. Surveying techniques

Given that the flowering times of individual plants are likely to be staggered across the species' flowering period, Eco Logical Australia conducted two pre-clearance surveys of potential *Swainsona recta* habitat within the pipeline easement. The first survey was conducted after determining the onset of the local flowering period and the second survey was conducted two weeks after the first survey. Two pre-clearance surveys, separated by a 2 week period, were used to improve the likelihood that all individuals and populations were identified prior to construction.

The pre-clearance surveys were undertaken as a walked traverse through potential habitat within the pipeline easement and surrounding habitat by 2 ecologists with experience in identifying *Swainsona spp*. in the field. The construction impact zone known as the pipeline easement will include a 40 m corridor around the pipeline location. It is important to note that while the construction impact zone may be reduced to 15 m in parts to avoid highly sensitive areas, the pre-clearance surveys were conducted for the 40 m corridor width at all times.

The walked traverse was conducted to ensure all potential habitat within the varying pipeline easement was surveyed. An ecologist can effectively survey a corridor width of 10m (assuming 5m on either side of the ecologist during the traverse). For the areas of the easement where the width is up to 40m, the traverse doubled back along the easement until the entire width was adequately surveyed.

d. Identifying Swainsona recta individuals

Swainsona recta was identified in the field via a morphological inspection of any *Swainsona spp.* individuals. Both *Swainsona recta* and *Swainsona sericea* are known to occur within the study area and its surrounds. *Swainsona recta* differs from *Swainsona sericea* by its generally greener appearance of the foliage, more erect habit, narrow and wider spacing leaflets and the relative absence of hairs on leaves.

Upon identifying *Swainsona* specimens, the species and a GPS location was recorded for each individual or population (if multiple individuals). Plants were photographed and the location of specimens was also suitably identified (pegged, photographed and numbered) on site.

When *Swainsona recta* individuals were identified on site, additional survey effort was undertaken on the adjoining area until a 40 m wide easement not containing *Swainsona recta* was identified and subsequently mapped. This information has been provided to BWA to guide avoidance and mitigation measures including potential micro alignment refinements of the pipeline location.

3.2 OTHER THREATENED FLORA SPECIES

During traverses for *Swainsona recta*, searches were also conducted for other threatened plant species with potential to occur within the area. Any individuals (or areas containing a substantial abundance in the case of *Swainsona sericea*) were recorded using a GPS. Threatened species with the potential to occur within the easement include:

- Swainsona Silky Pea *(Swainsona sericea)* – listed as Vulnerable under the TSC Act.
- Hoary Sunray *(Leucochrysum albicans var. tricolor)* – listed as Endangered under the EPBC Act.
- Button Wrinklewort *(Rutidosis leptorrhynchoides)* – listed as Endangered under the EPBC Act, TSC Act and NC Act.

These three species have very similar habitat requirements to *Swainsona recta* and are likely to occur in similar habitat types.

3.3 PINK-TAILED WORM LIZARD

Pink-tailed Worm Lizard (PTWL) is listed as Vulnerable under the EPBC Act, TSC Act and NC Act. The PTWL occurs in open grassland habitats which have a substantial cover of small rocks. The lizards are most commonly found sheltering under small rocks (15 - 60 cm basal dimensions) shallowly embedded in the soil (2 - 5 cm). Surveys should ideally occur in temperatures around 22^{o}C, and temperatures in excess of 28^{o}C should be avoided. Surveys should not be conducted on rainy days, but should ideally occur 2 weeks after rain.

Rocky habitats within the pipeline easement indicate potential PTWL habitat. Areas containing rocky habitats were identified using the EIS data (ACTEW 2009) and verified during field surveys. The EIS recorded

extensive areas of rocky outcrop in the Murrumbidgee River corridor, along Burra Creek and to a lesser extent on the Gibraltar 'saddle'. Smaller outcrops were associated with low hills and knolls, mainly in the western sections of the study area.

During traverses of the pipeline easement, rocky habitats were identified and recorded using GPS with data provided to BWA for mapping purposes.

