Department of **Environment & Climate Change** NSW

Application for a

# Section 91 Licence

to harm or pick a threatened species, population or ecological community*, or damage habitat under the *Threatened Species Conservation Act 1995.*

| | | |
|---|---|---|
| 1. Applicant's Name ^: *(if additional persons require authorisation by this licence, please attach details of names and addresses)* | Daryn Railey | |
| 2. ABN Number: | 39 052 096 769 | |
| 3. Organisation name and position of Applicant ^: *(if applicable)* | Springvale Coal<br>Environment and Community Co-ordinator | |
| 4. Postal address ^: | Centennial Coal – Springvale Colliery<br>PO Box 198<br>Wallerawang NSW 2845 | 4. Telephone ^:<br>B.H. 02 6350 1604 |
| 5. Location of the action *(including grid reference and local government area and delineated on a map).* | *East Wolgan Swamp* (Springvale Colliery)<br>Centre of Northern Transects (6304618N, 236528E)<br>Centre of Southern Transects (6304449N, 236487E)<br><br>LGA – Lithgow City Council<br><br>A comprehensive Flora and Fauna Assessment (FFA) and accompanying 7 part test assessment has been prepared by RPS (June 2010) in relation to DECCW requirements from the previous S91 application for a similar proposal. That report is attached to this S91 application.<br><br>See Figures 1-1 and 1-2 in the accompanying FFA for location information. | |

* A threatened species, population or ecological community means a species, population or ecological community identified in Schedule 1, 1A or Schedule 2 of the *Threatened Species Conservation Act 1995.*

^The personal details of all Section 91 licences will be displayed in the register of Section 91 licences required under Section 104 of the *Threatened Species Conservation Act 1995.* See notes.

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| 6. Full description of the action and its purpose *(eg., environmental assessment, development etc.).* | The space provided in this form does not allow for an effective description of the proposal. For a full description of the action and its purpose, refer to the FFA (RPS 2010) attached to this S91 Application.<br><br>In summary, the proposal consists of Geotechnical and Geophysical Investigations (GGI) within the area known as East Wolgan Swamp. This swamp is located on the Newnes Plateau (within Newnes State Forest) north of Lithgow. This has been proposed following consultation with DII, DECCW, DEWHA and Forests NSW where a plan to carry out further investigation within East Wolgan Swamp was agreed to (in principle).<br><br>The GGI is to be undertaken to provide valuable information on the geological and physical characteristics of the swamp. The rationale for and methodology of the proposed program are outlined in further detail within the FFA. This type of swamp habitat is considered to be important as it is a listed Endangered Ecological Community (EEC) under the Threatened Species Conservation Act 1995 (TSC Act 1995). The swamp community is known as Newnes Plateau Shrub Swamp (NPSS). NPSS within the site is also consistent with Temperate Highland Peat Swamps on Sandstone which is listed as a Threatened Ecological Community under the Environment Protection Biodiversity Conservation Act 1999 (EPBC Act 1999).<br><br>GGI are proposed at two isolated sites within East Wolgan Swamp (herein referred to as Northern Transects and Southern Transects) as shown in Figure 1-2 in the FFA). These transects have been numbered 1 to 8 as shown on that plan.<br><br>Previous ecological investigations within East Wolgan Swamp were undertaken in 2009 by RPS Harper Somers O'Sullivan (RPS HSO), now known as RPS only. These provided an overview of the proposal and its general impacts on the ecological characteristics of the swamp. A Section 91 application was submitted to the Department of Environment, Climate Change and Water (DECCW) in 2009 for the activity, primarily in relation to the potential impacts upon the NPSS.<br><br>In correspondence dated 19 February 2010, DECCW refused the application based on lack of detailed information provided on the impacts of the activity. DECCW outlined additional detailed information that was required to be submitted with a more detailed Section 91 application. The purpose of the accompanying FFA is to provide the detailed information to comply with the information request from DECCW and to accompany this second Section 91 application.<br><br>It should be noted that on 21 January 2010 the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) determined that the proposed activity was not a controlled action. As a result no further assessment is required in relation to the EPBC Act 1999. Forests NSW have also endorsed the activities in correspondence received on 7 January 2010. Correspondence from these parties is included in the FFA. |

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| 7. Details of the area to be affected by the action *(in hectares)*. | Detailed investigations in relation to the area to be affected as outlined in the attached FFA can be summarised as follows:<br>• Of a total length of 135m x 1.5m of the GPR transects, approximately 50% of this is already barren or cleared;<br>• The remaining 50% not already cleared means that a total area of approximately 105m$^2$ will need to be temporarily trimmed for the GPR activity. 105m$^2$ equates to less than 0.1Ha and a total of 0.2% of the total area (41,630m$^2$) of East Wolgan Swamp, and a negligible proportion of this EEC in total; and<br>• The resistivity transects will not require any clearing and will be temporary in nature. |
| 8. Duration and timing of the action *(including staging, if any)*. | It is expected that these activities would be undertaken as outlined in the FFA as soon as a S91 Licence is granted by DECCW as all other approvals from all other State and Federal departments have been obtained.<br><br>The actual activity itself would take four to five days at the most. This is weather dependant and based on winter daylight hours and rainfall. |
| 9. Is the action to occur on land declared as critical habitat*? *(please tick appropriate box)* | Yes ☐ No ✓ |

| 10. Threatened species, populations or ecological communities to be harmed or picked. | Scientific Name | Common Name *(if known)* | Conservation Status *(ie. critically endangered, endangered or vulnerable)* | Details of no. of individual animals, or proportion and type of plant material *(eg. fertile branchlets for herbarium specimens or whole plants or plant parts)* |
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| | Newnes Plateau Shrub Swamp (NPSS) in the Sydney Basin Bioregion.<br><br>Various other threatened flora and fauna have been considered in the FFA, however these are not likely to be 'harmed or picked' | | Endangered Ecological Community | Approximately 105m$^2$ of NPSS at *East Wolgan Swamp* will be temporarily affected by the monitoring works. For more detail please refer to the attached FFA. |

* Critical habitat means habitat declared as critical habitat under Part 3 of the *Threatened Species Conservation Act 1995*.

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| 11. Species impact: *(please tick appropriate box)*<br><br>a) For action proposed on land declared as critical habtat; or<br><br>b) For action proposed on land not declared as critical habitat. | ~~An SIS is attached~~<br><br>✓ Items 12 to 25 have been addressed |

*N.B: Provision of a species impact statement is a statutory requirement of a licence application if the action is proposed on critical habitat.*
*The provision of information addressing items 12 to 17 is a statutory requirement of a licence application if the action proposed is not on land that is critical habitat. Information addressing any of the questions below must be attached to the application.*

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| 12. Describe the type and condition of habitats in and adjacent to the land to be affected by the action. | The FFA that has been prepared to describe the detailed site surveys of the affected areas within East Wolgan Swamp attached to this application detail the type of habitats present. East Wolgan Swamp was subject to investigations in the Northern Transect and Southern Transect groups.<br><br>In summary:<br><br>• Approximately 50% of the area to be affected by the proposal is already barren or cleared;<br>• The other 50% is in relatively good condition, being mainly comprised of low (<50cm) swamp vegetation having a patchy distribution and density; and<br>• Upslope communities to the above areas were open forest exhibiting unaltered natural condition. |
| 13. Provide details of any known records of a threatened species in the same or similar known habitats in the locality *(include reference sources)*. | The attached FFA provides the results of a full desktop investigation of previous records and reporting in East Wolgan Swamp and in similar environments in the locality. The FFA fully outlines the reference sources in detail.<br><br>*Derwentia blakelyi* was found to occur at the foot of the western slope of the project area in a band extending up the lower slope from immediately adjacent to the swamp vegetation. The location of significant flora species in relation to the proposed sites is shown in Figure 3-1 of the FFA. *D. blakelyi* is listed under the TSC Act 1999 as Vulnerable. Detailed counts of *D. blakelyi* were not undertaken as it was determined on-site with Centennial that plants could easily be flagged and avoided as part of the protective measures to be implemented for the proposal. This plant numbered in the thousands along the edge of East Wolgan Swamp.<br><br>Scarlet Robin and Flame Robin, both vulnerable species, were recorded in the open woodland and forest adjoining East Wolgan Swamp.<br><br>The FFA considered impacts on the following species that had been listed in the locality: |

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| | Flora<br>Endangered Species<br>*Persoonia hindii*<br><br>Vulnerable Species<br>*Boronia deanei* subsp. *deanei* *Derwentia blakelyi*<br><br>Endangered Ecological Communities<br>Newnes Plateau Shrub Swamp (NPSS) in the Sydney Basin Bioregion<br><br>Fauna<br>Endangered Species<br>Stuttering Frog Bathurst Copper Butterfly<br>Blue Mountains Water Skink Giant Dragonfly<br>Regent Honeyeater<br><br>Vulnerable Species<br>Gang-gang Cockatoo Brown Treecreeper<br>Grey-crowned Babbler Speckled Warbler<br>Glossy Black-Cockatoo Yellow-bellied Glider<br>Little Lorikeet Squirrel Glider<br>Swift Parrot Grey-headed Flying-fox<br>Barking Owl Large-eared Pied Bat<br>Powerful Owl Eastern False Pipistrelle<br>Masked Owl Eastern Bentwing-bat<br>Black-chinned Honeyeater (eastern subspecies) Greater Broad-nosed Bat<br>Scarlet Robin Little Bentwing-bat<br>Flame Robin Eastern Freetail-bat<br>Varied Sittella Yellow-bellied Sheathtail-bat<br>Spotted-tailed Quoll Southern Myotis<br>Koala Eastern Cave Bat<br>Eastern Pygmy-possum<br>Long-nosed Potoroo<br><br>Preliminary Determinations<br>White-browed Woodswallow<br><br>Refer to the FFA for more detail on these species and their occurrence in the locality. |
| 14. Provide details of any known or potential habitat for a threatened species on the land to be affected by the action *(include reference sources)* | The attached FFA provides the results of a full desktop investigation of previous records and reporting in East Wolgan Swamp and in similar environments in the locality. The FFA also outlines the level of survey undertaken for likely species in East Wolgan Swamp and similar environments in the locality, both previously and for this assessment.<br><br>There is a level of potential habitat provided by East Wolgan Swamp and the adjoining forested environments for the species and NPSS listed above. The suitability of habitat for these species is outlined in Table 3-6 of the FFA.<br><br>Known habitat for the NPSS and *Derwentia blakelyi* is mapped in the FFA. Known habitat for the Scarlet Robin and Flame Robin consists of the entirety of the extensive woodland and forested environments surrounding East Wolgan Swamp. |

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| 15. Provide details of the amount of such habitat to be affected by the action proposed in relation to the known distribution of the species and its habitat in the locality. | As outlined in the FFA:<br><br>• Of a total length of 135m x 1.5m of the GPR transects, approximately 50% of this is already barren or cleared;<br>• The remaining 50% not already cleared means that a total area of approximately 105m$^2$ will need to be temporarily trimmed for the GPR activity. 105m$^2$ equates to less than 0.1Ha and a total of 0.2% of the total area (41,630m$^2$) of East Wolgan Swamp, and a negligible proportion of this EEC in total; and<br>• The resistivity transects will not require any clearing and will be temporary in nature.<br>• This swamp vegetation is adapted to disturbances such as fire and damage by fauna and weather events. The trimmed vegetation is expected to readily resprout and regrow post-trimming.<br>• Heaviest equipment to be used would be 40kg<br>• Program expected to take around 4 – 5 days<br>• The number of people will be minimised at all times. It is likely that there could be up to 8 people involved in the program at any one time ie. operators of the GGI equipment, personnel trimming in situ vegetation, ecologist, site personnel. These proposed numbers are much the same (or less) as a routine inspection, for example Government Department inspections.<br><br>In short:<br><br>• The NPSS habitat to be affected equates to 0.2% of East Wolgan Swamp, a comparatively negligible proportion and it is considered that this affected area will return to its natural state post-activity;<br>• The adjoining forested habitats will not be affected apart from short-term resistivity probes and short-term foot access to bring equipment onto the site;<br>• This effectively indicates that a negligible proportion of habitat is likely to be affected for all known or potentially occurring threatened species and the NPSS.<br><br>For further detail please refer to the FFA attached to this form. |
| 16. Provide an assessment of the likely nature and intensity of the effect of the action on the lifecycle and habitat of the species. | The likely nature and intensity of the effect of the GGI works are relatively minor and are outlined in the attached FFA.<br><br>The proposed activities are considered unlikely to impact on the lifecycle or habitat of any threatened species, populations or ecological communities. |
| 17. Provide details of possible measures to avoid or ameliorate the effect of the action. | The proposed GGI activities will occur in accordance with the following recommendations to avoid and ameliorate potential impacts as outlined in the FFA:<br><br>• Ecologist to be present to identify threatened species such as *Derwentia blakelyi.* These threatened species are to be avoided and the ecologist is to document on-ground supervision activities and report to Springvale and DECCW;<br>• The number of personnel in the swamp at any one time should be |

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| | limited to the minimum number necessary at any one time;<br>• Equipment and storage areas must be placed outside of the swamp and threatened species known areas of occurrence;<br>• All activities to be undertaken away from permanently pooled, flowing and / or open water;<br>• Preferably wait until at least 10 days after regular rain to avoid disturbing the substrate in its most susceptible state;<br>• Absolute minimal vegetation necessary to complete the project should be trimmed;<br>• Trimmed vegetation should be placed in existing cleared areas within the swamp to assist natural regeneration;<br>• Where fallen timber is require to be moved the ecologist should undertake an inspection for fauna before it is moved in order to protect and temporarily relocate any observed fauna. Wherever possible, timber shall be relocated back to its original position;<br>• To avoid establishing tracks, access to the swamp should be varied as required; and<br>• Appropriate environmental hygiene protocols should be implemented to avoid exotic seed and / or pathogens from contaminating the EEC. Hygiene protocols should be applicable to personnel and equipment alike. A brief protocol should be prepared for issue to personnel prior to the GGI activities being undertaken. |

*N.B: The Director-General must determine whether the action proposed is likely to significantly affect threatened species, populations or ecological communities, or their habitats. To enable this assessment the Applicant is required to address items 18 to 25. Information addressing any of the questions below must be attached to the application.*

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| 18. In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. | Impacts are expected to be minor (see Section 1.2 and Section 3 of FFA). 0.2% of the NPSS will be affected by the temporary trimming and GGI activities. No species are likely to be affected by the low-level impact over 4-5 days. Numerous recommendations have been made to ensure the protection of all habitats and threatened species as part of the GGI activities.<br><br>The proposal is <u>unlikely</u> to adversely affect the life cycle of any threatened flora species or fauna species. |
| 19. In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction. | No Endangered Populations are likely to occur within the subject site. |

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| 20. In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:<br><br>(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or<br><br>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction. | Impacts are expected to be minor (see Section 1.2 and Section 3 of the FFA). 0.2% of the NPSS will be affected by the temporary trimming and GGI activities. No species are likely to be affected by the low-level impact over 4 - 5 days. Numerous recommendations have been made to ensure the protection of all habitats and the NPSS as part of the GGI activities.<br><br>The proposal is unlikely to: adversely affect the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction. |
| 21. In relation to the habitat of a threatened species, population or ecological community:<br><br>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and<br><br>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and | Impacts are expected to be minor (see Section 1.2 and Section 3 of FFA). 0.2% of the NPSS will be affected by the temporary trimming and GGI activities. No species are likely to be affected by the low-level impact over 4 - 5 days. Numerous recommendations have been made to ensure the protection of all habitats, threatened species and the NPSS as part of the GGI activities.<br><br>No substantial areas of habitat would be removed for the proposal. No areas of habitat are likely to become fragmented or isolated from other areas of habitat as a result of the proposal due to the small areas associated with the project and the low intensity of the activity.<br><br>No areas of habitat are likely to be fragmented or isolated. Given the relatively high abundance of similar habitat areas across Newnes Plateau the area of habitat within the subject site is not of any particular importance to any of the above species. The areas of habitat within the subject site are of moderate importance to the NPSS and threatened flora species which are patchily distributed throughout Newnes Plateau. The impacts will be temporary and limited in nature. Sites have been chosen based on the existing level of impact. This may minimise any further disturbances associated with the proposed activity. |

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| (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality. | |
| 22. Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly). | No areas declared as Critical Habitat lie within the subject site. |
| 23. Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan. | No draft or final recovery plans or threat abatement plans or threatened species priorities action statements are currently listed on the Department of Environment, Climate Change and Water website for the majority of species.<br>As such minor modification of habitat areas will occur the Proposal is not inconsistent with the objectives of the recovery plans for Large Forest Owls, Koala, Yellow-bellied Glider or Bathurst Copper Butterfly. |
| 24. Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process. | Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is the main relevant KTP.<br>The impacts will be minor and result in very little disturbance to the groundcover and only 0.2% of the swamp. The natural flow regime will not be altered. |

## Important information for the Applicant

### Processing times and fees

The *Threatened Species Conservation Act 1995* provides that the Director-General must make a decision on the licence application within 120 days where a species impact statement (SIS) has been received. No timeframes have been set for those applications which do not require a SIS.

The Director-General will assess your application as soon as possible. You can assist this process by providing clear and concise information in your application.

Applicants may be charged a processing fee. The Director-General is required to advise prospective applicants of the maximum fee payable before the licence application is lodged. Therefore, prospective applicants should contact the DECC prior to submitting a licence application .

A $30 licence application fee must accompany a licence application.

**Protected fauna and protected native plants***

Licensing provisions for protected fauna and protected native plants are contained within the *National Parks and Wildlife Act 1974.* However, a Section 91 Licence may be extended to include protected fauna and protected native plants when these will be affected by the action.

If you are applying for a licence to cover both threatened and protected species please provide the information requested in Item 10 and a list of protected species and details of the number of individuals animals or proportion and type of plant material which are likely to be harmed or picked.

**Request for additional information**

The Director-General may, after receiving the application, request additional information necessary for the determination of the licence application.

**Species impact statement**

Where the application is not accompanied by a SIS, the Director-General may decide, following an initial assessment of your application, that the action proposed is likely to have a significant effect on threatened species, populations or ecological communities, or their habitats. In such cases, the *Threatened Species Conservation Act 1995* requires that the applicant submit a SIS. Following initial review of the application, the Director-General will advise the applicant of the need to prepare a SIS.

**Director-General's requirements for a SIS**

Prior to the preparation of a SIS, a request for Director-General's requirements must be forwarded to the relevant DECC Office. The SIS must be prepared in accordance with section 109 and 110 of the TSC Act and must comply with any requirements notified by the Director-General of the Department of Environment and Climate Change (NSW).

**Disclosure of Personal Information in the Public Register of s91 Licences**

The Public Register provides a list of licence applications and licences granted. A person about whom personal information is contained in a public register may request that the information is removed or not placed on the register as publicly available.

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* Protected fauna means fauna of a species not named in Schedule 11 of the *National Parks and Wildlife Act 1974.*
Protected native plant means a native plant of a species named in Schedule 13 of the *National Parks and Wildlife Service 1974.*

A full copy of licences granted is included on the DECC website at
http://www.environment.nsw.gov.au/npws.nsf/content/s91_tsca_register
or in a hardcopy available from The Librarian, DECC, 59 Goulburn St, Sydney.

Please contact the relevant Environment Protection and Regulation Division for more details (Contact details are below)

**Certificates**

If the Director-General decides, following an assessment of your application, that the proposed action is not likely to significantly affect threatened species, populations or ecological communities, or their habitats, a Section 91 Licence is not required and the Director-General must, as soon as practicable after making the determination, issue the applicant with a certificate to that effect.

*N.B: An action that is not required to be licensed under the Threatened Species Conservation Act 1995, may require licensing under the National Parks and Wildlife Act 1974, if it is likely to affect protected fauna or protected native plants.*

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I confirm that the information contained in this application is correct. I hereby apply for a licence under the provisions of Section 91 of the *Threatened Species Conservation Act 1995.*

| Applicant's name, organisation and position *(Please print)* | Applicant's signature | Date |
|---|---|---|
| Daryn Railey | | 17 June 2010 |

For more information or to lodge this form, contact the Climate Change and Environment Protection Group in your nearest DECC office:

Metropolitan Branch
P: 02 9995 6851
F: 02 9995 6900
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Parramatta
NSW 2124

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Email: info@environment.nsw.gov.au

# Springvale Colliery Geotechnical and Geophysical Works, East Wolgan Swamp

## Flora and Fauna Assessment Report


Prepared by:

**RPS**

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Document Status

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| Draft 1 | Client Review | AR | TL | 1-6-10 | SB 15-4-10 | T.Lambert | 1-6-10 |
| Draft 2 | 2nd Client Review | AR | TL | 9-6-10 | | T.Lambert | 9-6-10 |
| Final | Final for Issue | AR | TL | 17-6-10 | | T.Lambert | 17-6-10 |

Disclaimers

# Executive Summary

RPS Australia East Pty Ltd (RPS) was engaged by Springvale Coal Pty Ltd to prepare a Flora and Fauna Assessment (FFA) report for proposed Geotechnical and Geophysical Investigations (GGI) within the area known as East Wolgan Swamp. This swamp is located on the Newnes Plateau (within Newnes State Forest) north of Lithgow.

The GGI is to be undertaken to provide valuable information on the geological and physical characteristics of the swamp. The rationale for and methodology of the proposed program are outlined in further detail within this document. This type of swamp habitat is considered to be important as it is a listed Endangered Ecological Community (EEC) under the Threatened Species Conservation Act 1995 (TSC Act 1995). The swamp community is known as Newnes Plateau Shrub Swamp (NPSS). NPSS within the site is also consistent with Temperate Highland Peat Swamps on Sandstone which is listed as a Threatened Ecological Community under the Environment Protection Biodiversity Conservation Act 1999 (EPBC Act 1999).

Previous ecological investigations within East Wolgan Swamp were undertaken in 2009 by RPS Harper Somers O'Sullivan (RPS HSO), now known as RPS only. These provided an overview of the proposal and its general impacts on the ecological characteristics of the swamp. A Section 91 application was submitted to the Department of Environment, Climate Change and Water (DECCW) in 2009 for the activity, primarily in relation to the potential impacts upon the NPSS.

In correspondence dated 19th February 2010, DECCW refused the application based on lack of detailed information provided on the impacts of the activity. DECCW outlined additional detailed information that was required to be submitted with a more detailed Section 91 application. The purpose of this FFA is to provide the detailed information to comply with the information request from DECCW and accompanies a second Section 91 application.

It should be noted that on 21st January 2010 the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) determined that the proposed activity was not a controlled action. As a result no further assessment is required in relation to the EPBC Act 1999. Forests NSW have also endorsed the activities in correspondence received 7th January 2010.

This FFA provides an updated assessment of the potential impacts of the proposed GGI works on the NPSS and associated threatened species that were found within the proposed work site.

Assessment via a seven part test found that the Proposal was unlikely to significantly impact on any of the identified species or communities.

Assessment under SEPP 44 found that no 'Potential Koala Habitat' occurs within the subject site and no further assessment under SEPP 44 was required.

The proposal is unlikely to significantly impact on any species, population or ecological community listed under the TSC Act or SEPP 44.

A number of recommendations are provided hereunder to ensure protection of the swamp during the GGI activities.

- Ecologist to be present to identify threatened species such as *Derwentia blakelyi.* These threatened species are to be avoided and the ecologist is to document on-ground supervision activities and report to Springvale and to DECCW;
- The number of personnel in the swamp at any one time should be limited to the minimum number necessary at any one time;
- Equipment and storage areas must be placed outside of the swamp and away from threatened species known areas of occurrence;
- All activities to be undertaken away from permanently pooled, flowing and / or open water;
- Preferably wait until at least one week after regular rain to avoid disturbing the substrate in its most susceptible state;
- Absolute minimal vegetation necessary to complete the project should be trimmed;
- Trimmed vegetation should be placed in existing cleared areas within the swamp to assist natural regeneration;
- Where fallen timber is required to be moved the ecologist should undertake an inspection for fauna before it is moved in order to protect and temporarily relocate any observed fauna. Wherever possible, timber shall be relocated back to its original position;
- To avoid establishing tracks, access to the swamp should be varied as required; and
- Appropriate environmental hygiene protocols should be implemented to avoid exotic seed and / or pathogens from contaminating the EEC. These hygiene protocols shall be applied to both person and equipment. A brief protocol should be prepared for issue to personnel prior to the GGI activities being undertaken.

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# 1 Introduction

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The GGI is to be undertaken to provide valuable information on the geological and physical characteristics of the swamp. The rationale for and methodologies of the proposed program are outlined in further detail in this document. This type of swamp habitat is considered to be important as it is identified as an Endangered Ecological Community (EEC) and is listed as an EEC under the *Threatened Species Conservation Act 1995* (TSC Act 1995). The EEC is known as a Newnes Plateau Shrub Swamp (NPSS). NPSS within the site is also consistent with Temperate Highland Peat Swamps on Sandstone which is listed as an Threatened Ecological Community under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act 1999).

Previous ecological investigations were undertaken in 2009 by RPS Harper Somers O'Sullivan (RPS HSO), now known as RPS only. These provided an overview of the proposal and its general impacts on the ecological characteristics of the swamp. A Section 91 application was submitted to the Department of Environment, Climate Change and Water (DECCW) in November 2009 for the activity, primarily in relation to the potential impacts upon the NPSS.

In correspondence dated 19th February 2010, DECCW refused the application based on lack of detailed information provided on the impacts of the activity. DECCW outlined additional detailed information that was required to be submitted with a more detailed Section 91 application. The purpose of this FFA is to provide the detailed information to comply with the information request from DECCW and accompanies a second Section 91 application.

It should be noted that on 21st January 2010 the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) determined that the proposed activity was not a controlled action. This correspondence is provided in **Appendix 1**. As a result no further assessment is required in relation to the EPBC Act 1999. Forests NSW have also endorsed the activities in correspondence received 7th January 2010. This correspondence is also provided in **Appendix 1**.

This FFA provides an updated assessment of the potential impacts of the proposed GGI works the NPSS and associated threatened species. Particular care has been taken to address the issues provided in correspondence from DECCW in February 2010.

## 1.1 Site Particulars

**Locality** – Headwaters of Wolgan River, Newnes Plateau, NSW.

**LGA** – Greater Lithgow.

**Area** – The area to be affected by the proposal has been calculated to be in the order of 105m$^2$.

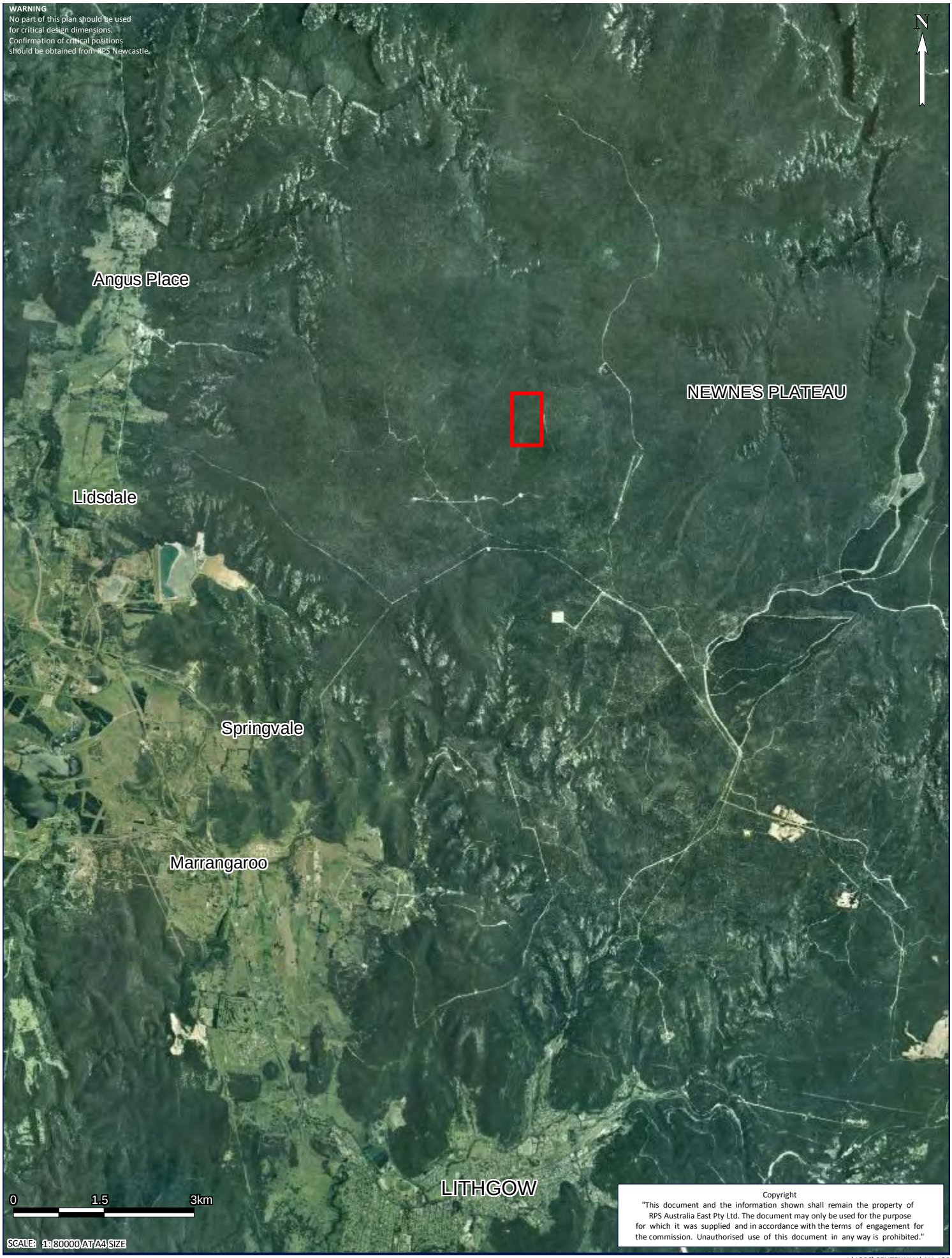
**Current Land Use** – The entire surface area of the subject site is contained within Newnes State Forest. The subject site includes an area of East Wolgan Swamp. The predominant land uses of the subject site and surrounding areas include native hardwood harvesting and recreational activities such as bush walking, motorbike riding and four-wheel driving.

**Topography** – The study area lies within and extends outside of the East Wolgan Swamp, which sits at the base of the adjoining sandstone foot slopes.

**Watercourses** – East Wolgan Swamp occurs along a formally un-named stream of the Wolgan River (approximately 500 metres to the north). East Wolgan Swamp consists of several minor breaches feeding into a broad flat valley.

**Vegetation** – Vegetation within the subject site is dominated by two distinct vegetation types, dense low swamp shrubby vegetation along the drainage lines and eucalypt forest vegetation on the slopes and ridges.

**Figure 1-1** shows the general location of the subject site within the local region. **Figure 1-2** shows the location of the proposed activities within the context of the East Wolgan Swamp boundary.






J:\JOBS\CENTENNIAL\ALL JOB \PR103037 SPRINGVALE S91\

TITLE: FIGURE 1-1 SITE LOCATION

LOCATION: SPRINGVALE

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 27/5/2010
PURPOSE: GGI F&F

LAYOUT REF: 10- DRAFTING\MAPINFO
VERSION (PLAN BY): T.L.

CLIENT: CENTENNIAL COAL
JOB REF: 103250

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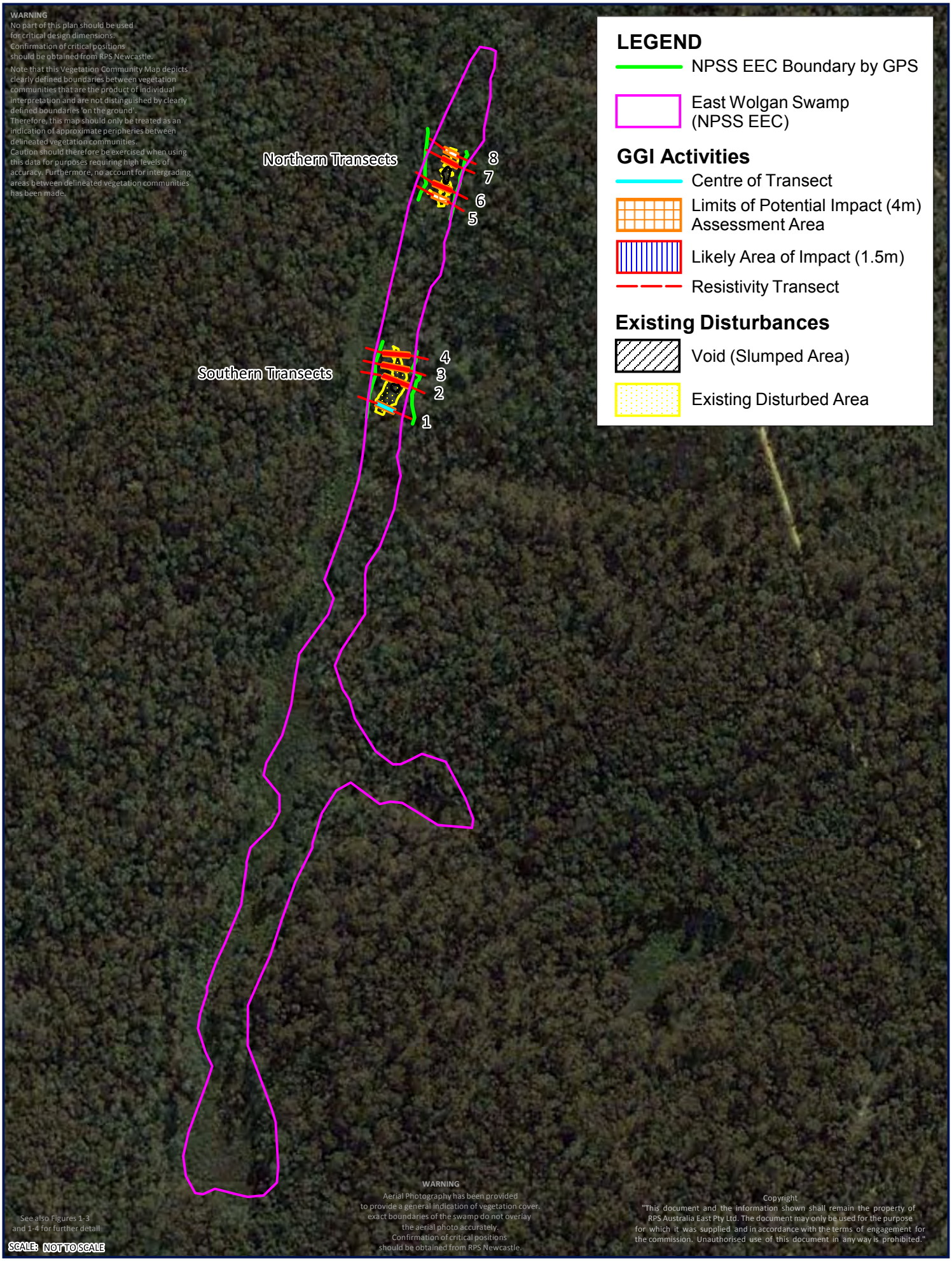


TITLE: FIGURE 1-2 GGI LOCATION

LOCATION: SPRINGVALE

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 27/5/2010
PURPOSE: PURPOSE

LAYOUT REF: J:\JOBS\Centennial \All Jobs \PR103037 Springvale S91 \10- Drafting\Mapinfo
VERSION (PLAN BY): A (T.L)

CLIENT: CENTENNIAL COAL
JOB REF: PR103037

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## 1.2 Description of the Proposal and Predicted Impacts

Geotechnical / geophysical investigations (GGI) are proposed at two isolated sites within East Wolgan Swamp (herein referred to as Northern Transects and Southern Transects as shown in **Figure 1-2**). These transects have been numbered 1 to 8, which will encompass the following cumulative works:

**Geophysical Works**

Ground penetrating radar (GPR) transects will be located in two separate areas of East Wolgan Swamp, which currently exhibit losses and / or degradation to Newnes Plateau Shrub Swamp (NPSS) vegetation and / or substrate degradation. Transects will be placed across the drainage line so that a profile of the swamp's subterranean substrate topography can be derived. Provision for a maximum of four transects at each transect group location (see **Figure 1-2**) has been made and assessed within this report. Length and area of each of the proposed transects and area of vegetation disturbance is contained in **Table 1-1**.

The GPR survey will be applied only to Swamp areas to define both internal structures and basement. Each transect will be cleared/trimmed with brush-cutter approximately 1.5m wide to enable the GPR to have direct sight with the ground. To provide greatest flexibility, 4 metre wide transects were assessed in the field (see Figures 1-3 and 1.4). The transect width required for the GPR equipment is limited to 1.5 metres. The reason for assessing a greater area than is actually required is to enable flexibility in the field so that the application of GPR equipment can go around an obstacle (or specific vegetation components) if discovered en-route. The wider assessment area will enable avoidance of the "obstacle" whilst remaining within the assessed area.

The transects have been located in areas where least impact will result, while occurring in the area most pertinent for GGI and subsequent analysis. In many cases, particularly where the swamp is relatively clear and regenerating there will be no need to trim vegetation further. This is due to the nature of the GPR unit(s) such that it incorporates a little ground clearance. Accordingly, there is the opportunity to pass over areas of regeneration without damage and without losing sight of the peat material primarily due to the height/density of the regeneration.

Transect length will vary depending on Swamp width as the GPR lines extend across an area of swamp sufficient to gather detailed substrate information, particularly any potential tunnelling, cavities or piping. Within the two proposed investigation areas, Swamp widths will require a maximum transect length of approximately 22 metres and a minimum length of 12 metres. The length of transects will vary in relation to swamp width and will be adjusted to fit the width of the swamp profile as it becomes narrow, see **Table 1-1** and **Figures 1-3** and **1-4** for actual length and maps as recently recorded on a GPS in the field.

**WARNING**
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'. Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities. Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

## LEGEND

NPSS Boundary

### GGI Activities

Centre of Transect

Likely Area of Impact (1.5m)

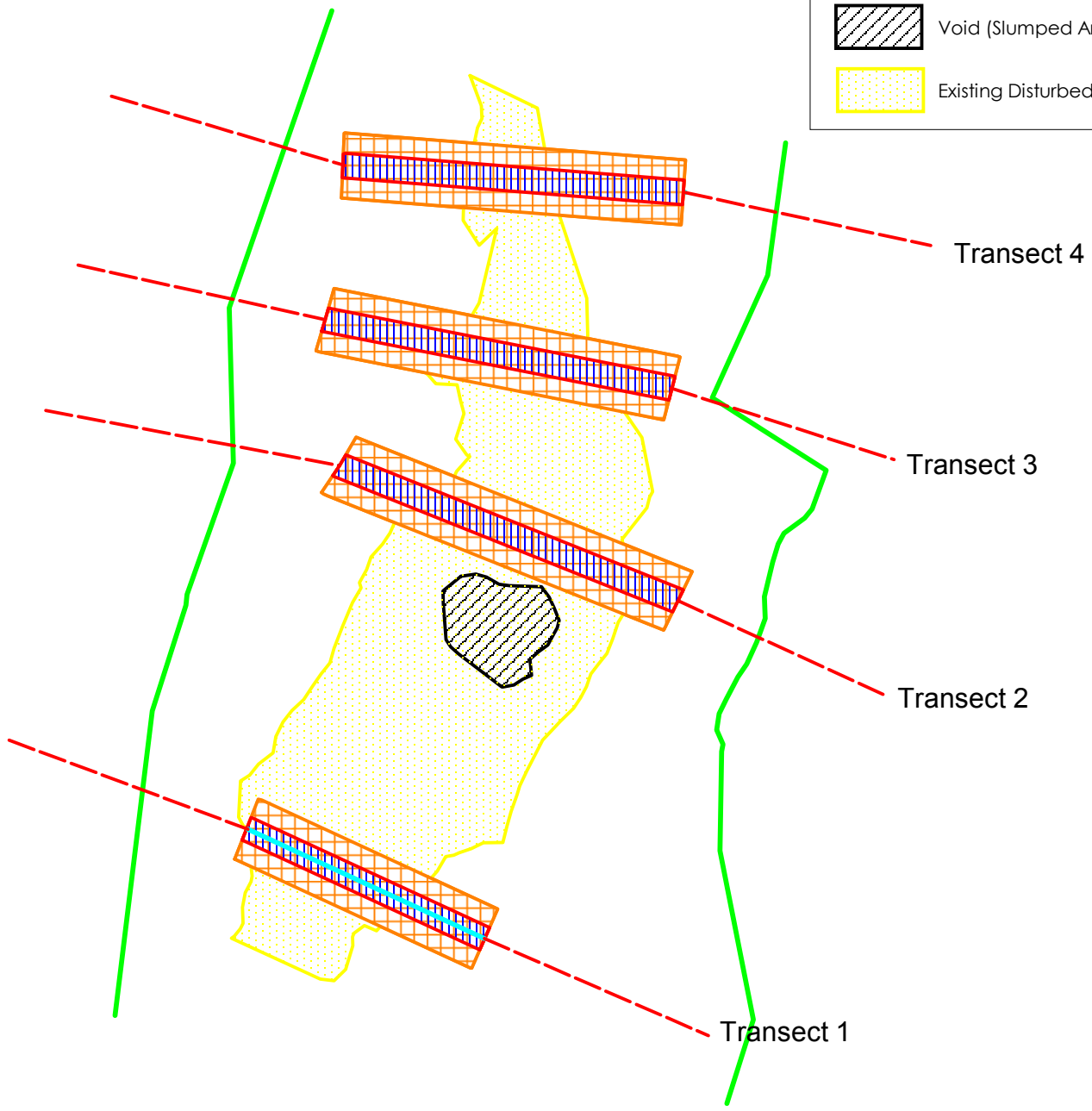
Limits of Potential Impact (4m) Assessment Area

Resistivity Transect

### Existing Disturbances

Void (Slumped Area)

Existing Disturbed Area






SCALE: 1: 400 AT A4 SIZE

TITLE: FIGURE 1-3 SOUTHERN TRANSECTS

LOCATION: SPRINGVALE

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 31/5/10
PURPOSE: PURPOSE

LAYOUT REF: J:\JOBS\Centennial\All Jobs\PR103037 Springvale S91\10- Drafting\Mapinfo
VERSION (PLAN BY): A (T.L.)

CLIENT: CENTENNIAL COAL
JOB REF: PR103037

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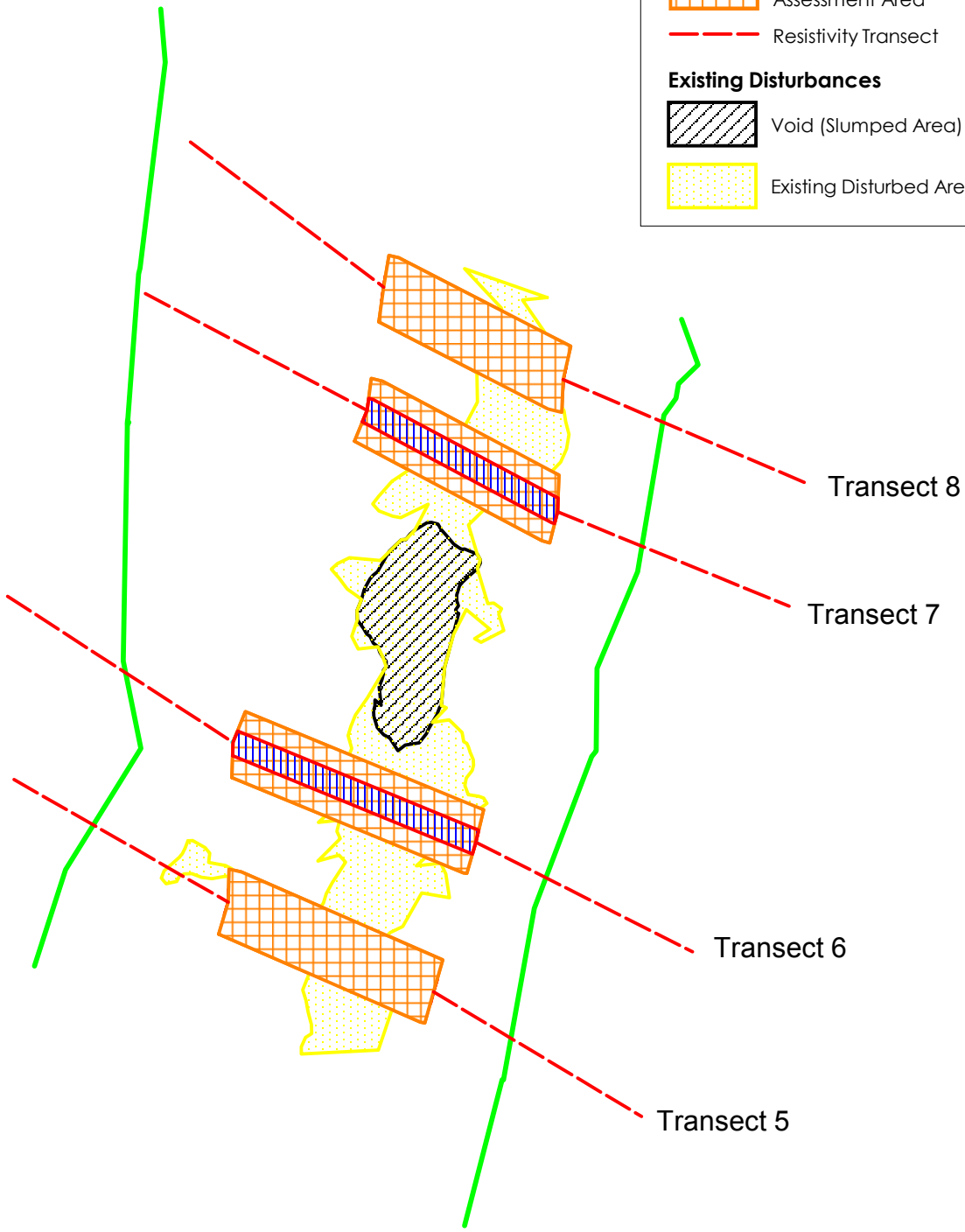
**WARNING**
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'. Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities. Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.