Opportunistic and targeted searches for the PTWL were undertaken within rocky habitats. A selection of potential habitat rocks were rolled and checked for the presence of PTWL. All rolled rocks were immediately returned to the position in which they were found. Surveys were conducted in October, as PTWL activity is highest during spring and early summer.

The location of any identified PTWL was recorded using GPS and data provided to BWA for mapping purposes. Photographs were taken of all individuals found.

3.4 HOLLOW BEARING TREES

Tree hollows can provide habitat for a range of arboreal fauna species including diurnal birds, possums, owls and microbats. For these species, tree hollows provide breeding sites and shelter from weather and predators. The removal of hollow-bearing trees can lead to the death or displacement of fauna reliant on the hollow.

During traverses of the entire pipeline easement, all trees containing hollows were clearly marked using spray paint and/or high visual flagging tape The location of these trees were also recorded using GPS and data was provided to BWA for mapping purposes.

3.5 WOMBAT BURROWS

Common wombats (*Vombatus ursinus*) are known to occur within the immediate area. An individual wombat may have up to 12 burrows with a number of entrances leading to the one burrow. When one burrow is inactive, another burrow is made and becomes active.

During traverses of the entire pipeline easement, wombat burrows were identified and checked for activity. Burrows were clearly marked (pegged and flagged), and were recorded using GPS with data provided to BWA for mapping purposes.

3.6 ALTERNATE OPTION

An alternate pipeline route is being considered within Lots 1102, 1104 and 1106. For this alternative route surveys were conducted for all the above species/habitat values through an area of approximately 1500 m in length and 60 m in width.

4 Results

The results of the pre-clearance surveys are summarised below. Locations of species and habitats recorded during surveys are presented in the maps at Appendix A. The raw data results of all surveys are provided in Appendix B.

4.1 SWAINSONA RECTA

4.1.1 Spot Checks

Spot checks were carried out on known *Swainsona recta* populations in two locations to determine the local flowering period for the species. These locations were:

- the railway corridor on land between the rail tracks and the Monaro Highway; and
- the proposed Williamsdale offset site.

Table 1 below outlines the observations of *Swainsona* species made during the spot checks.

Table 1: *Swainsona recta* spot checks to determine local flowering period

Date	Where	Comment
10/9/10	Rail corridor	Considerable rain in the previous week/s, however no *Swainsona* observed.
10/9/10	Offset site	No *Swainsona* observed.
17/9/10	Rail corridor and offset	No *Swainsona* observed.
22/9/10	Rail corridor and offset	No *Swainsona* observed.
29/9/10	Rail corridor and offset	*Swainsona* easy to spot, and a few plants beginning to flower. Estimate <5% within the Williamsdale property. Within the rail corridor they are also beginning to flower. Tom O'Sullivan separately confirmed the beginning of the flowering period within the rail corridor (fenced off area).
05/10/10	Rail corridor	*Swainsona* in flower and easily located.

4.1.2 Field Surveys

Following the confirmation of flowering in early October, the pre-clearance *Swainsona recta* surveys were conducted on 11-13 October and 25-26 October 2010.

The flowering season for *Swainsona spp*. and other herbaceous forbs was considered to have started later than in previous years. The region had experienced significant rainfall during September, which carried through to early October. This had pushed the general flowering periods for many species (besides exotic annuals) to later than previous seasons.

Two *Swainsona recta* individuals were recorded within the pipeline easement with another individual recorded approximately 5 metres from the corridor. All individuals recorded were observed within or very

close to the railway corridor (**Appendix A**). Also within the broad railway corridor area surrounding, but outside the pipeline easement, a number of *Swainsona recta* individuals were observed (**Appendix A**).

4.1 OTHER THREATENED FLORA SPECIES

Swainsona sericea were recorded in a number of areas along the pipeline easement where suitable habitat occurred. The abundance of *Swainsona sericea* varied considerably from a few individuals to areas containing a high density. Areas of high density generally represented sites containing 50-100 individuals and were recorded using GPS. No other threatened flora species were recorded within the pipeline easement.