SCALE: 1: 400 AT A4 SIZE

TITLE: FIGURE 1-4 NORTHERN TRANSECTS
LOCATION: SPRINGVALE
DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)
DATE: 31/5/2010
PURPOSE: GGI
J:\JOBS\Centennial \All Jobs \PR103037 Springvale S91 \10- Drafting\Mapinfo
LAYOUT REF:
VERSION (PLAN BY): A (A.P-A.R)

CLIENT: CENTENNIAL COAL
JOB REF: PR103037

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The total area of vegetation to be trimmed does not include those areas which are already cleared / degraded and adjusted lengths and areas in relation to specific transect footprint are provided later in Section 3 of this document. **Plate 1-1** shows the application of the GPR techniques in a cleared open site. As shown in **Plate 1-1**, two types of equipment will be used.

The GPR will be pushed or pulled across the transect lanes. Both pieces of equipment have different antenna. Data will be collected and interpreted real time. The GPR with the 250MHz antenna will be pushed over the transect length of the peat material (see Figure 1-5). The GPR with the 100MHz antenna will be pulled over the transect length of the peat material as well (see Figure 1-5). Both GPR's will be required for the project because the different antenna's provide different resolutions and detail at varying depths. For example, the 100MHz antenna may map the substrate in detail to a depth of say 1.5m and the 250MHz antenna may map the substrate to a greater depth of say 3-4m, but will not be able to map the detail that the 100MHz GPR can capture. The actual depths that the GPR antenna's will map is currently unknown as the density of the peat substrate is currently unknown, therefore the mapping limitations cannot be specifically determined until the surveys are complete. This is further explained in **Appendix 7**.

250MHz Antenna

100 MHz Antenna

**Plate 1-1 Ground Penetrating Radar equipment**

Resistivity profiling will also be undertaken requiring the insertion of narrow rods in an array across the profile of the swamp. This will involve an extension of the transects utilised for the GPR. The extension will be in the order of approximately 15m each side of the edge of the swamp. This shown schematically in **Figure 1-5**.

**Plate 1-2** shows the application of this technique in a cleared open site. The insertion of narrow rods is unlikely to require brush-cutting of vegetation in between rod insertion,

however, through thick areas of *Gleichenia dicarpa* or other ferns or shrubs, vegetation will need to be parted without the need for cutting to ensure the rods are appropriately inserted into the soil substrate.

Electrical cables will connect the rods and an electrical current sent through the cables. The risk of fire was addressed with Forests NSW and it was determined that there is minimal risk due to the low voltages being applied.

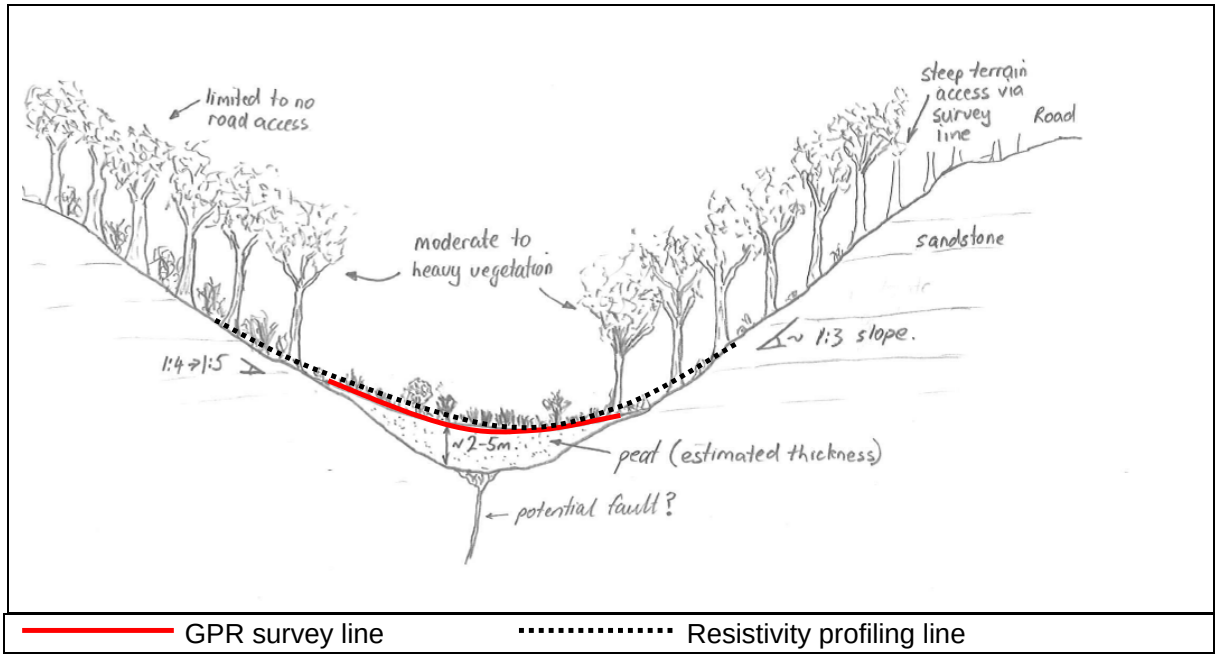



**Figure 1-5. Cross Section of GGI techniques within East Wolgan Swamp**

No other vegetation control measures will be required for resistivity profiling. No clearing or soil disturbance as shown in the plate below will be required; this just gives an indication of probe size and array.

**Plate 1-2 – Resistivity Profiling**
*(Source: Alpha Geoscience, 2009*

The table below shows the detailed information on specific transect lengths for the Resistivity and GPR aspects of the GGI, as ground-truthed with a hand-held GPS.

**Table 1-1: GGI Works Transect dimensions within East Wolgan Swamp**

| Transect Number | Total Transect Length in metres | Resistivity Transect Length in metres | GPR Transect Length in metres |
|---|---|---|---|
| Southern Transects | | | |
| T1 (most southerly) | 46.4 | 30 | 16.4 |
| T2 | 52.37 | 30 | 22.37 |
| T3 | 51.59 | 30 | 21.59 |
| T4 | 50.89 | 30 | 20.89 |
| Northern Transects | | | |
| T5 | 43.58 | 30 | 13.58 |
| T6 | 45.81 | 30 | 15.81 |
| T7 | 43 | 30 | 13 |
| T8 (most northerly) | 42.2 | 30 | 12.2 |
| **TOTALS** | **375.84** | **240** | **135.84** |

**Geotechnical Works**

Geotechnical works will be undertaken after the geophysical surveys, within the transects already established, to minimise impacts within NPSS vegetation and will consist of the following applications:

- Dynamic cone penetrometer (DCP) application will be utilised to measure soil penetration resistance by assessing soil compaction and granular strength of the substrate - requiring insertion of a narrow penetrometer rod into the substrate (6 maximum). **Plate 1-3** shows the application of this technique in a cleared open site, such disturbance will not be required for this proposal. The width of the DCP will be in the order of 1.5 cm.
- At selected areas within the transect profile, soil samples will be obtained using hand augurs. The holes, ideally, will be extended to the basement or to the limit of the hand augur tool. At various depths, soil samples will be obtained. The remaining material will be returned to the hole. The hand augured holes will be restricted to areas of the transect where there is currently no vegetation. Soil samples will provide information regarding the constituents and proportions of clay, sand, silt and organic material. Other information to be tested may include (but is

not limited to) plasticity, dispersability and general chemical analysis. This information will be used to understand peat make up, strength (cohesiveness) and susceptibility to water flows.

- A maximum of nine augur holes are proposed. Augur holes will be drilled within the transects and will avoid vegetation. Peat material will be replaced back into the holes after the peat has been sampled. Hand auguring will enable the peat material to be logged to depth to understand material layering. This will assist in the interpretation of how water might move through the material (ie. horizontal or vertical).

**Plate 1-3 – DCP Testing**

The above GGI at East Wolgan Swamp are proposed to accurately assess the current status and nature of the swamp's substrate and profile. The objective of the GGI is to also identify any geological structure, cavity, piping or anomaly down to a depth of approximately 25 metres. A depth of 25 metres extends beneath the peat profile into the peat basement geology underlying the peat. The GGI techniques proposed in this Stage 1 work is a trial to test the techniques' ability to achieve the desired outcomes. If successful, the GGI techniques may be applied across a larger area of the swamp to obtain a clear picture of the underlying material and to test the methods for utilisation in other swamps as a pre-mining and post mining monitoring tool.

The ability to identify geological structure beneath the peat material may provide further information in respect of negative consequence risk from subsidence. The ability to understand the peat characteristics will also add to the current scientific knowledge of NPSS. This may include an understanding of how water moves through a swamp both vertically and laterally, peat tolerances to disturbance and water flow forces. Information may also be used to assist in the development of successful remediation techniques ie. constituents of peat material, stability and material strength.

The primary reasons these techniques are being applied within the East Wolgan Swamp are summarised below:

1. Further investigate the causes of peat slumping/cavity formation within East Wolgan Swamp. Investigate whether piping has occurred within the peat material and whether peat slumping is the result of piping collapse. It is envisaged that the knowledge gained will assist in stabilisation and/or remediation planning. ie. is there an existing pipe that has not yet collapsed;
2. To understand the strength of the peat material. How resistant is the material to erosion and what forces may be applied in order to retain peat structure. This will provide an indication of stabilisation requirements and susceptibility;
3. Understand the geological environment beneath the Swamp with the aim of identifying geological structure. For example the ability to confirm geological structure beneath the peat base would provide a different risk classification to future mining areas. Furthermore, the presence of a geological structure may have caused a reactivation of a pre-existing joint or cavity;
4. Trial the various techniques for suitable application in future mining areas ie. the potential to search for geological structure beneath future swamps;
5. Apply the techniques within a swamp where the vegetation has been largely affected. This will result in minimal further disturbance;
6. Add to the science of NPSS which may contribute to furthering the science behind successful remediation techniques through a better understanding of the characteristics and constituents (proportions of organic material and sand) of the peat material;
7. The presence of piping and cavities may provide some understanding of how water moves through the peat material and some understanding of vertical and horizontal percolation and movement.

Access to the GGI locations will be by vehicle on the nearest track then on foot to the GGI locations to avoid the need to develop vehicle access and prevent unnecessary damage to and in the vicinity of the NPSS EEC. Recommendations regarding the conservation and protection of vegetation within and in the wider vicinity of the area of GGI are included in this report. Potential impacts are likely to be minimal considering the very small area of disturbance represented by the majority of GGI activities. **Plate 1-4** (Northern Transect area) represents an example of the current condition of some areas of East Wolgan Swamp. It is noted that plant bases from the trimmed vegetation (required for the GPR surveys) will be retained and this will allow for the regeneration of the trimmed plants. Photos presented in **Appendix 5** provide further detail of the transect areas in terms of condition.

**Figures 1-3** and **1-4** show the location and extent of the maximum GGI works footprint, although actual impacts are not expected to be anywhere near the size of the area shown as the areas presented in Figures 1-3 and 1-4 show the assessment area which is greater than the actual impact area. The GPR transects should be able to be easily accommodated within the 1.5m wide area of likely impact.

**Plate 1-4: East Wolgan Swamp vegetation condition and GGI location example**

## 1.3 Scope of the Study

The scope of this FFA report is to:

- Undertake a comprehensive flora and fauna assessment within East Wolgan Swamp and determine the impacts from the GGI proposal to accompany a Section 91 application under the TSC Act;
- Provide recommendations and controls to minimise and manage any impact from the proposal;
- Undertake a desktop assessment of relevant ecological assessments within and adjacent to the subject site;
- Update relevant database searches of threatened flora and fauna species, populations and ecological communities within a 10 kilometre radius of the subject site;
- Identify threatened flora and fauna species, populations and ecological communities known or likely to occur within the subject site;
- Provide detailed consideration of previous correspondence from DECCW in relation to the potential impacts of this project;
- Undertake additional detailed assessment in the field of the exact location of the proposed activities, in order to ascertain the likely impacts at a micro-scale;
- Undertake seven part test assessment under the TSC Act to assess the potential of the proposal to have a significant impact on any threatened species, populations or ecological communities (listed on the TSC Act) known or likely to occur within the subject site or its immediate vicinity;

Specific detailed consideration has been given to previous correspondence from DECCW on this project, in terms of the level of detail required to assess the impacts of the proposal on the NPSS and associated threatened species.

## 1.4 Qualifications

This report was written by Toby Lambert BEnvSc and Allan Richardson BEnvSc (Hons) of RPS Australia East Pty Ltd. The academic qualifications and professional experience of staff are documented in **Appendix 6**.

## 1.5 Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 30 November 2010);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2011);

- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2013); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 22 May 2011).

## 1.6 Certification

As the principal author, I, Toby Lambert make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the site;
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the Animal Research Act 1995, National Parks and Wildlife Act 1974 and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Toby Lambert
Senior Ecologist / Senior Project Manager
RPS Australia East Pty Ltd
June 2010

# 2 Methodology

The description of works as being of low-level impact has resulted from ecological investigations within the works area. This has been concluded by flora surveys and habitat assessments being undertaken within the impact zone. Trapping surveys, spotlighting surveys and other labour-intensive survey types were not conducted within the site for two reasons. The first reason is that they were considered to be unnecessary, due to the limited area of disturbed habitat that will be displaced by the proposed works. The second reason was that over five years of data has already been collected from a fauna monitoring site which is located in between the northern and southern transects. Seasonal monitoring surveys use the techniques mentioned above and collect the necessary data to determine fauna habitat use. Habitat assessment and targeted searches in conjunction with local records were conducted in lieu of trapping surveys to determine the potential for threatened fauna to occur within the site.

Initial general surveys were undertaken on 29th October 2009. The follow-up detailed surveys were undertaken over a period of two and half days from the morning of March 17th until midday March 19th 2010.

Extensive information on the flora and fauna of the shrub swamps on the Newnes Plateau has been collected on an annual basis for mines such as Springvale and Angus Place by Martin Denny (Mount King Ecological Surveys) and Roger Lembit (Gingra Ecological Surveys). Fauna monitoring has been undertaken by Mount King Ecological Surveys, for over five years during Autumn, Spring and Summer. Such surveys provide more than enough information on the flora and fauna of the swamps. Detailed surveys were undertaken primarily to identify the plant species likely to be affected by the proposed works and to record areas of existing disturbance.

## 2.1 Literature Review

Information sources reviewed included:

- Aerial Photograph Interpretation (API);
- Review of fauna and flora records contained in the Department of Environment, Climate Change and Water (DECCW) Atlas of NSW Wildlife (accessed 13 April 2010) within a 10 km radius of the site;
- Department of the Environment, Water, Heritage and the Arts (DEWHA) EPBC Act Protected Matters Search (accessed 12 April 2010) within a 10km radius of the site;
- DECCW Threatened Species, Populations and Ecological Communities website (http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/);
- Springvale Colliery Longwalls 411-418 Subsidence Management Plan Application Written Report – May 2005 (Springvale Coal, 2005);
- Springvale to Wallerawang Pipeline Project Bore 5 Pipeline and Route 4E Flora and Fauna Assessment – October 2004 (Hyder Consulting, 2004);

- East Wolgan Swamp Proposed Stage 1 Geotech / Geophysical Works, Soil Moisture Probes and Weed Control Works – November 2009 Letter Report to Centennial Coal (RPS, 2009a);
- Flora and Fauna Assessment for Proposed V-notch Weir Downstream of Sunnyside Swamp, Springvale Coal Mine, Newnes Plateau. November 2009 report to Springvale Coal Pty Ltd (RPS, 2009b);
- Sunnyside Swamp Proposed Piezometer Site Inspections – November 2009 Letter Report to Centennial Coal (RPS, 2009c);
- Narrow Swamp Proposed Geotech / Geophysical Works and Weed Control Works – November 2009 Letter Report to Centennial Coal (RPS, 2009d);
- Collective knowledge gained from previous work in the local area;
- Various fauna monitoring reports by Mount King Ecological Surveys (2005, 2006, 2007, 2008, 2009, 2010);
- Various flora monitoring reports by Gingra Ecological Surveys (2005, 2006, 2007, 2008) and the University of Queensland (2010); and
- Correspondence from DECCW to Springvale dated 19th February 2010
- Correspondence from Springvale to DECCW dated 2nd February 2010 with attached additional information regarding the GGI work in anticipation of DECCW knowledge gaps

## 2.2 Flora Surveys

### 2.2.1 Vegetation Mapping

Flora surveys and vegetation mapping carried out on the site has been undertaken as follows.

- DECC (2006) The Vegetation of the Western Blue Mountains. Unpublished report funded by the Hawkesbury – Nepean Catchment Management Authority. Department of Environment and Conservation, Hurstville.
- Confirmation of the community type(s) present (dominant species) via undertaking flora surveys and identification.
- Consideration was given to the potential for the derived vegetation communities to constitute 'Endangered Ecological Communities' (EEC) as listed within the TSC Act 1995 and the EPBC Act 1999.
- Flora surveys were carried out surrounding the site, with an emphasis on potentially significant species, as outlined below. The general flora survey also included the casual consideration of the site in line with methodology such as the "Random Meander Technique" described by Cropper (1993).

### 2.2.2 Survey Limitations

Timing limitations are often encountered during ecological surveys due to the seasonality of activity and detectability for a number of flora and fauna species being studied. There

is a range of common albeit cryptic plant species that have a brief flowering period and hence small 'window' of effective detectability. In addition, the seasonality of surveys also places limits on the number of flora species identified in the site. Therefore, some threatened species not detected cannot be discounted off-hand due to seasonality and other factors, and are therefore addressed in terms of their potential for occurrence within the site based on ecological factors. As such, the precautionary principle is applied and for some species, where appropriate, assumed presence is made for assessment purposes.

### 2.2.3 Significant Flora Survey and Detailed Field Analysis

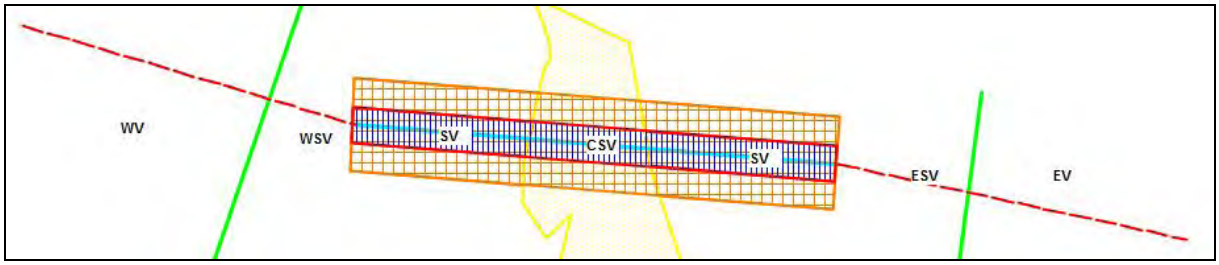
A list of potentially occurring significant flora species from the locality (10km radius) was compiled, which included threatened species (Endangered or Vulnerable) and EEC's listed under the TSC Act 1995, those species listed under the EPBC Act 1999, Rare or Threatened Australian Plants (RoTAP) listed flora species (Briggs and Leigh 1996), as well as any other species deemed to be of local importance. These species were targeted during the previous general and current detailed flora surveys.

Having considered previous DECCW comments on the project, it was determined that detailed flora surveys were required.

Each of the transects in the northern and southern groups were subjected to flora surveys in the following positions along the transects:

- Western Vegetation (WV): Species were recorded within the forest to the west of the swamp edge;
- Western Swamp Vegetation (WSV): Species were recorded within the western part of the swamp but outside of the GPR area;
- Cleared Swamp Vegetation (CSV): Species recorded in the predominantly already cleared / exposed areas within the GPR area;
- Swamp Vegetation (SV): Species recorded in the core swamp area subject to GPR activities;
- Eastern Swamp Vegetation (ESV): Species were recorded within the eastern part of the swamp but outside of the GPR area; and
- Eastern Vegetation (EV): Species were recorded within the forest to the east of the swamp edge.

The different zones are illustrated below, as apply to the information presented in **Figures 1-3** and **1-4.**



These surveys were to allow analysis of what species could be affected in the areas subject to the activity.

### 2.2.4 Habitat Surveys

An assessment of the relative value of the habitat present on site was carried out. This assessment focused primarily on the identification of specific habitat types and resources on the site favoured by known threatened species from the region. The assessment also considered the potential value of the site (and surrounds) for all major guilds of native flora and fauna.

Habitat assessment was based on the specific habitat requirements of each threatened fauna species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements. Consideration was given to contributing factors including topography, soil, light and hydrology for threatened flora and assemblages.

### 2.2.5 Fauna Survey

The fauna survey methodology initially consisted of the production of an Expected Fauna Species List for the area (**Appendix 4**) and an assessment of the potential use of the site by threatened fauna species (as listed under the TSC Act 1995) identified from the vicinity of the site. This was achieved by undertaking literature and database reviews followed by confirmation through field surveys, habitat assessment and any additional species observed were noted on the list.

A total of almost four days was spent within the swamp and surrounds and this is expected to have given a reliable indication of the likely fauna present, in combination with knowledge with other previous studies in the vicinity.

#### Avifauna Survey

The presence of avifauna on the site was carried out via opportunistic observations during site fieldwork visit. Birds were identified by direct observation or by recognition of calls or distinctive features such as nests, feathers, and owl regurgitation pellets etc. The potential for threatened avifauna to use the site was also assessed by habitat attributes occurring within the site and their capacity to support threatened species that are known to occur in the wider locality. Assessment of the site's potential to provide opportunities for Forest Owl species was based upon the known habitat requirements of these species.

#### Spotlighting Surveys

Spotlighting surveys were not conducted within the site, although the potential for threatened nocturnal species to occur within the site was assessed by assessing the potential for onsite habitat to support these species. The precautionary principle has been taken into account where potential impacts may occur upon these species.

Ongoing fauna surveys have been carried out in Spring, Summer and Autumn at Springvale in general. These surveys include spotlighting.

### Herpetofauna Survey

Opportunistic amphibian and reptile searches were conducted during the fauna survey. Known occurrences of threatened herpetofauna species from the region were taken into account during assessment of onsite habitat, to determine the potential for the site to support such species.

Ongoing fauna surveys carried out in Spring, Summer and Autumn include systematic searches for reptiles and amphibians within each habitat type at the survey site associated with the proposed work. Litter is usually raked and rocks and logs turned over. Loose bark may also be prised from the trunks of dead trees. Each search would normally take approximately 30 minutes. Searches for amphibians usually takes place at night using spotlights (particularly after rain) and recognition of characteristic calls. Spotlighting searches are also usually attempted for reptiles.

### Invertebrate Survey

Opportunistic invertebrate surveys were conducted during the fauna survey. These particularly targeted potential observations of the Giant Dragonfly.

### Secondary Indications and Incidental Observations

Opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were noted. Potential indicators may include:

- Distinctive scats and scents left by mammals;
- Nests made by various guilds of birds;
- Potential whitewash, regurgitation pellets and prey remains from Owls;
- Skeletal material of vertebrate fauna;
- The calls of fauna; and
- Footprints left by mammals.

Any other incidental observations of fauna were recorded during all phases of fieldwork.

# 3 Results

## 3.1 Weather

The prevailing weather conditions during the survey period are presented in **Table 3-1**.

**Table 3-1: Survey Weather Conditions**

| | Date | | |
|---|---|---|---|
| | 17/03/2010 | 18/03/2010 | 19/03/2010 |
| *Temperature* | *2.6 – 24.6* | *4.9 – 25.7* | *6.7 - 26.4* |
| *Wind* | *Low* | *Low* | *Low* |
| *Cloud* | *0%* | *15%* | *40%* |
| *Rain* *(24 hrs to 9:00am)* | *0* | *0* | *0* |

## 3.2 Literature Review

### 3.2.1 Review of Local Reports

**Threatened Species and Communities Records**

A review of the literature listed in **Section 2.1** identified the following threatened species, populations and ecological communities as occurring or likely to occur within the subject site (**Table 3-2**).

**Table 3-2: Relevant Threatened Species and Threatened Ecological Communities Identified During a Review of Local Ecological Studies**

| Scientific Name | Common Name | TSC Act | Notes and Source |
|---|---|---|---|
| **Flora Species** | | | |
| *Persoonia hindii* | | E | Recorded adjacent to Sunnyside Swamp[1]<br>Recorded adjacent to East Wolgan Swamp[2]<br>Recorded in Newnes Plateau area[4]<br>Recorded in the vicinity of a proposed weir location along Sunnyside Creek[6] |
| *Derwentia blakelyi* | | V | Recorded in East Wolgan Swamp[2]<br>Recorded in Newnes Plateau area[4] |
| *Boronia deanei* | | V | Likely to occur in the Sunnyside / Springvale SMP area[4] |
| *Olearia quercifolia* | Oak-leaved Daisy-bush | | ROTAP listed. Recorded in East Wolgan Swamp[2] |
| **Fauna Species** | | | |
| *Mixophyes balbus* | Stuttering Frog | E | Recorded in Springvale SMP area[3] |

| Scientific Name | Common Name | TSC Act | Notes and Source |
|---|---|---|---|
| *Eulamprus leuraensis* | Blue Mountains Water Skink | E | Potential habitat within nearby Sunnyside Swamp[1]<br>Potential habitat in East Wolgan Swamp[2]<br>Recorded near Longwall 409 at Springvale[4] |
| *Climacteris picumnus* | Brown Treecreeper | V | Recorded in Springvale SMP area[3] |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | Local Knowledge[8] |
| *Ninox strenua* | Powerful Owl | V | Recorded in Springvale SMP area[3,4]<br>Recorded along pipeline route[5] |
| *Melithreptus gularia gularis* | Black-chinned Honeyeater | V | Recorded in SMP area[3] |
| *Daphoenositta chrysoptera* | Varied Sittella | V | Likely to occur in the vicinity of the proposed weir location along Sunnyside Creek[6]<br>Local Knowledge[8] |
| *Petroica boodang* | Scarlet Robin | V | Likely to occur in the vicinity of the proposed weir location along Sunnyside Creek[6]<br>Local Knowledge[8] |
| *Petroica phoenicea* | Flame Robin | V | Likely to occur in the vicinity of the proposed weir location along Sunnyside Creek[6]<br>Local Knowledge[8] |
| *Petaurus norfolcensis* | Squirrel Glider | V | Recorded in Springvale SMP area[3] |
| *Cercartetus nanus* | Eastern Pygmy Possum | V | Recorded in Springvale SMP area[3]<br>Local Knowledge[8] |
| *Miniopterus schreiberii oceanensis* | Eastern Bentwing-bat | V | Recorded in Springvale SMP area[3]<br>Recorded along pipeline route[5]<br>Local Knowledge[8] |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | V | Local Knowledge[8] |
| *Paralucia spinifera* | Bathurst Copper Butterfly | E | Local Knowledge[8] |
| *Petalura gigantean* | Giant Dragonfly | E | Recorded on eastern boundary of Springvale Lease Area on the eastern arm of a Wolgan River tributary[4]. |
| Newnes Plateau Shrub Swamp (NPSS) in the Sydney Basin Bioregion[7] | | E | Recorded within Sunnyside Swamp[1]<br>Recorded in East Wolgan Swamp[2]<br>Recorded at proposed weir location along Sunnyside Creek[6] |

1 - (RPS, 2009c)
2 - (RPS , 2009a)
3 - (Mount King Ecological Surveys, 2005)
4- (Springvale Coal, 2005)
5 - (Hyder Consulting, 2004)
6 - (RPS, 2009b)
7 - Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion listed on the TSC Act
8 – Local knowledge from various consultancy projects completed in the local area.

### 3.2.2 Database Searches

A total of seven flora species on the Atlas of NSW Wildlife database have been recorded within the 10 kilometre radius of the subject site (**Table 3-3**). Four of the species are listed as Endangered and three as Vulnerable on the TSC Act.

### Table 3-3: Flora Species Identified Within a 10km Radius of the Subject Site by a Search of the NSW Atlas of Wildlife.

| Scientific Name | Common Name | Status TSC Act | Status EPBC Act | First Date | Last Date | 10km Radius | 2.5km Radius |
|---|---|---|---|---|---|---|---|
| *Lastreopsis hispida* | Bristly Shield Fern | E | | 1914 | 1914 | 1 | 0 |
| *Eucalyptus pulverulenta* | Silver-leafed Gum | V | V | 1973 | 1973 | 1 | 0 |
| *Eucalyptus aggregate* | Black Gum | V | | 1921 | 1970 | 2 | 0 |
| *Genoplesium superbum* | | E | | 2005 | 2005 | 1 | 0 |
| *Persoonia hindii* | | E | | 1992 | 2008 | 68 | 18 |
| *Boronia deanei* | Deane's Boronia | V | V | 1906 | 2009 | 29 | 0 |
| *Derwentia blakelyi* | | V | | 1988 | 2009 | 34 | 6 |

**Status (TSC Act):**
E Schedule 1: Endangered Species
V Schedule 2: Vulnerable Species

**Status (EPBC):**
V Vulnerable Species

A total of 30 threatened fauna species on the Atlas of NSW Wildlife database have been recorded within the 10 kilometre radius of the subject site (**Table 3-4**). Five of the species are listed as Endangered and 25 as Vulnerable, on the TSC Act.

### Table 3-4: Fauna Species Identified Within a 10km Radius of the Subject Site by a Search of the NSW Atlas of Wildlife.

| Common Name | Scientific Name | Status TSC Act | Status EPBC Act | First Date | Last Date | 10km Radius | 2.5km Radius |
|---|---|---|---|---|---|---|---|
| **Amphibians** | | | | | | | |
| Stuttering Frog | *Mixophyes balbus* | E | V | 2004 | 2004 | 1 | 1 |
| **Reptiles** | | | | | | | |
| Blue Mountains Water skink | *Eulamprus leuraensis* | E | E | 1979 | 2009 | 21 | 4 |
| **Birds** | | | | | | | |
| Little Eagle | *Hieraaetus morphnoides* | V | | 2005 | 2006 | 3 | 0 |
| Gang-gang Cockatoo | *Callocephalon fimbriatum* | V | | 1998 | 2009 | 62 | 28 |
| Glossy Black-Cockatoo | *Calyptorhynchus lathami* | V | | 2005 | 2009 | 11 | 1 |
| Little Lorikeet | *Glossopsitta pusilla* | V | | 2009 | 2009 | 1 | 0 |
| Barking Owl | *Ninox connivens* | V | | 2005 | 2007 | 10 | 1 |
| Powerful Owl | *Ninox strenua* | V | | 1993 | 2009 | 27 | 17 |
| Masked Owl | *Tyto novaehollandiae* | V | | 2008 | 2008 | 1 | 0 |
| Brown Treecreeper | *Climacteris picumnus* | V | | 2004 | 2009 | 50 | 26 |
| Speckled Warbler | *Pyrrholaemus saggitatus* | V | | 2006 | 2009 | 3 | 0 |
| Black-chinned Honeyeater (eastern subspecies) | *Melithreptus gularis gularis* | V | | 2004 | 2004 | 2 | 1 |
| Hooded Robin | *Melanodryas cucullata* | V | | 2004 | 2008 | 7 | 4 |
| Flame Robin | *Petroica phoenicea* | V | | 2004 | 2009 | 48 | 24 |
| Scarlet Robin | *Petroica boodang* | V | | 1998 | 2009 | 88 | 22 |
| Grey-crowned Babbler (eastern subspecies) | *Pomatostomus temporalis temporalis* | V | | 2005 | 2005 | 1 | 1 |
| Varied Sittella | *Daphoenositta chrysoptera* | V | | 2004 | 2009 | 8 | 1 |
| Diamond Firetail | *Stagonopleura guttata* | V | | 1999 | 1999 | 1 | 0 |
| **Mammals** | | | | | | | |
| Spotted-tailed Quoll | *Dasyurus maculatus* | V | E | 1996 | 2009 | 3 | 0 |
| Koala | *Phascolarctos cinereus* | V | | 1985 | 2007 | 5 | 0 |
| Eastern Pygmy-possum | *Cercartetus nanus* | V | | 2004 | 2009 | 6 | 5 |
| Yellow-bellied Glider | *Petaurus australis* | V | | 1999 | 1999 | 1 | 0 |
| Squirrel Glider | *Petaurus norfolcensis* | V | | 1998 | 2009 | 6 | 3 |
| Brush-tailed Rock-wallaby | *Petrogale penicillata* | E | V | 1998 | 1998 | 1 | 0 |
| Large-eared Pied Bat | *Chalinolobus dwyeri* | V | V | 1998 | 2008 | 11 | 1 |
| Eastern False Pipistrelle | *Falsistrellus tasmaniensis* | V | | 1998 | 2008 | 7 | 1 |
| Eastern Bentwing-bat | *Miniopterus schreibersii oceanensis* | V | | 2004 | 2009 | 4 | 2 |

| Common Name | Scientific Name | Status TSC Act | Status EPBC Act | First Date | Last Date | 10km Radius | 2.5km Radius |
|---|---|---|---|---|---|---|---|
| Greater Broad-nosed Bat | *Scoteanax rueppellii* | V | | 1999 | 2007 | 4 | 0 |
| **Invertebrates** | | | | | | | |
| Bathurst Copper Butterfly | *Paralucia spinifera* | E | V | 2000 | 2006 | 14 | 0 |
| Giant Dragonfly | *Petalura gigantea* | E | | 2004 | 2008 | 17 | 4 |

**Status (TSC Act):**
E Schedule 1: Endangered Species
V Schedule 2: Vulnerable Species

**Status (EPBC):**
E Endangered Species
V Vulnerable Species
M Migratory Species

## 3.3 Flora

### 3.3.1 Vegetation Mapping

Vegetation mapping of EECs covering the subject site has been undertaken by DECC (2006). One EEC is mapped within the subject site, namely Newnes Plateau Shrub Swamp (MU 50, NPSS), see **Figure 1** for general extent. NPSS has been identified as the dominant vegetation type of East Wolgan Swamp (See **Table 3-2** above).

The forest adjoining the NPSS in the vicinity of the northern and southern transects is mapped as Newnes Plateau Narrow-leaved Peppermint - Mountain Gum - Brown Stringybark Layered Forest (MU 7) to the west. Newnes Plateau Gum Hollows variant: Brittle Gum - Mountain Gum, Scribbly Gum - Snow Gum Shrubby Open Forest (MU26a) has been mapped adjoining the northern transects, while adjoining the southern transects the similar Newnes Plateau Gum Hollows variant: Brittle Gum - Mountain Gum, Scribbly Gum - Snow Gum Shrubby Open Forest (MU 26a) has been shown.

Ground-truthing of vegetation in the vicinity of the GGI areas found that three vegetation communities occur in the vicinity of the site, namely:

- MU 26 Newnes Plateau Narrow-leaved Peppermint - Silver-top Ash Layered Open Forest (western slopes);
- MU 26a Newnes Plateau Gum Hollows variant: Brittle Gum - Mountain Gum, Scribbly Gum - Snow Gum Shrubby Open Forest (eastern slopes); and
- MU 50 Newnes Plateau Shrub Swamp (where the majority of GGI will be conducted).

The impact on the NPSS community is the focus of this report. The impacts upon the adjoining forest are expected to be very limited as the works will be concentrated within the NPSS, and only resistivity probes will be placed in the adjoining forest at the edge of the swamp. Accordingly, no trimming or clearing will be required away from the peat substrate of the swamp area.

### 3.3.2 Significant Flora

A list of potentially occurring significant flora species from the locality (10km radius) and those that were deemed to have potential to occur within the site due to habitat attributes,

was compiled (presented in **Table 3-2**). This included threatened species (Endangered or Vulnerable) and EEC's listed under the TSC Act 1995. Where suitable habitat for potentially occurring significant flora species was found on site, targeted surveys were conducted across the site during the field survey.

Two threatened flora species were recorded within the locality of the broader East Wolgan Swamp, being *Derwentia blakelyi* and *Persoonia hindii*, with the ROTAP *Olearia quercifolia* (Oak-leaved Daisy-bush) also being recorded.

*O. quercifolia* is listed as a ROTAP species and does not occur within the GGI sites, although it occurs in a number of locations elsewhere within East Wolgan Swamp and provision should be made for its protection if encountered during onsite works.

*Persoonia hindii* was not recorded within the proposed GGI sites during the site inspection as shrub swamp vegetation associated with the site is not suited to the habitat requirements of this species. However a band of this species was noted well up the slope of the swamp. Traversing of open forest habitats between the swamp and access roads should avoid locations of this species where possible. *P. hindii* is listed under the TSC Act 1999 as Endangered.

*Derwentia blakelyi* was found to occur at the foot of the western slope in a band extending up the lower slope from immediately adjacent to the swamp vegetation. As such, care should be taken to avoid *D. blakelyi* plants during the location of specific GGI sites, especially GPR transects that extend into and beyond the edges of swamp vegetation. The location of significant flora species in relation to the proposed sites is shown in **Figure 3-1**. *D. blakelyi* is listed under the TSC Act 1999 as Vulnerable.

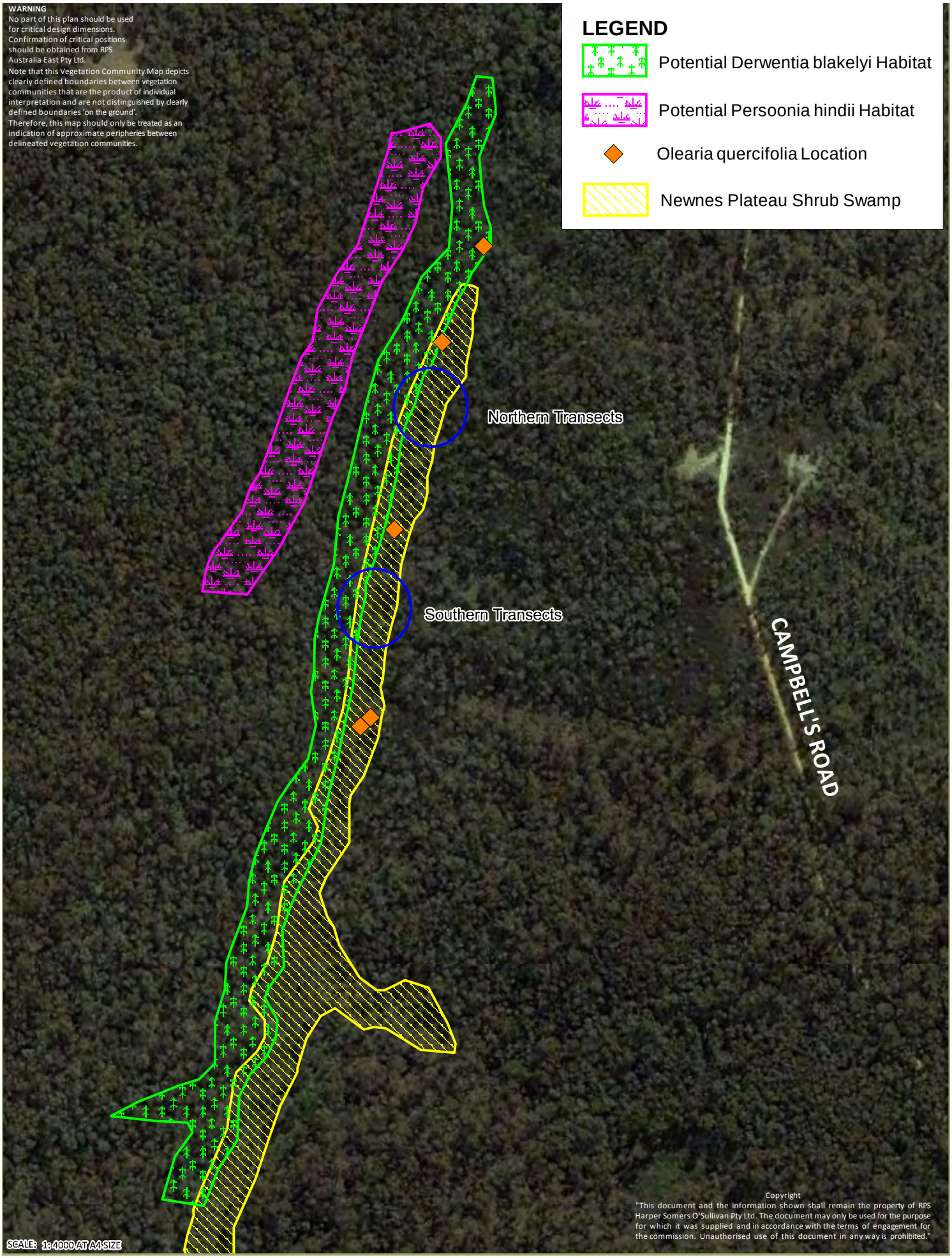
Detailed counts of *D. blakelyi* were not undertaken as it was determined on-site with Centennial that plants could easily be flagged and avoided as part of the protective measures to be implemented for the proposal.

### 3.3.3 Detailed Plant Impact Results

The plant species recorded in the various zones for the northern and southern groups of transects are provided in the lists in **Appendix 3**.

Photographs taken at the main points of each of the eight transects are provided in **Appendix 5**. These photos illustrate the vegetation and habitat condition along each of the proposed transects. They show that the majority of the transects are composed of absent or low-lying swamp vegetation, not higher than 30cm. There are some areas that contain taller sporadic occurrences of native species, however these are distributed in a similar pattern throughout the remainder of the swamp.

The detailed surveys undertaken along each transect identified levels of impact in relation to existing clearings. **Table 3-5** outlines the results of these investigations.




TITLE: FIGURE 3-1
SIGNIFICANT SPECIES

LOCATION: EAST WOLGAN
SWAMP, SPRINGVALE

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 31/5/10
PURPOSE: GGI

LAYOUT REF: J:\JOBS\Centennial\All Jobs\PR103037 Springvale S91\10- Drafting\Mapinfo
VERSION (PLAN BY): A-A4 (A.RICHARDSON)

CLIENT: CENTENNIAL COAL
JOB REF: 26407

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

RPS

**Table 3-5 GGI Transect Survey Results**

| Transect Number | Total Transect Length in metres | Total Transect Length minus cleared / degraded areas in metres | Resistivity Transect Length in metres | GPR Transect Length in metres | Length of currently cleared / degraded vegetation within GPR Transect in metres | Length of GPR Transect without currently cleared / degraded areas in metres | Area of EEC veg to be temporarily trimmed in sq metres | Area of other veg to be temporarily trimmed in sq metres |
|---|---|---|---|---|---|---|---|---|
| T1 | 46.4 | **35.59** | 30 | 16.4 | **10.81** | **5.59** | 8.385 | 0 |
| T2 | 52.37 | **37.25** | 30 | 22.37 | **15.12** | **7.25** | 10.875 | 0 |
| T3 | 51.59 | **40.35** | 30 | 21.59 | **11.24** | **10.35** | 15.525 | 0 |
| T4 | 50.89 | **45.73** | 30 | 20.89 | **5.16** | **15.73** | 23.595 | 0 |
| T5 | 43.58 | **37.94** | 30 | 13.58 | **5.64** | **7.94** | 11.91 | 0 |
| T6 | 45.81 | **38.21** | 30 | 15.81 | **7.6** | **8.21** | 12.315 | 0 |
| T7 | 43 | **37.87** | 30 | 13 | **5.13** | **7.87** | 11.805 | 0 |
| T8 | 42.2 | **36.84** | 30 | 12.2 | **5.36** | **6.84** | 10.26 | 0 |
| TOTALS | 375.84 | **309.78** | 240 | 135.84 | **66.06** | **69.78** | 104.67 | 0 |

The above data illustrates the following:

- Of a total length of 135m x 1.5m of the GPR transects, approximately 50% of this is already barren or cleared;
- The remaining 50% not already cleared means that a total area of 105m$^2$ will need to be temporarily trimmed for the GPR activity. 105m$^2$ equates to a total of 0.2% of the total area (41,630m$^2$) of East Wolgan Swamp and a negligible proportion of this EEC in total; and
- The resistivity transects will not require any clearing and will be temporary in nature.