4.2 PINK-TAILED WORM LIZARD

PTWL is typically found in open grassland habitats that have a substantial cover of small rocks. A total of 2.31 ha of known or potential habitat for the PTWL will be directly impacted by the proposed pipeline (ACTEW 2009).

The moderate temperatures following periods of substantial rains prior to the surveys made prime conditions for PTWL searches. PTWL individuals were recorded in one area within the pipeline easement (**Appendix A**). Within the surrounding rocky area, approximately 100 rocks were rolled revealing three individuals (two individuals were observed beneath a single rock). The habitat would be considered to be of moderate quality with grazing occurring sporadically and a number of exotic grass species present. No other PTWL were recorded within the study area, however rocky outcrops (areas of potential habitat) were also recorded and mapped (**Appendix A**).

It is recommended that further surveys for PTWL be conducted immediately prior to construction works in potential habitat areas. Any PTWL or other fauna observed during these surveys should be relocated to nearby habitat of the same or higher habitat value away from the pipeline impact zone.

It may be possible to relocate suitable sized habitat rocks to nearby habitat. If so, an ecologist should be present to supervise the relocation.

4.3 HOLLOW BEARING TREES

Approximately 32 hollow bearing trees were recorded during the field surveys within or immediately adjacent to the pipeline corridor with another 17 trees identified in the surrounding area (**Appendix A**). These trees consisted of primarily eucalypt species including Blakely's Red Gum (*Eucalyptus blakelyi)*, Apple Box (*E. bridgesiana*), Yellow Box (*E. melliodora*) and Brittle Gum (*E. mannifera*).

4.4 WOMBAT BURROWS

Numerous wombat burrows were recorded within the western section of the pipeline easement particularly adjacent to the Murrumbidgee River (**Appendix A**). To the east of the river the number of burrows tended to decline, with occasional burrows recorded throughout the rest of the pipeline easement. The majority of burrows showed signs of activity.

4.5 ALTERNATE OPTION

The vegetation within the alternative pipeline option in Lots 1102, 1104 and 1106 is considered to vary from good to moderate condition. Approximately one-third to a one-half of the proposed alternative route traverses land considered to be Box-Gum Woodland under both the Commonwealth and NSW definitions. The Box-Gum Woodland varies from areas of open woodland to derived grassland. Particular patches of derived

native grassland contain a significant abundance of *Swainsona sericea* individuals numbering in one instance up to an estimated 1000 individuals.

The vegetation within the alternative route through lots 1104 and 1106 is considered to be of moderate to high condition. There was a low to moderate grazing pressure observed throughout the alternative route.

5 Recommendations

5.1 SWAINSONA RECTA

For individuals that may be directly impacted by construction, Eco Logical Australia will continue to liaise with BWA regarding the possible avoidance of these individuals through detailed design, alignment and construction technique refinements in order to minimise impacts of the project on this species.

Where individual plants cannot be avoided, any impacts shall be considered in the context of a proposed translocation, propagation and offsets strategy described below.

5.1.1 Translocation and propagation plan (potential offsets)

If *Swainsona recta* individuals cannot be avoided, the feasibility of undertaking translocation (including soil relocation) and propagation of individuals will be investigated. This will serve as a mitigation / offset measure if individual plants are to be directly impacted to avoid a net loss of *Swainsona recta* within the area. The plan would be developed in conjunction with stakeholders, including:

- Local botanists familiar with the species;
- DECCW, TAMS and SEWPAC;
- Victorian Department of the Sustainability and the Environment (DSE) who have experience in *Swainsona recta* propagation and replanting;
- Botanists at the Australian National Botanic Gardens; and
- BWA construction personnel.

The plan would be developed to ensure that all regulators support the activities proposed and would be developed in the context of NSW, ACT and Commonwealth priority actions as part of the ongoing recovery strategy for the species.

5.2 HOLLOW-BEARING TREES

Eco Logical Australia will liaise with BWA to determine which hollow bearing trees can be conserved within the pipeline easement and which trees can be felled. If possible, felled trees may be kept for reinstatement during the rehabilitation of the development footprint.