This demonstrates the low level of temporary impact that will result from the activities.

## 3.4 Habitat

Habitat within the study area was assessed for its potential to support native flora and fauna species including threatened fauna for which records occur within the wider locality.

### 3.4.1 Flora Habitat

The site is characterised within the NPSS by wet area plants and then a relatively sparse open vegetation community of shrubby woodland plant species up slope. The habitat provided by the humus in the NPSS supports a range of common flora species. It provides limited habitat for threatened flora, apart from the collective species forming an EEC itself. The ROTAP species *Olearia quercifolia* occurs within the swamp itself but not in the areas to be affected by the proposal.

### 3.4.2 Fauna Habitat

The NPSS provides a range of habitats for species known to occur in the area. The habitat provided is relatively simplistic in nature and this therefore limits its value for threatened fauna. However threatened fauna known to occur in swamp habitats on the Newnes Plateau could potentially occur in parts of the swamp, including the Blue Mountains Water Skink and the Giant Dragonfly.

Habitat quality is variable, with some areas having the soil substrate completely exposed and other areas having a dense low occurrence of wet shrub species. These areas are used by common bird and reptile species and area also likely to be utilised by a number of common amphibians and mammals.

The small area (0.2% of swamp habitat) to be affected by the proposal will not impact significantly upon habitat for fauna.

## 3.5 Corridors and Habitat Linkages

The proposal occurs within a large expanse of contiguous natural vegetation. The entire area, including the habitats covered by the proposal, is well connected.

The small area (0.2% of swamp habitat) to be affected by the proposal will not impact significantly upon corridors or linkages.

## 3.6 Aquatic Habitats

Apart from the provision of water to downstream habitats the stream is not considered to be of significance to threatened aquatic species and no aquatic animals were observed during onsite investigations. Design of the proposed GGI aims to minimise changes to existing water regimes and to maintain the existing swamp profile and character.

The small area (0.2% of swamp habitat) to be affected by the proposal will not impact significantly upon aquatic habitats.

## 3.7 Fauna Survey

The fauna survey methodology initially consisted of the production of an Expected Fauna Species List for the area (**Appendix 4**) and an assessment of the potential use of the site by threatened fauna species (as listed under the TSC Act 1995) identified from the vicinity of the site. This was achieved by undertaking literature and database reviews followed by confirmation through field surveys where additional species observed were noted on the list.

### 3.7.1 Mammals

Common native terrestrial mammal species such as Eastern Grey Kangaroo and Red-necked Wallaby were observed within the wider locality as were introduced species

including Rabbits. Other common native species likely to occur based on results of surveys of similar habitats nearby in Springvale Colliery by Mount King Ecological Surveys include Antechinus species such as Brown, Dusky and Agile; Sugar Glider and Greater Glider, Common Ringtail Possum and Common Wombat; Bush Rat and Swamp Rat.

The potential for threatened mammal species to occur within the site is limited by the lack of structural complexity within onsite vegetation. Understorey complexity is generally limited although little litter and shrubs to provide shelter for small terrestrial mammal species.

Threatened species previously recorded in similar environs within Springvale include the Eastern Pygmy Possum and Squirrel Glider. Threatened bats previously recorded on the mine also include Eastern False Pipistrelle, Large-eared Pied Bat, Eastern Bent-wing Bat and Greater Broad-nosed Bat. All of these species are likely to occur within the vicinity of the project.

There are no opportunities for arboreal mammals associated with the proposed works area due to the absence of hollow-bearing trees; although there is ample opportunity for arboreal fauna and bats in surrounding habitats. Koalas are unlikely to use resources within the proposed activity area due to the lack of feed tree species.

The small area (0.2% of swamp habitat) to be affected by the proposal will not impact significantly upon mammals.

### 3.7.2 Avifauna

Limited bird species were recorded within close vicinity of the activity area, although the area surrounding the site was noted as being frequented by common forest bird species and two threatened bird species. The threatened bird species recorded were *Petroica boodang* (Scarlet Robin) and *Petroica phoenicea* (Flame Robin). These species were recorded in the trees within the woodland to the east of the NPSS and forest to the west of the NPSS. Habitats surrounding the site are suited to a number of open forest and woodland threatened bird species such as these species, however the site does not contain primary habitat opportunities for these species, apart from potentially occasional foraging habitat.

Previous studies in similar environments within Springvale by Mount King Ecological Surveys have noted threatened birds such as Gang-Gang Cockatoo, Brown Treecreeper, Glossy Black-cockatoo, Powerful Owl, Black-chinned Honeyeater, Grey-crowned Babbler, Hooded Robin and Varied Sittella. These are all likely to occur in the vicinity on occasions, primarily within the adjoining forest and woodland environs.

The small area (0.2% of swamp habitat) to be affected by the proposal will not impact significantly upon avifauna.

### 3.7.3 Herpetofauna

Incidental surveys were conducted for reptiles within the proposed works area, with Yellow-bellied Water Skink and Tussock Cool-skink observed within the NPSS and Mountain Dragon observed upslope. Habitat occurring in the vicinity of the proposed works area exhibited cover for reptile species including low shrubs, woodland debris and leaf litter. Other common species likely to occur include Dark-flecked Sun Skink, Jacky Lashtail, Red-throated Cool-skink and Highlands Copperhead. Potential habitat exists for the threatened Blue Mountains Water Skink, although it has never been recorded in East Wolgan Swamp.

In terms of amphibians, only one species was recorded being Red-backed Toadlet. Other common species likely to occur in the NPSS include Common Eastern Froglet and Spotted Marsh Frog. One previous record of the threatened Stuttering Frog has been recorded to the east in Sunnyside Swamp, but it is not considered that the current site comprises suitable habitat for this species.

The small area (0.2% of swamp habitat) to be affected by the proposal will not impact significantly upon herpetofauna.

### 3.7.4 Invertebrates

No sightings of the Giant Dragonfly have ever been recorded in East Wolgan Swamp despite numerous previous surveys and the current surveys being undertaken.

The small area (0.2% of swamp habitat) to be affected by the proposal will not impact significantly upon invertebrates.

### 3.7.5 Secondary Indications and Incidental Observations

No opportunistic sightings of secondary indications (scratches, scats, skeletal remains, diggings, tracks etc.) suggested the presence of other fauna species within the proposed activity area.

## 3.8 Threatened Species and Communities Assessment

### 3.8.1 Preliminary and Final Determinations of Species Listings on the TSC Act

The Scientific Committee under the TSC Act may at any time alter the list of species on Schedules 1, 1A and 2 of the TSC Act. Such changes may include the addition of new species, the removal of previously listed species or changes in the schedule status of a species. During a period of consideration by the Scientific Committee the species under consideration is listed as a Preliminary Determination. If the proposed Preliminary Determination is approved the change is listed as a Final Determination.

Where a development application has been lodged for a s. 91 TSC Act licence and is awaiting approval the implications of any final determinations declared during that period depend on the schedule on which the species is to be listed. Final Determinations affecting Schedules 1 and 1A (endangered and critically endangered species) must still be considered in the assessment of significance of all applications prior to approval, even after lodgement. Final Determinations affecting Schedule 2 (vulnerable species) are not subject to impact assessment if they are declared after the date of lodgement of a development application, as long as the application is determined within 12 months of lodgement (s. 113C TSC Act).

For the purposes of this assessment and using a precautionary approach all species listed as preliminary determinations under the TSC Act are assessed as approved final determinations.

At the date of submission of this report there were 12 preliminary determinations of fauna species listed on the Department of Environment, Climate Change and Water (DECCW) website. Of the 12 species only one, the White-browed Woodswallow (*Artamus supercilious*), is likely to occur in the area of the subject site.

### 3.8.2 Additional Relevant Species Recorded on the Lithgow 1:100000 Map-sheet

The following additional species have been recorded on the Lithgow 1:100,000 map sheet on the Atlas of NSW Wildlife database and require some consideration:

- Booroolong Frog (*Litoria booroolongensis);*
- Giant Burrowing Frog (*Heleioporus australiacus);*
- Little John's Tree Frog (*Litoria littlejohni);*
- Broad-headed Snake (*Hoplocephalus bungaroides)*;
- Australian Painted Snipe (*Rostratula australis);*
- Swift Parrot (*Lathamus discolor);* and
- Long-nosed Potoroo (*Potorous tridactylus).*

### 3.8.3 Additional Species Likely to Occur

The following additional species are likely to occur based on local site knowledge and an understanding of threatened species habitat requirements:

- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Southern Myotis (*Myotis macropus*); and
- Eastern Cave Bat (*Vespadelus troughtoni*).

### 3.8.4 Summary of State-listed Threatened Flora and Fauna Species Previously Recorded or Predicted to Occur

The literature review and survey has identified the following list of threatened fauna species and threatened flora species as occurring within a 10 km radius of the subject site.

**Flora**

TSC Act – Endangered Species

- *Lastreopsis hispida*
- *Genoplesium superbum*
- *Persoonia hindii*
- *Eucalyptus aggregata*

TSC Act – Vulnerable Species

- *Eucalyptus pulverulenta*
- *Boronia deanei*
- *Boronia deanei* subsp. *deanei*
- *Derwentia blakelyi*

TSC Act – Endangered Ecological Communities

- Newnes Plateau Shrub Swamp (NPSS) in the Sydney Basin Bioregion

**Fauna**

TSC Act – Endangered Species

- Stuttering Frog
- Swift Parrot
- Blue Mountains Water Skink
- Brush-tailed Rock Wallaby
- Booroolong Frog
- Regent Honeyeater
- Australian Painted Snipe
- Bathurst Copper Butterfly
- Giant Dragonfly
- Broad-headed Snake

TSC Act – Vulnerable Species

- Giant Burrowing Frog
- Little Eagle
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Little Lorikeet
- Barking Owl
- Powerful Owl
- Masked Owl
- Brown Treecreeper
- Speckled Warbler
- Little John's Tree Frog
- Spotted-tailed Quoll
- Koala
- Eastern Pygmy-possum
- Yellow-bellied Glider
- Squirrel Glider
- Grey-headed Flying-fox
- Large-eared Pied Bat
- Eastern False Pipistrelle
- Eastern Bentwing-bat

- Black-chinned Honeyeater (eastern subspecies)
- Hooded Robin
- Grey-crowned Babbler (eastern subspecies)
- Scarlet Robin
- Flame Robin
- Varied Sittella
- Diamond Firetail
- Long-nosed Potoroo
- Greater Broad-nosed Bat
- Little Bentwing-bat
- Eastern Freetail-bat
- Yellow-bellied Sheathtail-bat
- Southern Myotis
- Eastern Cave Bat

TSC Act – Preliminary Determinations

- White-browed Woodswallow

## 3.9 Threatened Species and Communities Likelihood of Occurrence Assessment

**Section 3.8** identified seven threatened flora species, 30 threatened fauna species and one TEC listed on the TSC Act that are known or predicted to occur within a 10 kilometre radius of the subject site. Following is an assessment of the likelihood of occurrence of each species within the subject site based on a comparison of the habitat requirements of each species/community and the habitat types present within the subject site.

Each species / community is considered for its potential to occur on the subject site and the likely level of impact as a result of the Proposal. This assessment deals with each species / community separately and identifies the ecological parameters of significance associated with the Proposal. This assessment deals with the following heads of consideration in tabulated form (refer to **Table 3-6**):

'**Species / Community'** – Lists each threatened species / EEC known from the vicinity. The status of each threatened species under the TSC Act.

**'Habitat Description'** – Provides a brief account of the species / community and the preferred habitat attributes required for the existence / survival of each species / community.

**'Chance of Occurrence on Site'** – Assesses the likelihood of each species / community to occur along or within the immediate vicinity of the subject site in terms of the aforementioned habitat description and taking into account local habitat preferences, results of current field investigations, data gained from various sources (such as DECCW Atlas of NSW Wildlife, herbariums, etc.) and previously gained knowledge via fieldwork undertaken within other ecological assessments in the locality.

**'Likely Level of Impacts from Proposal'** – Assesses the likely level / significance of impacts to each species / community that would result from the proposed development, taking into account direct and indirect short and long-term impacts.