It is recommended that marked trees be left standing for a minimum of 1 night after surrounding non-marked trees have been cleared with the presumption that any fauna present will move out of the area on their own accord. A ‘stag watch’ of hollow-bearing trees at dusk should be conducted to:

- Determine if any fauna are still present.
- If no fauna are confirmed, then marked trees can then be cleared.

A qualified ecologist will be onsite prior to the commencement of works the next day to conduct a detailed inspection and fauna relocation if necessary.

5.3 WOMBAT BURROWS

The loss of wombat burrows should be avoided were possible. Should this not be possible, a non-invasive method should be used to deter wombats from returning to burrows within the pipeline easement before construction commences within that area.

References

ACTEW 2010, Murrumbidgee to Googong Water Transfer, Public Environment Report June 2010. Full PER and supplementary documents are available at: <http://www.actew.com.au/WaterSecurity/MajorProjects/murrumbidgee_googong.aspx>

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Appendix A - Maps

Maps 1-20 provided below detail the pre-clearance survey results of the pipeline corridor and adjacent areas.

Appendix B - Results

Provided below are the raw field survey results. Refer to the Results sections for records within the pipeline easement and immediate surrounds. Projections are in mapping Datum GPA1994 MGA Zone 55.

Hollow Bearing Trees (HBT)

Type	Y-Projection	X-Projection	Species	Size
HBT	6060522	694016	E.dives	small
HBT	6060520	694042	E.mannifera	moderate
HBT	6060537	694116	E.mannifera	moderate
HBT	6060527	694146	E.mannifera	moderate
HBT	6060528	694145	E.mannifera	moderate
HBT	6060544	694124	Eucalyptus sp	moderate
HBT	6060543	694168	E.mannifera	large
HBT	6060493	694419	E.mellidora	not noted
HBT	6060493	694505	E.blakeyli	moderate & small
HBT	6060461	694915	E.mellidora	moderate
HBT	6060443	694937	E.mellidora	small
HBT	6060381	695293	E.mellidora	moderate & small
HBT	6060379	695300	E.mellidora	small
HBT	6060416	694584	E.mellidora	small
HBT	6060457	694438	E.mellidora	small
HBT	6060463	694408	E.dives	small
HBT	6060497	694239	E.mannifera	small
HBT	6060539	694063	E.mannifera	large
HBT	6060538	693726	E.blakeyli	small
HBT	6060663	692999	Stag	moderate
HBT	6060669	692736	Eucalyptus sp	small
HBT	6060648	693011	E.dives	small
HBT	6060554	693322	Eucalyptus sp	small
HBT	6060560	694386	E.mannifera	moderate & large
HBT	6060612	694499	E.bridgesiana	small
HBT	6060559	695316	Stag	large
HBT	6060621	695133	E.mellidora	moderate & large
HBT	6060239	697249	Eucalyptus sp	moderate
HBT	6060234	697222	Eucalyptus sp	moderate
HBT	6060228	697276	Eucalyptus sp	small
HBT	6060350	697564	Eucalyptus sp	moderate
HBT	6060356	697580	Eucalyptus sp	large
HBT	6060658	697855	E.bridgesiana	moderate
HBT	6060682	697852	E.bridgesiana	small
HBT	6060219	696336	Eucalyptus sp	not noted

HBT	6060167	696381	E.mellidora	moderate & large
HBT	6061036	698227	Eucalyptus sp	not noted
HBT	6061103	698367	Eucalyptus sp	not noted
HBT	6061128	698324	E.mannifera	not noted
HBT	6060365	691577	Stag	large
HBT	6060543	692011	E.mellidora	moderate
HBT	6060592	692240	E.mellidora	moderate
HBT	6060670	6092799	E.mellidora	moderate
HBT	6060660	692980	Stag	moderate
HBT	6060527	693367	E.mellidora	small
HBT	6060552	692165	E.mellidora	moderate
HBT	6060429	691829	E.blakeyli	not noted
HBT	6060527	694044	E.mannifera	moderate
HBT	6060474	694125	E.mannifera	moderate
HBT	6060475	694080	E.mannifera	moderate
HBT	6060496	694070	E.mannifera	moderate