## Table 3-6: Chance of Occurrence and Likely Level of Impact Assessments

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| **THREATENED ECOLOGICAL COMMUNITIES** | | | |
| Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion<br>(E) | This community occurs in the headwaters of water courses draining the Newnes Plateau. It occurs where low slope gradients and vegetation impede water flow in headwater valleys and is dominated by sedges and shrubs that favour poorly drained sites. The community occurs at higher elevations than Blue Mountains sedge swamps and in the Bell and Clarence area the transition between these communities occurs at approximately 850-950 metres. Newnes Plateau shrub swamp has a greater dominance of shrubs when compared to Blue Mountains Sedge Swamps. | **High**<br>Previously recorded on the subject site | **Low**<br>Surface impacts are expected to be minor (see **Section 1.2** and **3.3**) and therefore the EEC is unlikely to be affected by the Proposal. However further assessment via a seven part test is required due to the EEC's presence within the subject site. |
| **FLORA SPECIES** | | | |
| *Lastreopsis hispida*<br>Bristly Shield Fern<br>(E) | A fern with 15-60cm (occasionally up to 90cm) fronds scattered on creeping rhizomes. The main rachis of fronds is covered with dark red-brown bristly scales with tuberculate bases. Ranging south to Victoria it occurs in NSW within wet forests of the Blue Mountains where it grows on rotting logs. | **Low**<br>Habitat within the vicinity of the subject site is unsuitable for this species. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be affected by the Proposal. |
| *Boronia deanei* subsp. *deanei*<br>*Boronia deanei*<br>(V) | Occurs in wet heath appearing to prefer the margins of open forest where it adjoins swamps and streams. It is known to occur in the Blue Mountains in the upper Kangaroo River near Carrington falls, the Endrick River near Nerriga and on the Nalbaugh Plateau. | **Moderate**<br>This species has been recorded within a 10 km radius of the subject site and the site is within damp riparian habitat however, this species was not observed during previous studies that sampled parts of swamp habitat areas within the subject site. This species is unlikely to but may occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.3**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible but unlikely presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Derwentia blakelyi* (V) | Occurring in small numbers, often in moister areas of Eucalypt forest, this species flowers in summer and is known from fewer than 20 locations. It is known to occur in the Western Blue Mountains near Clarence, near Mt Horrible, Nullo Mountain and in the Coricudgy Range. | **High** Previously recorded locally and occurs in suitable habitat occurs above the western margins of swamp vegetation areas. | **Low** Surface impacts are expected to be minor (see **Section 1.2** and **3.3**) and therefore this species is unlikely to be affected by the Proposal. Specific measures have been recommended to protect every occurrence of this species. Further assessment via a seven part test is required due to the presence of the species. |
| *Eucalyptus aggregata* (V) | Occurs on the central and southern tablelands of NSW. Grows in grassy woodlands on alluvial soils in moist sites along creeks, flats and hollows. Associated plants include *Eucalyptus rubida* (Candlebark), *E. viminalis* (Ribbon Gum) and *E. pauciflora* (Snow Gum) and *Poa labillardieri* (River Tussock) as an understorey grass. *E. aggregate* grows mainly in frost hollows and plains and is mainly found in grassy areas due to clearing. | **Low** Habitat within the vicinity of the subject site is unsuitable for this species. | **Low** Due to the lack of preferred habitat this species is unlikely to be found within the proposed project site and therefore unlikely to be affected by the Proposal. |
| *Eucalyptus pulverulenta* Silver-leafed Gum (V) | Grows in shallow soils as an understorey plant in open forest, typically dominated by Brittle Gum (*Eucalyptus mannifera*), Red Stringybark (*E. macrorhyncha*), Broad-leafed Peppermint (*E. dives*), Silvertop Ash (*E. sieberi*) and Apple Box (*E. bridgesiana*). Often occurs on granite substrates. | **Low** Although this species has been recorded within a 10 km radius of the subject site, habitat within the vicinity of the site is unsuitable for this species. | **Low** Due to the lack of preferred habitat this species is unlikely to be found within the proposed project site and therefore unlikely to be affected by the Proposal. |
| *Genoplesium superbum* (E) | Genoplesium is a genus of relatively inconspicuous ground orchids with clustered spikes of dark-coloured flowers that are non-resupinate. *Genoplesium superbum* is restricted to the southern tablelands of NSW where it has been recorded from 2 locations near Nerriga, c. 20 km apart. *Genoplesium superbum* occurs predominantly in wet heathland on shallow soils above a sandstone cap but has also been found in open woodland interspersed with heath. | **Low** **T**his species has been recorded within a 10 km radius of the subject site and the site provides some areas of potentially suitable habitat. This species was not observed during previous studies that sampled parts of habitat areas within the subject site. This species is unlikely to but may occur. | **Low** Due to the lack of preferred habitat this species is unlikely to be found within the proposed project site and therefore unlikely to be affected by the Proposal. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Persoonia hindii*<br>(E) | An erect to spreading shrub with linear-oblong leaves usually concave on the upper surface. Numerous shoots arise from underground rhizomes with reddish young shoots often hairy. Mature leaves are glabrous. Distribution is limited to the Newnes plateau in the Upper Blue Mountains where it occurs in dry forest habitats. | **Low**<br>Previously recorded upslope of East Wolgan Swamp margins above the occurrence of *Derwentia blakelyi* but outside of the actual area to be impacted.<br>(see **Section 3.3**). | **Low**<br>Species occurrence outside the area of impact. However further assessment via a seven part test is required due to the species presence to the west of East Wolgan Swamp. |
| **INVERTEBRATES** | | | |
| *Parlucia spinifera*<br>Bathurst Copperwing Butterfly<br>(E) | Found in open woodland or open forest with a sparse understorey that is dominated by *Bursaria spinosa subsp. lasiophylla* (Blackthorn) which is used as the larval food plant. Found above 850m, where direct sunlight reaches the habitat, with a south-west to north-west aspect. These areas come with extreme cold cycles such as frost or winter snowfalls. | **Moderate**<br>This species has been recorded within a 10 km radius of the subject site and the site may provide some areas of potentially suitable habitat. No areas of Blackthorn have been identified within the sampled areas of the subject site. This species may occur. | **Low**<br>Surface impacts are expected to be minor (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible but unlikely presence within the subject site further assessment via a seven part test is required. |
| *Petalura gigantea*<br>Giant Dragonfly<br>(E) | *Petalura gigantea* can be found along the east coast of NSW, from the Victorian border to northern NSW. There are only a handful of known locations in NSW. They occur in permanent swamps and bogs with some water and open vegetation. | **Moderate**<br>This species has been recorded within a 10 km radius of the subject site and the site may provide some areas of potentially suitable habitat within East Wolgan Swamp. This species may occur. | **Low**<br>Surface impacts are expected to be minor (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| **FROGS** | | | |
| *Mixophyes balbus*<br>Stuttering Frog<br>(E) | Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Breeds in streams during summer after heavy rain, outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Eggs are laid on rock shelves or shallow riffles in small, flowing streams. | **Moderate**<br>Previously recorded along Sunnyside Swamp to the east, but not previously recorded in East Wolgan Swamp (see **Section 3.4**). | **Low**<br>Surface impacts are expected to be minor (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However further assessment via a seven part test is required due to the potential occurrence of the species. |
| *Litoria booroolongensis*<br>Booroolong Frog<br>(E) | Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge. Sometimes bask in the sun on exposed rocks near flowing water during summer. Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools. | **Low**<br>Although stream-side habitat along East Wolgan Swamp has some suitable shelter, stream-side rocky or cobble bank habitats favoured by this species are not present. This species is unlikely to occur. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be found within the proposed project site and therefore unlikely to be affected by the Proposal. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Heleioporus australiacus*<br>Giant Burrowing Frog<br>(V) | The current distribution of *H. australiacus* is south-eastern NSW to Vic. Locally it occurs north to Jervis Bay (Daly 1996), and is mostly restricted to sandy creek banks, often in association with crayfish burrows in this area (Robinson, M. 1996). The northern population has a marked preference for sandstone ridge-top habitat and broader upland valleys. In these locations the frog is associated with small headwater creek lines and along slow flowing to intermittent creek-lines. *H. australiacus* is grey to dark chocolate brown or black above with a white belly, a few yellow spots along the flanks. During the summer, males call like an owl hoot, from burrows within creek banks. Females lay eggs in a foamy nest in the burrow, and the developing tadpoles are washed from the burrows into the creeks during heavy rain. | **Low – Moderate**<br>Sandstone ridge-top habitat areas may provide suitable habitat for this species, however East Wolgan Swamp does not provide suitable creek line habitat for the species. This species is unlikely to occur. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be found within the proposed project site and therefore unlikely to be affected by the Proposal. |
| *Litoria littlejohni*<br>Little John's Tree Frog<br>(V) | Occurs on the plateaus and eastern plains of the Great Dividing Range from scattered locations between the Watagan Mountains NSW south to Buchan in Victoria. It is pale brown dark speckles. Occurs along permanent rocky creeks with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. Despite its very large distribution there are very few records of the *Litoria littlejohni*. It is known to call through most of the year with a peak in Summer. Clusters of up to 60 eggs are attached to submerged twigs, stems or branches, often near the banks of still pools or clear, slowly flowing streams. Metamorphosis occurs mostly in the months of December and January. | **Low**<br>Although stream-side habitat along East Wolgan Swamp has some suitable shelter, it does not provide a permanent rocky creek as favoured by this species. This species is unlikely to occur. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be found within the proposed project site and therefore unlikely to be affected by the Proposal. |
| **REPTILES** | | | |
| *Eulamprus leuraensis*<br>Blue Mountains Water Skink<br>(E) | A very dark coloured Eulamprus water skink occurring in the Blue Mountains in isolated and naturally fragmented sedge and shrub swamps. Occurs from the Newnes plateau to just south of Hazelbrook. | **Moderate to High**<br>This species has been recorded nearby (See **Section 3.4**) and the shrub swamp habitat of East Wolgan Swamp may provide suitable habitat for the species. | **Low**<br>Surface impacts are expected to be minor (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Hoplocephalus bungaroides*<br>Broad-headed Snake<br>(E) | Largely confined to Triassic sandstones, including the Hawkesbury, Narellan and Shoalhaven formations, within the coast and ranges. Nocturnal, sheltering by day in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. In summer it is known to become semi-arboreal in its search for prey including geckos and skinks, and will shelter in hollows in large trees within 200 m of rocky escarpments. The Broad-headed Snake is regarded as potentially dangerous, although it has not been attributed to any human fatalities. Destruction of habitat, particularly the removal of sandstone slabs has lead to a decline in numbers. | **Low**<br>Habitat within the vicinity of the subject site is unsuitable for this species. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be found within the proposed project site and therefore unlikely to be affected by the Proposal. |
| **BIRDS** | | | |
| *Heiraaetus morphonoides*<br>Little Eagle<br>(V) | Inhabits open eucalypt forest, woodland and open woodland. Birds of inland NSW can occur across riparian woodland and acacia woodland. Can be found across the mainland except the most densely forested areas of the great divide. It requires a tall living tree within a forested area for nesting. Occurs across the western slopes and southern, central and northern tablelands. | **Low**<br>Forest areas within the subject site are likely too dense for the species to occur. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be affected by the Proposal. |
| *Rostratula australis*<br>Australian Painted Snipe<br>(E) | A small freshwater and estuarine wader, which prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber | **Low**<br>No suitable habitat areas occur for this species within the subject site. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be found within the proposed project site and therefore unlikely to be affected by the Proposal. |
| *Callocephalon fimbriatum*<br>Gang-Gang Cockatoo<br>(V) | Found in the summer months in tall mountain forests and woodlands, and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open Eucalypt forests and woodlands, and often found in urban areas in some districts. | **Moderate to High**<br>Suitable habitat occurs within the subject site for the species. This species is likely to occur. | **Low**<br>Surface impacts are expected to be minor (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Calyptorhynchus lathami*<br>Glossy Black-Cockatoo<br>(V) | Occurs in forests and woodlands where it forages predominantly on Allocasuarina cones, particularly those of A. littoralis, A. torulosa and at time A. distyla. Requires large Eucalypt tree hollows for nesting. Local records occur on the Newnes Plateau (Atlas of NSW Wildlife Data 2009). | **Moderate**<br>This species has been recorded within a 10 km radius of the subject site and the site may provide some areas of potentially suitable habitat. No areas of Allocasuarina spp. have been identified within the sampled areas of the subject site. This species may occur in the adjoining forested environs. | **Low**<br>Surface impacts are expected to be minor (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Glossopsitta pusilla*<br>Little Lorikeet<br>(V) | Glossopsitta pusilla extends from Cairns to Adelaide coastally and to inland locations. Commonly found in dry, open eucalypt forests and woodlands. Can be found in roadside vegetation to woodland remnants. G. pusilla feeds on abundant flowering Eucalypts, but will also take nectar from, Melaleuca sp and Mistletoe sp. Eucalyptus albens (White Box) and E. melliodora (Yellow Box) are favoured food sources on the western slopes in NSW. On the eastern slopes and coastal areas favoured food sources are Corymbia maculata (Spotted Gum), E. fibrosa (Broad-leaved Ironbark), E. robusta (Swamp Mahogany) and E. pilularis (Blackbutt). Nesting takes place in hollow bearing trees. | **Moderate**<br>Suitable habitat occurs within the subject site for this species. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Lathamus discolor*<br>Swift Parrot<br>(E) | On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year. Swift Parrots are dependent on habitats that provide winter foraging resources such as nectar and lerps (sugary exudates from leaf insects). Within these habitats, Swift Parrots prefer foraging in mature trees that provide a higher quality and quantity of nectar than regrowth trees. | **Moderate**<br>Suitable habitat occurs within the subject site for this species during winter eucalypt flowering periods. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Ninox connivens*<br>Barking Owl<br>(V) | Occurs mainly in dry sclerophyll woodland. Nests in large Eucalypt hollows, and roosts in hollows or thick vegetation. Can be found roosting in dense Acacia sp. and Casuarina sp. or the dense clumps of Eucalypt trees. More commonly found west of the divide and on the slopes. Favours tree lined watercourses, with hollow bearing tress. Hunts a range of prey species including birds and both terrestrial and arboreal mammals. | **Low**<br>Generally a more western species, individuals are occasionally recorded in more easterly habitat, particularly those areas characterised by large expanses of wooded habitat. As such this species may sparsely occur in Newnes Plateau forests on an intermittent basis. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Ninox strenua*<br>Powerful Owl<br>(V) | Occurs in coastal and adjacent ranges of eastern Australia in sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals such gliders and flying foxes, but also preys on birds). Requires large and specific hollow characteristics for nesting. Pairs appear to mate for life and occupy exclusive territories in the order of 1000 ha in size. | **High**<br>This species has been recorded nearby (See **Section 3.1.1**) and likely occurs across the subject site and surrounding areas. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Tyto novaehollandiae*<br>Masked Owl<br>(V) | Found in a range of habitats, more commonly found in dry eucalypt forests and woodlands. A forest owl which often hunts on forest edges and also roadsides. Requires large Eucalypt hollows for nesting and these hollows are also preferred for roosting sites. Breeding has also been recorded in caves. | **Moderate**<br>Potential habitat exists for this species within the subject site. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Climacteris picumnus*<br>Brown Treecreeper<br>(V) | Frequents drier forests and woodlands, particularly open woodland lacking a dense understorey. Also found in grasslands in proximity to wooded areas where there are sufficient logs, stumps and dead trees nearby. Feeds on invertebrate larvae and small insects, particularly ants. Utilises hollows for roosting/nesting. Appears not to persist in remnants less than 200ha. | **Low**<br>No suitable open woodland areas with a sparse understorey occur within the subject site. This species is unlikely to occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Chthonicola sagittata*<br>Speckled Warbler<br>(V) | Occupies Eucalypt and Cypress woodlands in drier areas and on the western/eastern slopes of the Great Dividing Range. More commonly found on the western slopes, mainly due to habitat. Requires a grassy understorey, a sparse shrub layer and an open canopy. Most foraging takes place on ground around tussocks, around bushes and trees. Appears unable to persist in districts where no forested fragments larger than 100ha remain. | **Moderate**<br>Potential habitat exists for this species within the subject site. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Pomatostomus temporalis*<br>Grey-crowned Babbler<br>(V) | Occupies open forests and woodlands, Acacia shrubland and adjoining farmland. Also Box-Gum Woodlands on the divide slopes and Box-Cypress Pine and open Box Woodlands on the plains. They feed on terrestrial invertebrates and insects on lower trunks and branches. Generally they prefer wooded areas with an intact ground cover, although in such areas as the Hunter Valley they occur in sparsely vegetated areas such as properties and golf courses. Appears unable to persist in cleared and highly fragmented habitats. Nest comprise of a dome shape stick nest which is often only a couple of metres from the ground in shrubs or Eucalypt saplings. | **Low**<br>No suitable habitat areas occur for this species within the subject site. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Anthochaera phrygia*<br>Regent Honeyeater<br>(E) | Occurs in temperate woodlands and open forest, including forest edges. Seasonal movements appear to be dictated by the flowering of various species of Eucalyptus sp. that are characteristic of the dry forests and woodlands of South-Eastern Australia. The Regent Honeyeater prefers to forage on large-flowered Eucalypts. They also forage on mistletoe and Banksia flowers, and arthropods. Nesting occurs mainly between November and January, but breeding has been recorded in all months between July and February. | **Moderate**<br>Suitable habitat occurs within the subject site for this species during winter eucalypt flowering periods. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Melithreptus gularis*<br>Black-chinned Honeyeater<br>(V) | In NSW this species occurs in eastern Australia, along the inland slopes of the Great Dividing Range, extending to the coast between Sydney and Newcastle, NSW, Occupies dry Eucalypt woodland within an annual rainfall range between 400-700 mm, particularly within associations containing Ironbark and Box species. It is estimated that the Black-chinned Honeyeater spends 60% of its time searching foliage for such food as insects, nectar and lerp. | **Moderate**<br>Potential habitat exists for this species within the subject site. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Melanodryas cucullata*<br>Hooded Robin<br>(V) | Primarily known from Eucalypt forest, woodland and scrub, although has been known to use cleared paddocks with regrowth or stumps in close proximity to wooded areas. Favours areas with sparse shrub cover and fallen timber. Appears unable to persist in remnants less than 100-200ha. | **Low**<br>No suitable habitat areas occur for this species within the subject site. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be affected by the Proposal. |
| *Petroica boodang*<br>Scarlet Robin<br>(V) | In NSW this species occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. | **High**<br><br>Open woodland / forest surrounding the GGI Sites are characterised by suitable habitat for this species and it was recorded within the vicinity of the sites during field surveys. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species presence within the subject site further assessment via a seven part test is required. |
| *Petroica pheonicea*<br>Flame Robin<br>(V) | In summer this species habits upland moist Eucalypt forest and woodlands, usually near ridges and slopes with open understorey. It migrates in winter to more open lowland habitats, such as grasslands with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). Feeds on invertebrates taken from the ground, tree trunks and logs. Open cup nest of plant material and spider webs, near ground ledge or cavity in a tree, stump or bank. | **High**<br><br>Open woodland / forest surrounding the GGI Sites are characterised by suitable habitat for this species and it was recorded within the vicinity of the sites during field surveys. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species presence within the subject site further assessment via a seven part test is required. |
| *Daphoenositta chrysoptera*<br>Varied Sitella<br>(V) | This species inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. | **High**<br>Suitable habitat exists for this species. This species is likely to occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Stagonopleura guttata*<br>Diamond Firetail<br>(V) | Occupies open woodlands / forests and associated habitats with grassy understorey. Generally found west of the Divide or in drier semi-coastal areas such as the upper Hunter Valley. Appears unable to persist in remnants less than 200ha. A small number of records exist from the Lower Hunter Region (HBOC, Atlas of NSW Wildlife data 2009). | **Low**<br>No suitable habitat areas occur for this species within the subject site. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be affected by the Proposal. |
| *Aratmus supercilious*<br>White-browed Woodswallow<br>(PD[V]) | A traditional western species. Habitat includes Eucalypt, Acacia and Casuarina woodlands and other open areas including grassland with scattered trees or shrubs, also mallee. Also can be found across agricultural areas with woodland patches. Distribution can be highly variable. This species is highly irruptive in areas across NSW. Birds can influx areas due to string winds or drought affected areas. These movements can see this species cover areas of habitat not normally encountered, eg. Rainforest. Coastal movements because of these factors can happen in summer. Coastal Eucalypt habitats are then used as a result. Breeding usually occurs inland but has been recorded on the coast in otherwise unfamiliar habitats. | **High**<br>Suitable habitat exists for this species. This species is likely to occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |
| **MAMMALS** | | | |
| *Dasyurus maculatus*<br>Spotted-tailed Quoll<br>(V) | Found in a variety of forested habitats from sclerophyll forests, rainforests and coastal woodlands. This species creates a den in fallen hollow logs or among rocky outcrops. Generally does not occur in otherwise suitable habitats that are in close proximity to urban development. A number of records occur across the Newnes Plateau (Atlas of NSW Wildlife data). It is an opportunistic hunter of a variety of prey. | **High**<br>Suitable habitat exists for this species. This species is likely to occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |
| *Cercartetus nanus*<br>Eastern Pygmy Possum<br>(V) | Occurs from rainforest through sclerophyll forest to tree heath. Favoured food being banksias, myrtaceous shrubs and trees and insects. Nesting sites are generally in drier habitats (Strahan, 1995a) Records exist from the Watagan Mountains (Atlas of NSW Wildlife data). | **High**<br>Potential habitat exists for this species within the subject site. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Petaurus norfolcensis*<br>Squirrel Glider<br>(V) | Occurs in eucalypt forests and woodlands where it feeds on sap exudates and blossoms. In these areas tree hollows are utilised for nesting sites. Also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. | **High**<br>Suitable habitat exists for this species. This species is likely to occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |
| *Petaurus australis*<br>Yellow-bellied Glider<br>(V) | Usually associated with tall, mature wet Eucalypt forest usually with high rainfall and nutrient rich soils. Also known from tall dry open forest and mature woodland. In the north of NSW they favour mixed coastal forests to dry escarpment forests and in the south they prefer moist coastal gullies to creek flats and tall montane forests. The diverse diet of this species is primarily made up of Eucalypt nectar, sap, honey dew, manna and invertebrates found under decorticating bark and pollen. Tree hollows for nest sites are essential, as are suitable food trees in close proximity. | **Low**<br>Suitable habitat exists for this species. This species is likely to occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |
| *Petrogale penicillata*<br>Brush-tailed Rock-wallaby<br>(E) | Occurs in forests and woodlands along the Great Divide and on the western slopes in escarpment country with suitable caves and rocky overhangs for shelter. Records exist from the Watagan Mountains where it is associated with the above habitats (DEC 2005; RPS pers. obs.). | **Low**<br>No suitable habitat areas occur for this species within the subject site. | **Low**<br>Due to the lack of preferred habitat this species is unlikely to be affected by the Proposal. |
| *Phascolarctos cinereus*<br>Koala<br>(V) | Occurs in forests and woodlands where it requires suitable feed trees (particular Eucalyptus spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions. Records from the Upper Hunter are largely confined to substantial woodland and forest habitat within reserves. | **Moderate**<br>Potential habitat exists for this species within the subject site. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Potorous tridactylus*<br>Long-nosed Potoroo<br>(V) | Prefers cool rainforest, wet sclerophyll forest and heathland. Essentially, requires dense understorey with occasional open areas. These open areas most likely consist of sedges, ferns, heath or grass-trees. Sleeps by day in a nest on the ground, and digs for succulent roots, tubers, fungi and subterranean insects. Some diggings seemingly attributable to this species may belong to Isoodon macrourus (Northern Brown Bandicoot). Generally east of the divide, hides by day in dense vegetation, sometimes feeds during winter during daylight hours during overcast or low light conditions. | **Moderate**<br>Potential habitat exists for this species within the subject site. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Pteropus poliocephalus*<br>Grey-headed Flying-fox<br>(V | Forages over a large area for nectar / fruits etc. Occurs across subtropical and temperate forest, sclerophyll forest and woodlands,heaths,swamps,urban gardens and cultivated crops. Frequently observed to forage in flowering Eucalypts. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforest. These camps are usually located within 20km's of their food source. Frequently observed to forage in flowering Eucalypts. | **Moderate**<br>Potential habitat exists for this species within the subject site. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Miniopterus schreibersii subsp. oceanensis*<br>Eastern Bentwing Bat<br>(V) | This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Feed above the canopy catching moths and other flying insects. Requires caves or similar structures for roosting habitat such as derelict mines, disused buildings and storm-water tunnels. | **High**<br>Suitable habitat exists for this species. This species is likely to occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |
| *Miniopterus australis*<br>Little Bentwing-bat<br>(V) | Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests and also dense coastal banksia scrub. Requires caves or similar structures for roosting habitat. Occasionally roost in tree hollows. Largely confined to more coastal areas. Often found roosting with Miniopterus schreibersii (Eastern Bentwing-bat). | **High**<br>Suitable habitat exists for this species. This species is likely to occur. | **Low**<br>Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Chalinolobus dwyeri* Large-eared Pied Bat (V) | This species forages in tall open forests and the edges of rainforest. It roosts in mine shafts and similar structures. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of Hirundo ariel (Fairy Martin), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. | **High** Suitable habitat exists for this species. This species is likely to occur. | **Low** Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |
| *Mormopterus norfolkensis* Eastern Freetail-bat (V) | This species forages predominantly in dry forests and woodlands east of the divide. Individuals have been recorded in riparian zones in rainforest and wet sclerophyll forest. Forages above the canopy or forest edges. It roosts in tree hollows, under bark and within man-made structures. | **Moderate** Potential habitat exists for this species within the subject site. | **Low** Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat (V) | Range of habitats from rainforest to arid shrubland, roosts in tree-hollows, sometimes roosts in mammal burrows when no hollows available. Seasonal movements are unknown, may migrate to southern Australia in summer. Feeds by foraging for insects over the canopy, but flys low in arid shrubland. | **High** Suitable habitat exists for this species. This species is likely to occur. | **Low** Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |

| Species / Community | Habitat Description | Chance Of Occurrence On Subject Site | Likely Level Of Impact |
|---|---|---|---|
| *Falsistrellus tasmaniensis* Eastern False Pipistrelle (V) | This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows. Hunts beetles, moths, weevils and other flying insects below or just above the canopy. | **High** Suitable habitat exists for this species. This species is likely to occur. | **Low** Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |
| *Myotis macropus* Southern Myotis (V) | Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to their roost site. Although usually recorded foraging over wet areas, it also utilises a variety of wooded habitats adjacent to such areas including rainforest, wet and dry sclerophyll forest, woodland, and swamp forest. Roosts in small colonies of between 15 and several hundred individuals in caves, mines and disused railway tunnels. | **Moderate** Despite a lack of suitable sized water bodies for the species to forage over within the subject site, suitable waterbodies likely occur in nearby Wolgan River and the species may occur in the subject site while moving between areas. Potential habitat exists for this species within the subject site. | **Low** Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species possible presence within the subject site further assessment via a seven part test is required. |
| *Scoteanax rueppellii* Greater Broad-nosed Bat (V) | Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces/ ecotones, most commonly found in tall wet forest. Open woodland and habitat and dry open forest suits the direct flight of this species as it searches for beetles and other larvae. This species roosts in tree hollows, although has been recorded in buildings. | **High** Suitable habitat exists for this species. This species is likely to occur. | **Low** Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |
| *Vespadelus troughtoni* Eastern Cave Bat (V) | A cave dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas. | **High** Suitable habitat exists for this species. This species is likely to occur. | **Low** Surface impacts are expected to be minor or absent (see **Section 1.2** and **3.4**) and therefore the species is unlikely to be affected by the Proposal. However, due to the species probable presence within the subject site further assessment via a seven part test is required. |

Notes:

V = Vulnerable Species listed under the TSC Act.

CE = Critically Endangered Species listed under the TSC Act.

E = Endangered Species listed under the TSC Act.

E** = Endangered Species listed under the Fisheries Management Act 1994.

PD = Preliminary determination under the TSC Act.

# 4 Impact Assessment

## 4.1 Impact Assessment under the TSC Act

**Section 3.9** identified the following species as requiring assessment via seven part tests under the TSC Act. This is despite the proposal being likely to result in a comparatively low level of disturbance to intact habitats for threatened flora and fauna, that being that only 0.2% of the swamp will be temporarily affected by the works.

Flora

Endangered Species

- *Persoonia hindii*

Vulnerable Species

- *Boronia deanei* subsp. *deanei*
- *Derwentia blakelyi*

Endangered Ecological Communities

- Newnes Plateau Shrub Swamp (NPSS) in the Sydney Basin Bioregion

Fauna

Endangered Species

- Stuttering Frog
- Blue Mountains Water Skink
- Regent Honeyeater
- Bathurst Copper Butterfly
- Giant Dragonfly

Vulnerable Species

- Gang-gang Cockatoo
- Grey-crowned Babbler
- Glossy Black-Cockatoo
- Little Lorikeet
- Swift Parrot
- Barking Owl
- Powerful Owl
- Masked Owl
- Black-chinned Honeyeater (eastern subspecies)
- Scarlet Robin
- Flame Robin
- Varied Sittella
- Spotted-tailed Quoll
- Koala
- Eastern Pygmy-possum
- Long-nosed Potoroo
- Brown Treecreeper
- Speckled Warbler
- Yellow-bellied Glider
- Squirrel Glider
- Grey-headed Flying-fox
- Large-eared Pied Bat
- Eastern False Pipistrelle
- Eastern Bentwing-bat
- Greater Broad-nosed Bat
- Little Bentwing-bat
- Eastern Freetail-bat
- Yellow-bellied Sheathtail-bat
- Southern Myotis
- Eastern Cave Bat

Preliminary Determinations

- White-browed Woodswallow

A seven part test assessment has been undertaken and is provided in **Appendix 2**.

### 4.1.1 Seven Part Test Conclusion

The 7 part test assessment provided in **Appendix 2** assesses the likely impact of the GGI works.

The assessment concludes that the proposal GGI activities are unlikely to significantly impact on any threatened species, populations or ecological communities.

Recommendations are provided in this assessment to ensure that the activities are undertaken in a highly considerate and sympathetic manner to the sensitivity of the NPSS and related ecological values.

### 4.1.2 Key Threatening Processes

The following KTP's are considered to be potentially associated with the Proposal:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

The impacts will be minor and result in very little disturbance to the groundcover and only 0.2% of the swamp. The natural flow regime will not be altered.

## 4.2 State Environmental Planning Policy No. 44 (Koala Habitat Protection)

Assessment of potential koala habitat under SEPP 44 requires the following steps be undertaken:

a) Identification of "potential Koala Habitats" within the proposed development area; if the total tree cover contains 15% or more of the koala food tree species listed in Schedule 2 of SEPP 44 then it is deemed to be "potential" koala habitat. Identification of 'potential koala habitat requires the determination of the presence of 'core koala habitat';

b) Identification of "core Koala habitat" within the development area. "Core Koala habitat" is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;

c) Identification of "core Koala habitat" will require that a plan of management must accompany the DA application;

d) If the rezoning of lands, other than to environmental protection, involves potential or core Koala habitat then the Director of planning may require a local environmental study be carried out.

None of the tree species listed on Schedule 2 are known to occur within the subject site and therefore the subject site does not provide 'potential koala habitat'. No further assessment under SEPP 44 is required.

# 5 DECCW Issues

## 5.1 Consideration of Issues Raised

As outlined, DECCW raised some issues that required additional information to clarify impacts upon the NPSS. All issues have been listed and where they have been addressed elsewhere within this assessment, the appropriate reference is provided. Those not listed below have been addressed in some form in this report or through revision of the activity design. For ease of reference these are referred to and addressed below.

***Questions associated with test of significant impact not answered appropriately***

Refer to **Appendix 2** for a revised 7 part test in relation to the updated information presented in this report.

***Description of the methods used are not sufficient to allow assessment of impacts***

The workscope provided by the relevant consultants regarding the geophysical and geotechnical work is presented in **Appendix 7**. It was originally proposed to carry out a comparative assessment between East Wolgan Swamp and Narrow Swamp. Accordingly, the workscope has described work within Narrow Swamp and East Wolgan Swamp. Due to questioning by DECCW, Springvale has at this stage removed the work within Narrow Swamp until the proposed techniques can be proven. This is unfortunate as other Government Departments had requested a comparative assessment.

***Description of the area and current condition not detailed enough***

This has now been covered by a series of photographs focussing on each transect. These are provided in **Appendix 5**. Condition is described throughout the document and mapped in detail.

***Equipment is potentially very heavy, won't this impact the swamp substrate in the form of pugging, wheel ruts?***

Equipment not overly heavy, heaviest equipment in the GPR which is 40kg. This is less than half the weight of an average person and will be distributed evenly across four rubber tyres to result in minimal impact. No pugging or substantial wheel ruts are likely and the greatest care will be taken in this regard within the 1.5 metre transects.

The area will be avoided for a period of 10 days following rainfall. This will avoid the potential for trampling and pugging when the peat material is most susceptible.

***Could timber plywood be used to move the equipment over while working in the swamps rather than directly on the swamp substrate?***

Plywood or any other similar material cannot be used as direct line of sight with the ground surface is required.

***Need more understanding of why Narrow Swamp is a relevant reference swamp, why a reference swamp is needed, what will a comparison show?***

To enable appropriate answer to this question, a more full description of the circumstances was required. Additional information was provided to the DECCW in February 2010 explaining why Narrow Swamp as a reference was relevant and needed for the proposed investigation. Whilst Springvale is unable to categorically say what the comparison will show (as this is the reason for carrying out the investigation), it was hoped that the comparative assessment might show why consequences within Narrow Swamp were not of the same magnitude as East Wolgan Swamp. As these two swamps have been subject to similar circumstances (climate, discharge waters and subsidence), an investigation of this nature may have provided some sort of evidence or data which may have explained the two different consequences as seen within East Wolgan Swamp and Narrow Swamp. This is still presently unknown.

The previous s91 as well as the additional information provided, was refused. Springvale is unable to provide any more reasons than that already provided in terms of a comparative assessment. Furthermore, Springvale considered that due to the delay in procuring approvals (now more than 7 months) it may be simpler to remove the Narrow Swamp proposal from the work scope at this stage.

*Excerpts from the Additional information provided February 2010:*

Following consultation with DII, DECCW, DEWHA and Forests NSW a plan to carry out further investigation within East Wolgan Swamp was agreed to (in principle). This includes a comparative assessment of East Wolgan Swamp (EWS) and Narrow Swamp (NS) and includes the implementation of a range of geotechnical and geophysical techniques. Springvale is unaware of the implementation of the proposed geophysical/geotechnical techniques within NPSS's to achieve the desired objectives (see below). Accordingly, Springvale is proposing to conduct a trial of the techniques in isolated areas to determine whether or not they are applicable to use across a broader area of the EWS and NS.

In summary, the objectives of the GGI is provided below:

- To provide an understanding of the peat substrate contained with EWS and NS including:
    - peat strength (to erosive forces)
    - depth of peat
    - in situ piping
    - in situ cavities
    - constituents (make up) of the peat material
    - peat layering characteristics

- To compare the results of the GGI of NS and EWS in an attempt to understand why EWS suffered slumping and NS did not
- To provide a clearer understanding of the causes of isolated slumping within EWS
- To understand why slumping did not occur in NS despite similar conditions
- To assess the appropriateness of GGI techniques to assess the characteristics of peat substrates
- To assess the appropriateness of GGI techniques for the pre-mining baseline assessment of NPSS

The desired outcome of the information and data obtained from the GGI is to assist in understanding the causes of the slumping (ie. Subsidence related, piping structures, collapse of in-situ piping, are there structures that may compromise further work etc). The other desired outcomes include answers to the following questions:

- Are any of these techniques appropriate to use for a larger assessment of EWS and NS?
- Are any of these techniques appropriate to use for baseline monitoring of NPSS?
- What materials would be appropriate for stabilisation and/or remediation?
- Is the existing slumping stable? Is there a risk that the slumping will continue to move if stabilised or remediated? Is it appropriate to stabilise? Is it appropriate to remediate?
- What further actions are required to design an appropriate stabilisation and/or remediation program?
- How sensitive are NPSS to water flow? How can emergency discharges be better managed to minimise impact on the NPSS?
- Why did NS not suffer the same impacts as EWS even though they were subject to the same effects?
- What caused the slumping within EWS?
- Did the underlying geology affect the response of the peat material?

***More information required on how much impact is has already occurred in the swamp?***

This has been addressed in Section 3.3

***How much of the 270m2 East Wolgan and 210m2 (Narrow Swamp) is already cleared?***

This has been addressed in Section 3.3.

***What are the consequences of doing resistivity only?***

Resistivity only would result in no temporary trimming being required. With resistivity only Springvale will not get any information regarding the peat layer and therefore will not be able to establish whether piping has occurred. Radar is probably the most important aspect of the project.

***Will trimming of non-threatened native vegetation be required (given the dense and steep access to the swamp in most areas)? If so has approval been given for this?***

Access into the swamp will be from along an existing foot track as shown in Plate 5-1. This access contains mainly a fallen bark substrate, with few native groundcover species. The GPR and other associated equipment will easily be able to be transported into the swamp from the gravel roadway approximately 300m to the west without affecting the integrity of this substrate.

The only trimming proposed relates to the trimming required to carry out the surveys within the transects. Accordingly, the only approval required relates to this s91 application. Forests NSW have endorsed the project proposal (see **Appendix 1**).

**Plate 5-1 – Western Access Track**

***How long will the activity in the swamp take?***

Four to five days at the most. This is weather dependant and based on winter daylight hours and rainfall.

***Will equipment be removed on the day/s of assessment or will some gear remain in the swamp?***

Every day the majority of equipment will be removed from the swamp. This is mainly for security purposes as the equipment is quite expensive.

***Does the current level of impact in both swamps represent significant impact?***

This is not the subject of the current proposal. The current proposal assesses the impact of undertaking geophysical and geotechnical assessments within east Wolgan Swamp. These activities are limited to a very small area of the swamp (0.2% of the total area).

***What is the size of the each swamp in relation to current damage and proposed activities?***

This has been assessed in Section 3.

***Need explanation of why trimming of swamps to create transects for geophys and geotech work is not considered fragmentation or isolation in parts of habitat. In relation to the EEC and any threatened flora or fauna that may use that habitat.***

This has been assessed in 7 Part Tests

***What is the current height and density of the vegetation to be trimmed?***

Photos provided in **Appendix 5** provide a good visual indication of the height of vegetation along transects. Within the NPSS the vegetation is generally less than 50cm in height, although some larger shrubs also exist up to 2m. The density is generally low, as shown in the photos. This swamp vegetation is adapted to disturbances such as fire and damage by fauna and weather events. The trimmed vegetation is expected to readily resprout and regrow post-trimming.

***What will be done with the vegetation that is trimmed ie. the trimmings?***

Trimmed vegetation will be placed within the existing bare areas of the swamp to assist in regeneration of endemic species through seed set and to provide habitat for small ground-dwelling fauna.

***Wombat burrows must be avoided.***

This has been addressed in Section 6.

# 6 Conclusion and Recommendations

## 6.1 Conclusion

RPS Australia East Pty Ltd (RPS) was engaged by Springvale Coal Pty Ltd to prepare a Flora and Fauna Assessment (FFA) report for proposed Geotechnical and Geophysical Investigations (GGI) within the area known as East Wolgan Swamp.

The GGI is to be undertaken to provide valuable baseline data on the geological and physical characteristics of the swamp. Reasons and methods were outlined in further detail within this document. This type of swamp habitat is considered to be important as it is identified as an Endangered Ecological Community (EEC). It is listed as an EEC under the *Threatened Species Conservation Act 1995* (TSC Act 1995), being known as Newnes Plateau Shrub Swamp (NPSS).

Previous ecological investigations were undertaken in 2009 by RPS Harper Somers O'Sullivan (RPS HSO), now known as RPS only. These provided an overview of the proposal and its general impacts on the ecological characteristics of the swamp. A Section 91 application was submitted to the Department of Environment, Climate Change and Water (DECCW) in 2009 for the activity, primarily in relation to the potential impacts upon the NPSS. Following a refusal by DECCW the additional work undertaken for this more comprehensive report have aimed to addressed issued raised by DECCW previously.

Assessment via a seven part test found that the Proposal was unlikely to significantly impact on any of the identified species or communities.

Assessment under SEPP 44 found that no 'Potential Koala Habitat' occurs within the subject site and no further assessment under SEPP 44 was required.

The proposal is unlikely to significantly impact on any species, population or ecological community listed under the TSC Act or SEPP 44.

A number of recommendations are provided in **Section 6.2** to ensure protection of the swamp and any threatened species during the GGI activities.

## 6.2 Recommendations

A number of these recommendations are consistent with previous suggestions by DECCW as part of the previous Section 91 application process. These should be implemented during the GGI activities.

- Ecologist to be present to identify threatened species such as *Derwentia blakelyi.* These threatened species are to be avoided and the ecologist is to document on-ground supervision activities and report to Centennial and DECCW;
- The number of personnel in the swamp at any one time should be limited to the minimum number necessary at any one time;
- Equipment and storage areas must be placed outside of the swamp and threatened species known areas of occurrence;
- All activities to be undertaken away from permanently pooled, flowing and / or open water;
- Preferably wait until at least 10 days after regular rain to avoid disturbing the substrate in its most susceptible state;
- Absolute minimal vegetation necessary to complete the project should be trimmed;
- Trimmed vegetation should be placed in existing cleared areas within the swamp to assist natural regeneration;
- Where fallen timber is require to be moved the ecologist should undertake an inspection for fauna before it is moved in order to protect and temporarily relocate any observed fauna. Wherever possible, timber shall be relocated back to its original position;
- To avoid establishing tracks, access to the swamp should be varied as required; and
- Appropriate environmental hygiene protocols should be implemented to avoid exotic seed and / or pathogens from contaminating the EEC. Hygiene protocols should be applicable to personnel and equipment alike. A brief protocol should be prepared for issue to personnel prior to the GGI activities being undertaken.

# 7 References


ANZECC. 1998. *National Koala Conservation Strategy.* Canberra : Environment Australia, 1998.

Biodiversity Monitoring Services. 2008. *Fauna Monitoring Within The Subsidence Management Plan Area At Springvale Colliery*

DEC. 2006. *Recovery Plan for the Large Forest Owls: Powerful Owl (Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae).* Sydney : DEC, 2006.

DECC. 1998. *Approved Recovery Plan for the Koala (Phascolarctos cinereus).* Sydney : Department of Environment and Climate Change, 1998.

Gingra Ecological Surveys. 2005. *Vegetation Monitoring Program Springvale Colliery - Report on 2004 Surveys and Eight Part Tests. Appendix D of Springvale Colliery Longwalls 411-418 Subsidence Management Plan Application Written Report.* s.l. : Springvale Coal, 2005.

Hyder Consulting. 2004. • *Springvale to Wallerawang Pipeline Project Bore 5 Pipeline and Route 4E Flora and Fauna Assessment .* s.l. : Hyder Consulting Pty Ltd, 2004.

—. 2004. *Springvale to Wallerawang Pipeline Project Bore 5 Pipeline and Route 4E Flora and Fauna Assessment. A Report to Delta Electricity.* s.l. : Hyder Consulting, 2004.

Mount King Ecological Surveys. 2005. *Fauna Monitoring Within The Subsidence Management Plan Area At Springvale Colliery and Eight Part Tests - Appendix E Springvale Colliery Longwalls 411-418 Subsidence Management Plan Application Written Report.* s.l. : Springvale Coal, 2005.

NPWS. 2001. *Bathurst Copper Butterfly (Paralucia spinosa) Recovery Plan.* s.l. : NSW National Parks and Wildlife Service, 2001.

—. 2003. *Draft Recovery Plan for the Barking Owl.* Hurstville, NSW : NSW National Parks and Wildlife Service, 2003.

—. 2003. *Recovery Plan for the Yellow-bellied Glider (Petaurus australis).* s.l. : NSW National Parks and Wildlife Service, 2003.

RPS . 2009a. *East Wolgan Swamp Proposed Stage 1 Geotech / Geophysical Works, Soil Moisture Probes and Weed Control Works.* Broadmeadow, NSW : RPS , 2009.

—. 2009b. *Flora and Fauna Assessment for Proposed V-Notch Weir Downstream of Sunnyside Swamp, Springvale Coal Mine, Newnes Plateau.* Broadmeadow, NSW : RPS, 2009.

—. 2009c. *Sunnyside Swamp Proposed Piezometer Site Inspections - Letter Report.* Broadmeadow, NSW : RPS, 2009.

—. 2009d. *Narrow Swamp Proposed Geotech / Geophysical Works and Weed Control Works - Letter to Centennial Coal.* Broadmeadow, NSW : RPS, 2009.

Springvale Coal. 2005. *Springvale Colliery Subsidence Management Plan Application - Written Report.* 2005.

# Appendix 1

## Government Department Correspondence

**Australian Government**

**Department of the Environment, Water, Heritage and the Arts**

Mr Terry O'Brien
Mine Manager – Springvale Colliery
Springvale Colliery Pty Ltd
PO Box 198
WALLERAWANG NSW 2845

Date: 21 January 2010
EPBC Ref: 2009/5258
EPBC contact: Ms Helen Byrne
02 6247 2636
helen.byrne@environment.gov.au

Dear Mr O'Brien

**Decision on referral**
**Environmental Monitoring Activities at the Existing Springvale Colliery, NSW**

This is to advise you of my decision, under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), about the proposed action to install six hand augured groundwater monitoring piezometers and undertake geotechnical and geophysical monitoring activities in Temperate Highland Peat Swamps on Sandstone on the Newnes Plateau, approximately 10 km north of Lithgow, New South Wales.

**I have decided that the proposed action is not a controlled action. This means that the proposed action does not require further assessment and approval under the EPBC Act before it can proceed.** A copy of the document recording this decision is enclosed. This document will be notified publicly on the Department's website.

Please note that this decision relates only to the specific matters protected under Chapter 4 of the EPBC Act.

This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

I have written separately to Mr Toby Lambert of RPS Harper Somers O'Sullivan advising him of this decision.

If you have any questions about the referral process or this decision, please contact the EPBC project manager and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Mr Tim Kahn
A/g Assistant Secretary
Environment Assessment Branch

**Australian Government**

**Department of the Environment, Water, Heritage and the Arts**

## Notification of REFERRAL DECISION – not controlled action

Environmental Monitoring Activities at the Existing Springvale Colliery (EPBC 2009/5258)

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

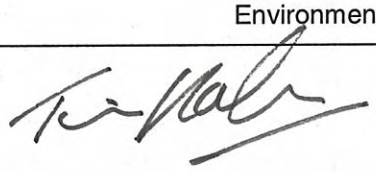
### Proposed action

| | |
|---|---|
| **person named in the referral** | Springvale Colliery Pty Ltd |
| **proposed action** | To install six hand augured groundwater monitoring piezometers and undertake a range of geotechnical and geophysical monitoring activities in Temperate Highland Peat Swamps on Sandstone on the Newnes Plateau, approximately 10km north of Lithgow, New South Wales, and as described in the referral received under the EPBC Act on 22 December 2009. |

### Referral decision: Not a controlled action

| | |
|---|---|
| **status of proposed action** | The proposed action is not a controlled action. |

### Person authorised to make decision

| | |
|---|---|
| **Name and position** | Mr Tim Kahn<br>A/g Assistant Secretary<br>Environment Assessment Branch |
| **signature** |  |
| **date of decision** | 21 January 2010 |

FORESTS NSW
ABN 43 141 857 613
Cnr Browning St & Panorama Ave (PO Box 143) Bathurst NSW 2795
www.dpi.nsw.gov.au/forests T 02 6331 2044 F 02 6331 5528

Mr Terry O'Brien
Mine Manager - Springvale Coal P/L
PO Box 198
Wallerawang NSW 2845

7/01/2010
Our ref: 664 DK

Dear Terry

***Proposed works in Sunnyside Swamp, East Wolgan Swamp, and Narrow Swamp, Newnes State Forest***

I refer to your correspondences of 25 November 2009, 1 December 2009 and information provided by Edwina White relating to the proposed Newnes Plateau Shrub Swamp monitoring works within Newnes State Forest.

Thank you for supplying comprehensive due diligence assessments for:

1) Installation of three shallow piezometers in Sunnyside Swamp,
2) Installation of a flow monitoring weir below Sunnyside Swamp,
3) Geotechnical & Geophysical Investigative works within East Wolgan Swamp and Narrow Swamp,
4) Installation of soil moisture probes within East Wolgan Swamp,
5) Weed control works within East Wolgan Swamp and Narrow Swamp,
6) Stabilisation and remediation works within the areas of East Wolgan Swamp affected by slumping.

On review of these documents Forests NSW determines that:

a) as long as approval has been gained as required under the *Threatened Species Conservation Act 1995,* the *Environment Protection and Biodiversity Conservation Act 1999*, and the *Water Act 1912,* and;

b) work is conducted as per mitigation measures requested by the Department of Environment Climate Change and Water (DECCW) and DECCW Office of Water (formally the Department of Water & Energy);

the specified works are not likely to significantly affect the environment, and have the endorsement of Forests NSW.

Please also find attached the completed land owner consent relating to the Controlled Activity approval for the weir.

An extension to the Occupation Permit PB 03787 is granted for the proposed piezometers within Sunnyside Swamp (3x1$m^2$), weir below Sunnyside Swamp (1$m^2$), and soil moisture probes within East Wolgan Swamp (20$m^2$) conditional on obtaining approval as mentioned above, and on compliance with all conditions within the current Occupation Permit. The additional area on the Occupation Permit will be 0.0024ha.

Please note that this determination is limited to the specified areas within Newnes State Forest and only so much as the information submitted to Forest NSW is true and correct. All associated work conducted within Newnes State Forest must comply with the attached *Macquarie – Miscellaneous Forest Practices*. It is incumbent on the project proponent to ensure that all other statutory/legislative requirements are met before commencement of the specified works.

Please contact Dan Kirby on (02) 6331 1012 for further information.

Yours faithfully

**GAVIN JEFFRIES**

**REGIONAL MANAGER**

# Appendix 2

## 7 Part Test

***a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

Impacts are expected to be minor (see **Section 1.2** and **Section 3**). 0.2% of the NPSS will be affected by the temporary trimming and GGI activities. No species are likely to be affected by the low-level impact over 4-5 days. Numerous recommendations have been made to ensure the protection of all habitats and threatened species as part of the GGI activities.

The proposal is unlikely to adversely affect the life cycle of any threatened flora species or fauna species.

***b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,***

No endangered populations were identified within the subject site or surrounding area.

***c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

> ***(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,***

- Newnes Plateau Shrub Swamp (NPSS) in the Sydney Basin Bioregion

Impacts are expected to be minor (see **Section 1.2** and **Section 3**). 0.2% of the NPSS will be affected by the temporary trimming and GGI activities. No species are likely to be affected by the low-level impact over 4-5 days. Numerous recommendations have been made to ensure the protection of all habitats and the NPSS as part of the GGI activities.

The proposal is unlikely to: adversely affect the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

***d) In relation to the habitat of a threatened species, population or ecological community:***

Flora

Endangered Species

- *Persoonia hindii*

Vulnerable Species

- *Boronia deanei* subsp. *deanei*
- *Derwentia blakelyi*

Endangered Ecological Communities

- Newnes Plateau Shrub Swamp (NPSS) in the Sydney Basin Bioregion

Fauna

Endangered Species

- Stuttering Frog
- Blue Mountains Water Skink
- Regent Honeyeater
- Bathurst Copper Butterfly
- Giant Dragonfly

Vulnerable Species

- Gang-gang Cockatoo
- Grey-crowned Babbler
- Glossy Black-Cockatoo
- Little Lorikeet
- Swift Parrot
- Barking Owl
- Powerful Owl
- Masked Owl
- Black-chinned Honeyeater (eastern subspecies)
- Scarlet Robin
- Flame Robin
- Varied Sittella
- Spotted-tailed Quoll
- Koala
- Eastern Pygmy-possum
- Long-nosed Potoroo
- Brown Treecreeper
- Speckled Warbler
- Yellow-bellied Glider
- Squirrel Glider
- 
- Grey-headed Flying-fox
- Large-eared Pied Bat
- Eastern False Pipistrelle
- Eastern Bentwing-bat
- Greater Broad-nosed Bat
- Little Bentwing-bat
- Eastern Freetail-bat
- Yellow-bellied Sheathtail-bat
- Southern Myotis
- Eastern Cave Bat

Preliminary Determinations

- White-browed Woodswallow

***(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and***

Impacts are expected to be minor (see **Section 1.2** and **Section 3**). 0.2% of the NPSS will be affected by the temporary trimming and GGI activities. No species are likely to be affected by the low-level impact over 4-5 days. Numerous recommendations have been made to ensure the protection of all habitats, threatened species and the NPSS as part of the GGI activities.

The proposal is unlikely to result in the significant modification of habitat areas for any threatened species or population.

***(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and***

No substantial areas of habitat would be removed for the proposal. No areas of habitat are likely to become fragmented or isolated from other areas of habitat as a result of the proposal.

***(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

No areas of habitat are likely to be fragmented or isolated. Given the relatively high abundance of similar habitat areas across Newnes Plateau the area of habitat within the subject site is not of any particular importance to any of the above species. The areas of habitat within the subject site are of moderate importance to the NPSS and threatened flora species which are patchily distributed throughout Newnes Plateau. The impacts will be temporary and limited in nature.

***e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),***

No areas of critical habitat occur within or adjacent to the subject site.

***f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,***

<u>Flora</u>

Endangered Species

- *Persoonia hindii*

Vulnerable Species

- *Boronia deanei* subsp. *deanei*
- *Derwentia blakelyi*

Endangered Ecological Communities

- Newnes Plateau Shrub Swamp (NPSS) in the Sydney Basin Bioregion

<u>Fauna</u>

Endangered Species

- Stuttering Frog
- Blue Mountains Water Skink
- Regent Honeyeater
- Giant Dragonfly

Vulnerable Species

- Gang-gang Cockatoo
- Brown Treecreeper

- Grey-crowned Babbler
- Glossy Black-Cockatoo
- Little Lorikeet
- Swift Parrot
- Grey-headed Flying-fox
- Black-chinned Honeyeater (eastern subspecies)
- Scarlet Robin
- Flame Robin
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- Long-nosed Potoroo
- Eastern Cave Bat
- Speckled Warbler
- 
- Squirrel Glider
- Regent Honeyeater
- Large-eared Pied Bat
- Eastern False Pipistrelle
- Eastern Bentwing-bat
- Greater Broad-nosed Bat
- Little Bentwing-bat
- Eastern Freetail-bat
- Yellow-bellied Sheathtail-bat
- Southern Myotis

Preliminary Determinations

- White-browed Woodswallow

No draft or final recovery plans or threat abatement plans or threatened species priorities action statements are currently listed on the Department of Environment, Climate Change and Water website for the above species.