Wombat Burrows (WB)

Type	Y-Projection	X-Projection	Comments (active status)
WB	6060508	693761	Potentially active
WB	6060181	691105	Active (sth side of road)
WB	6060155	691095	Active
WB	6060149	691106	2 holes – 1 active
WB	6060041	691077	Active
WB	6060036	691078	6 entrances within 5 m
WB	6060012	691075	Inactive
WB	6065999	691071	Active
WB	6060223	691131	Active (nth side of road)
WB	6060217	691135	Active
WB	6060211	691147	Active
WB	6060224	691157	Active
WB	6060258	691180	Inactive – flooded on steep bank
WB	6060255	691190	Active -on steep bank
WB	6060252	691191	2 holes on steep bank - active
WB	6060251	691193	Potentially active
WB	6060259	691220	Active - down steep bank on flat
WB	6060266	691231	2 holes potentially active & active
WB	6060266	691239	Active
WB	6060282	691266	Active
WB	6060155	691339	Potentially active
WB	6060163	691325	Not active
WB	6060291	691404	4 entrances - one active
WB	6060379	691646	2 holes - active
WB	6060543	692106	Potentially active & inactive
WB	6060607	692301	Flooded - inactive
WB	6060651	692452	Flooded - inactive
WB	6060703	692538	Potentially active
WB	6060278	691513	Under stag - potentially active

Pink-tailed Worm Lizard (PTWL)

Type	Y-Projection	X-Projection	Habitat quality	PTWL recorded
PTWL	6060400	694921	Moderate	no
PTWL	6060172	696369	Low	no
PTWL	6060672	692524	High	yes
PTWL	6060655	692554	High	yes
PTWL	6060581	692321	Low	no
PTWL	6060639	692958	Low	no
PTWL	6060665	692809	Low	no
PTWL	6060345	691555	Low	no
PTWL	6060577	692150	Moderate	no
PTWL	6060629	692354	Low	no
PTWL	6060676	692526	Moderate	no

Swainsona recta (S.recta)

Type	Y-Projection	X-Projection	Individuals Recorded
S.recta	6060521	693793	1 plant
S.recta	6060461	693772	1 plant
S.recta	6060524	693733	1 plant
S.recta	6060605	693748	1 plant
S.recta	6060610	693758	3 plants
S.recta	6060611	693766	1 plant
S.recta	6060022	693636	1 plant
S.recta	6060025	693639	1 plant
S.recta	6060272	693831	1 plant
S.recta	6060245	693829	1 plant
S.recta	6060546	693782	1 plant
S.recta	6060578	693778	1 plant
S.recta	6060583	693771	1 plant
S.recta	6060532	693699	1 plant
S.recta	6060740	693706	4 plants
S.recta	6060787	693681	4 plants
S.recta	6060793	693682	6 plants
S.recta	6060872	693693	7-8 plants
S.recta	6060879	693708	2 plants

Swainsona sericea (S.sericea)

Type	Y-Projection	X-Projection	Estimated Abundance
S.sericea	6060401.926	695298.1824	50+ plants
S.sericea	6060708.785	694728.9115	1000+ plants
S.sericea	6060778.249	694924.3157	200+ plants
S.sericea	6060486.404	694293.4713	50+ plants
S.sericea	6060469.871	695545.3061	50+ plants

ecological AUSTRALIA

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW
T 02 8536 8600
F 02 9542 5622

SYDNEY
Suite 604, Level 6
267 Castlereagh Street
Sydney NSW 2000
T 02 9993 0566
F 02 9993 0573

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 4
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

HUNTER
Suite 17, Level 4
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

BRISBANE
93 Boundary St
West End QLD 4101
T 0429 494 886

WESTERN AUSTRALIA
108 Stirling Street
Perth WA 6000
T 08 9227 1070
F 08 9227 1078