- Powerful Owl
- Masked owl

As such minor modification of habitat areas will occur the Proposal is not inconsistent with the objectives of the large forest owl recovery plan.

- Barking Owl

As such minor modification of habitat areas will occur the Proposal is not inconsistent with the objectives of the Barking Owl recovery plan.

- Koala

As such minor modification of habitat areas will occur the Proposal is not inconsistent with the objectives of the Koala recovery plan.

- Yellow-bellied Glider

As such minor modification of habitat areas will occur the Proposal is not inconsistent with the objectives of the Yellow-bellied Glider recovery plan.

- Bathurst Copper Butterfly

As such minor modification of habitat areas will occur the Proposal is not inconsistent with the objectives of the Bathurst Copper Butterfly recovery plan.

***g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.***

The following KTP's are considered to be potentially associated with the Proposal:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.

The impacts will be minor and result in very little disturbance to the groundcover and only 0.2% of the swamp. The natural flow regime will not be altered.

# Appendix 3

## Flora Lists

| Class/Subclass | Family | Scientific Name | Common Name | Form | TSC Act Status | T1 WV | T1 WSV | T1 CSV | T1 SV | T1 ESV | T1 EV | T2 WV | T2 WSV | T2 CSV | T2 SV | T2 ESV | T2 EV | T3 WV | T3 WSV | T3 CSV | T3 SV | T3 ESV | T3 EV | T4 WV | T4 WSV | T4 CSV | T4 SV | T4 ESV | T4 EV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Filicopsida | Dennstaedtiaceae | *Pteridium esculentum* | Bracken | g | | | | | | | | | | | | | | X | | | | | | X | | | | | |
| Filicopsida | Gleicheniaceae | *Gleichenia dicarpa* | Pouched Coral Fern | g | | X | | | | X | | X | X | | X | X | | X | X | X | X | X | | | X | X | X | X | |
| Magnoliidae | Apiaceae | *Centella asiatica* | Swamp Pennywort | g | | | | X | | | | | | | | | | | | | | | | | | | | | |
| | Apiaceae | *Hydrocotyle algida* | Pennywort | g | | | | X | | | | | | X | | | | | | | | | | | | X | | | |
| Magnoliidae | Apiaceae | *Hydrocotyle peduncularis* | Pennywort | g | | | | | | | | | | X | | | | | | | | | | | | | | X | |
| Magnoliidae | Apiaceae | *Platysace linearifolia* | Narrow-leafed Platysace | s | | | | | | | | | | | | | X | | | | | | X | | | | | | |
| Magnoliidae | Araliaceae | *Polyscias sambucifolia* | Elderberry Panax | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Arrhenechthites mixta* | Purple Fireweed | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Centipeda cunninghamii* | Sneezeweed | g | | | | X | | | | | | X | | | | | | X | | | | | | X | | | |
| Magnoliidae | Asteraceae | *Cirsium vulgare** | Spear Thistle | g | | | | X | | | | | | X | | | | | | X | | | X | | | X | | | |
| Magnoliidae | Asteraceae | *Conyza bonariensis** | Flax-leaf Fleabane | g | | | | X | | | | | | | | | | | | X | X | | | | | X | | | |
| Magnoliidae | Asteraceae | *Euchiton gymnocephalus* | Cudweed | g | | | | | | | | | | X | | | | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Euchiton sphaericus* | - | g | | | | | | | | | | X | | | | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Helichrysum rutidolepis* | Pale Everlasting | g | | X | | | | | | X | | | | | X | | | | | | X | X | | | | | X |
| Magnoliidae | Asteraceae | *Helichrysum scorpioides* | Pale Everlasting | g | | X | | | | | | | | | | X | X | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Hypochaeris radicata** | Flatweed | g | | | | | | | | | | X | X | | | | | | | | | X | | | | | |
| Magnoliidae | Asteraceae | *Lagenophora stipitata* | - | g | | X | | | | | | | | | | | X | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Olearia erubescens* | Silky Daisy Bush | s | | X | | | | | | X | | | | | | X | | | | | | X | | | | X | |
| Magnoliidae | Asteraceae | *Pseudognaphalium luteo-album* | Cudweed | g | | | | X | | | | | | X | | | | | | | | | | | | X | | | |
| Magnoliidae | Asteraceae | *Senecio minimus* | | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Sonchus oleraceus** | Common Sow-thistle | g | | | | | | | | | | X | | | | | | | | | | | | X | | | |
| Magnoliidae | Asteraceae | *Taraxacum officinale** | Dandelion | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Casuarinaceae | *Allocasuarina nana* | Dwarf She-oak | t | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Clusiaceae | *Hypericum gramineum* | Small St Johns Wort | g | | X | | | | | | | | | | | | X | | | | | | | | | | | |
| Magnoliidae | Dilleniaceae | *Hibbertia acicularis* | Prickly Guinea Flower | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Epacridaceae | *Epacris paludosa* | Swamp Epacris | g | | | X | | | | | | | | | | | | | | X | X | | | | X | | | |
| Magnoliidae | Epacridaceae | *Epacris pulchella* | Wallum Heath | s | | | | | | | | | | | | | | | | | | X | | | | | | | |
| Magnoliidae | Epacridaceae | *Leucopogon lanceolatus* | Lance-leaf Beard-heath | s | | X | | | | | | X | | | | | | | | | | | | | | | | | |
| Magnoliidae | Epacridaceae | *Monotoca elliptica* | Tree Broom-heath | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Epacridaceae | *Monotoca scoparia* | Prickly Broom-heath | s | | X | | | | | | X | | | | | X | X | | | | | X | X | | | | | |
| Magnoliidae | Euphorbiaceae | *Poranthera microphylla* | - | g | | | | | | | | | | | | | | X | | | | | | | | | | X | |
| Magnoliidae | Fabaceae / faboideae | *Daviesia latifolia* | - | s | | | | | | | | | | | | | | X | | | | | | X | | | | | |
| Magnoliidae | Fabaceae / faboideae | *Daviesia squarrosa* | Gorse Bitter Pea | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Fabaceae / faboideae | *Gompholobium huegelii* | Pale Wedge Pea | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Fabaceae / faboideae | *Hovea* sp. | - | s | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Magnoliidae | Fabaceae / faboideae | *Phyllota squarrosa* | Dense Phyllota | s | | | | | | | | | | | | | X | | | | | | | | | | | | |
| Magnoliidae | Fabaceae / Mimosoideae | *Acacia rubida* | Red-stemmed Wattle | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Geraniaceae | *Geranium potentilloides* | Geranium | g | | | X | X | | | | | | | | | | | | | | | | | | X | | | |
| Magnoliidae | Goodeniaceae | *Dampiera stricta* | Blue Dampiera | g | | | | | | | | | | | | | X | | | | | | | | | | | | |
| Magnoliidae | Haloragaceae | *Gonocarpus tetragynus* | Poverty Raspwort | g | | X | | | | | | X | | | | | | | | | | | | | X | | | | |
| Magnoliidae | Myrtaceae | *Baeckea diosmifolia* | Fringed Baeckea | s | | | | X | | X | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Myrtaceae | *Baeckea linifolia* | Weeping Baeckea | s | | | | | | X | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Myrtaceae | *Eucalyptus gregsoniana* | Wolgan Snow Gum | t | | | | | | | | | | | | | X | | | | | | | | | | | | |
| Magnoliidae | Myrtaceae | *Eucalyptus oreades* | Blue Mountains Ash | t | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Myrtaceae | *Eucalyptus radiata* | Narrow-leaved Peppermint | t | | X | | | | | | X | | | | | | | | | | | | | X | | | | |
| Magnoliidae | Myrtaceae | *Eucalyptus sclerophylla* | Scribbly Gum | t | | X | | | | X | | X | X | | | | | X | | | | | X | X | | | | | X |
| Magnoliidae | Myrtaceae | *Leptospermum grandifolium* | Wooly Tea-tree | s | | X | | | | | | | | | | X | | | | | | | | | | | | | |
| Magnoliidae | Myrtaceae | *Leptospermum lanigerum* | Coast Tea-tree | s | | | | | | X | | | | | | | | | | | X | X | X | | | | | X | |
| Magnoliidae | Myrtaceae | *Leptospermum obovatum* | - | s | | | X | X | | X | | | X | | | X | | X | X | X | | X | | X | | | | X | |
| Magnoliidae | Myrtaceae | *Leptospermum polygalifolium* subsp. *polygalifolium* | Tantoon | s | | | | | | X | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Myrtaceae | *Leptospermum polyanthum* | Slender Tea-tree | s | | | | | | | | | | | | | X | | | | | | | | | | | | |
| Magnoliidae | Oxalidaceae | *Oxalis perrenans* | Yellow-flowered Wood Sorrel | g | | | | | | | | | | | | | | X | | | | | | | | | | | |
| Magnoliidae | Pittosporaceae | *Billardiera scandens* | Hairy Appleberry | v | | | | | | | | X | | | | | | X | | | | | | | | | | | |
| Magnoliidae | Poaceae | *Dichondra repens* | Kidney Weed | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Banksia cunninghamii subsp. cunninghamii* | - | s | | X | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Banksia marginata* | Silver Banksia | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Grevillea acanthifolia subsp. acanthifolia* | Bog Grevillea | s | | | X | X | | X | | | | X | X | X | | | X | X | X | X | | | | X | X | | |
| Magnoliidae | Proteaceae | *Hakea dactyloides* | Broad-leaved Hakea | s | | | | | | | | | | | | | | | | | | | | X | | | | | X |
| Magnoliidae | Proteaceae | *Isopogon anemonifolius* | Flat-leaved Drumsticks | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Lomatia myricoides* | River Lomatia | s | | X | | | | | | X | | | | | | X | | | | | | X | | | | | |
| Magnoliidae | Proteaceae | *Lomatia silaifolia* | Crinkle Bush | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Persoonia chamaepitys* | Mountain Geebung | s | | X | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Persoonia recedens* | - | s | | | | | | | | | | | | X | X | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Petrophile sessilis* | Conesticks | s | | X | | | | | | | | | | | | | | | | | X | | | | | | X |
| Magnoliidae | Ranunculaceae | *Clematis aristata* | Old Man's Beard | v | | | | | | | | X | | | | | | | | | | | | | | | | | |
| Magnoliidae | Rubiaceae | *Galium gaudichaudii* | Rough Bedstraw | g | | | | | | | | | | | | | | X | | | | | | | | | | | |
| Magnoliidae | Rutaceae | *Boronia microphylla* | Small-leaved Boronia | s | | | | | | | | | | | | | | | | | | | X | | | | | | X |
| Magnoliidae | **Scrophulariaceae** | ***Derwentia blakelyi*** | **-** | **s** | **V** | **X** | | | | | | **X** | | | | | | **X** | | | | | | **X** | | | | | |
| Magnoliidae | Scrophulariaceae | *Gratiola pedunculata* | Stalked Brooklime | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Thymelaeaceae | *Pimelea linifolia* subsp. *linifolia* | Slender Rice Flower | g | | | | | | | | | | | | | | | | | | | | | | | | | |

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| Magnoliidae | Violaceae | *Viola betonicifolia* | Native Violet | g | | | | | | | | X | | | | | | | | | | | | | | | | |
| Liliidae | Cyperaceae | *Baumea rubiginosa* | Twig Rush | w | | | X | | | | | | | | | | | | | X | | | | | | X | | | |
| Liliidae | Cyperaceae | *Gahnia grandis* | Black-fruit Saw-sedge | wg | | | | | | | | | X | | | X | | | | | | | | | | | | | |
| Liliidae | Cyperaceae | *Gahnia sieberiana* | Red-fruited Saw-sedge | g | | | | | | X | | | | | | | | | | | | X | | | | | X | | |
| Liliidae | Cyperaceae | *Lepidosperma limicola* | - | wg | | | | X | | X | | | | | | | | | | | | | | | | | | | |
| Liliidae | Cyperaceae | *Lepidosperma* sp. | - | g | | | X | | | | | | | | | | | | | | | | | | | X | | | |
| Liliidae | Iridaceae | *Patersonia sericea* | Wild Iris | g | | | | | | | | | | | | X | | | | | | | | | | | | | |
| Liliidae | Juncaceae | *Juncus continuus* | - | g | | | X | X | | | | | | X | | | X | | | | X | X | | | | X | X | | |
| Liliidae | Lomandraceae | *Lomandra filiformis* subsp. *coriacea* | Wattle Mat-rush | g | | X | | | | | | X | | | | | X | X | | | | | X | X | | | | | X |
| Liliidae | Lomandraceae | *Lomandra glauca* | Pale Mat-rush | g | | | | | | | | | | | | | X | | | | | | | | | | | | |
| Liliidae | Lomandraceae | *Lomandra multiflora* | Many-flowered Mat-rush | g | | X | | | | | | | | | | | | | | | | | X | | | | | | |
| Liliidae | Orchidaceae | *Eriochilus autumnalis* | Parson's Bands | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Phormiaceae | *Dianella revoluta* var. *revoluta* | Spreading Flax Lily | g | | X | | | | | | | | | | | X | X | | | | | | X | | | | | X |
| Liliidae | Poaceae | *Poa labillardieri* var. *labillardieri* | Tussock Grass | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Poaceae | *Poa sieberiana* var. *sieberiana* | Tussock Grass | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Poaceae | *Poa sieberiana* var. *cyanophylla* | - | g | | X | | | | | | X | | | | | | X | | | | | X | X | | | | | X |
| Liliidae | Restionaceae | *Baloskion australe* | - | wg | | | | X | | X | | X | | | X | X | | | | | X | X | | | X | | X | X | |
| Liliidae | Restionaceae | *Empodisma minus* | - | w | | | X | X | | X | | | | | X | X | | | | X | X | X | | | X | | X | X | |
| Liliidae | Xanthorrhoaceae | *Xanthorrhoea resinifera* | - | g | | X | | | | | | | | | | | | | | | | | | | | | | | |

| Class/Subclass | Family | Scientific Name | Common Name | Form | TSC Act Status | T5 WV | T5 WSV | T5 CSV | T5 SV | T5 ESV | T5 EV | T6 WV | T6 WSV | T6 CSV | T6 SV | T6 ESV | T6 EV | T7 WV | T7 WSV | T7 CSV | T7 SV | T7 ESV | T7 EV | T8 WV | T8 WSV | T8 CSV | T8 SV | T8 ESV | T8 EV |
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| Filicopsida | Dennstaedtiaceae | *Pteridium esculentum* | Bracken | g | | X | X | | | | | | | | | | | x | | | | | | | | | | | |
| Filicopsida | Gleicheniaceae | *Gleichenia dicarpa* | Pouched Coral Fern | g | | | X | | | X | | X | X | X | X | X | | X | X | | X | X | | X | X | X | X | X | |
| Magnoliidae | Apiaceae | *Centella asiatica* | Swamp Pennywort | g | | | | | | | | | | | | | | | | X | | | | | | | | | |
| | Apiaceae | *Hydrocotyle algida* | Pennywort | g | | | | X | | | | | | X | | | | | | X | | | | | | X | | | |
| Magnoliidae | Apiaceae | *Hydrocotyle peduncularis* | Pennywort | g | | | | X | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Apiaceae | *Platysace linearifolia* | Narrow-leafed Platysace | s | | | | | | | X | | | | | | X | | | | | | X | | | | | | |
| Magnoliidae | Araliaceae | *Polyscias sambucifolia* | Elderberry Panax | s | | | | | | | | | | | | | | x | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Arrhenechthites mixta* | Purple Fireweed | g | | | | | | | | | | | | | | x | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Centipeda cunninghamii* | Sneezeweed | g | | | | X | | | | | | X | | | | | | | | | | | | X | | | |
| Magnoliidae | Asteraceae | *Cirsium vulgare** | Spear Thistle | g | | | | X | | X | | | | X | | | | | | X | | | | | | X | | | |
| Magnoliidae | Asteraceae | *Conyza bonariensis** | Flax-leaf Fleabane | g | | | | | | | | | | X | | | | | | X | | | | | | X | | | |
| Magnoliidae | Asteraceae | *Euchiton gymnocephalus* | Cudweed | g | | | | X | | | | | | X | | | | | | X | | | | | | X | | | |
| Magnoliidae | Asteraceae | *Euchiton sphaericus* | - | g | | | | X | | | | | | X | | | | | | x | | | | | | x | | | |
| Magnoliidae | Asteraceae | *Helichrysum rutidolepis* | Pale Everlasting | g | | X | | | | | | | | | | | X | | | | | | X | | | | | | X |
| Magnoliidae | Asteraceae | *Helichrysum scorpioides* | Pale Everlasting | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Hypochaeris radicata** | Flatweed | g | | | | | | | | | | X | | | | | X | X | X | X | | | | X | | | |
| Magnoliidae | Asteraceae | *Lagenophora stipitata* | - | g | | | | | | | | | | | | | | X | | X | | | | | | | | | |
| Magnoliidae | Asteraceae | *Olearia erubescens* | Silky Daisy Bush | s | | X | | | | | X | X | | | | | X | X | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Pseudognaphalium luteo-album* | Cudweed | g | | | | X | | | | | | | X | | | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Senecio minimus* | | g | | | | X | X | | | | | X | | | | | | | | | | | | X | | | |
| Magnoliidae | Asteraceae | *Sonchus oleraceus** | Common Sow-thistle | g | | | | X | | X | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Asteraceae | *Taraxacum officinale** | Dandelion | g | | | | X | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Casuarinaceae | *Allocasuarina nana* | Dwarf She-oak | t | | | | | | | | | | | | | X | | | | | | | | | | | | X |
| Magnoliidae | Clusiaceae | *Hypericum gramineum* | Small St Johns Wort | g | | | | | | | | | | | | | | | | | | | | | | X | | | |
| Magnoliidae | Dilleniaceae | *Hibbertia acicularis* | Prickly Guinea Flower | s | | | | | | | | | | | | | | | | | | | | | | | | | X |
| Magnoliidae | Epacridaceae | *Epacris paludosa* | Swamp Epacris | g | | | X | | X | X | | | X | | X | | | | X | | | | | | X | X | X | | |
| Magnoliidae | Epacridaceae | *Epacris pulchella* | Wallum Heath | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Epacridaceae | *Leucopogon lanceolatus* | Lance-leaf Beard-heath | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Epacridaceae | *Monotoca elliptica* | Tree Broom-heath | s | | | | | | | | | | | | | X | | | | | | | | | | | | |
| Magnoliidae | Epacridaceae | *Monotoca scoparia* | Prickly Broom-heath | s | | X | | | | | X | X | | | | | X | X | | | | X | X | X | | | | | X |
| Magnoliidae | Euphorbiaceae | *Poranthera microphylla* | - | g | | | | | | | | X | | | | | | | | | | | | | | | | | |
| Magnoliidae | Fabaceae / faboideae | *Daviesia latifolia* | - | s | | X | | | | | | x | | | | | | X | | | | | | X | | | | | |
| Magnoliidae | Fabaceae / faboideae | *Daviesia squarrosa* | Gorse Bitter Pea | s | | | | | | | X | | | | | | x | | | | | | | X | | | | | |
| Magnoliidae | Fabaceae / faboideae | *Gompholobium huegelii* | Pale Wedge Pea | s | | | | | | | X | | | | | | | | | | | X | X | | | | | | X |
| Magnoliidae | Fabaceae / faboideae | *Hovea* sp. | - | s | | | | | | | | | | | | | | | | | | | x | | | | | | |

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| Magnoliidae | Fabaceae / faboideae | *Phyllota squarrosa* | Dense Phyllota | s | | | | | | | | | | | | | | | | | | | X | | | | | | X |
| Magnoliidae | Fabaceae / Mimosoideae | *Acacia rubida* | Red-stemmed Wattle | s | | | | | | | | | | | | | X | X | | | | | X | | | | | X | X |
| Magnoliidae | Geraniaceae | *Geranium potentilloides* | Geranium | g | | | | | | | | | | | | | | | | | | | | | | X | | | |
| Magnoliidae | Goodeniaceae | *Dampiera stricta* | Blue Dampiera | g | | | | | | | X | | | | | | X | X | | | | X | X | | | | | | X |
| Magnoliidae | Haloragaceae | *Gonocarpus tetragynus* | Poverty Raspwort | g | | | | | | | X | | | | | | X | X | | | | | X | X | | | | | X |
| Magnoliidae | Myrtaceae | *Baeckea diosmifolia* | Fringed Baeckea | s | | | | | | X | | | | | | | | | X | X | | | | | | | X | | |
| Magnoliidae | Myrtaceae | *Baeckea linifolia* | Weeping Baeckea | s | | | | | | X | | | | | | X | | | | | | | | | | | | X | |
| Magnoliidae | Myrtaceae | *Eucalyptus gregsoniana* | Wolgan Snow Gum | t | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Myrtaceae | *Eucalyptus oreades* | Blue Mountains Ash | t | | X | | | | | | | | | | | | X | | | | | X | | | | | |
| Magnoliidae | Myrtaceae | *Eucalyptus radiata* | Narrow-leaved Peppermint | t | | X | | | | | | X | | | | | | | | | | | | | | | | | |
| Magnoliidae | Myrtaceae | *Eucalyptus sclerophylla* | Scribbly Gum | t | | | | | | X | X | | | | | | | X | | X | | X | X | X | | | | | X |
| Magnoliidae | Myrtaceae | *Leptospermum grandifolium* | Wooly Tea-tree | s | | | | | | X | | | | | | | | X | | | | | | X | | | | | |
| Magnoliidae | Myrtaceae | *Leptospermum lanigerum* | Coast Tea-tree | s | | | X | | | X | | | | | X | | | | | X | X | | | | | | | | |
| Magnoliidae | Myrtaceae | *Leptospermum obovatum* | - | s | | | X | X | X | X | | | | X | X | | | | | | | | | X | X | | X | | |
| Magnoliidae | Myrtaceae | *Leptospermum polygalifolium* subsp. *polygalifolium* | Tantoon | s | | | | | | | | | | | | | | | | | | | | | | | | X | X |
| Magnoliidae | Myrtaceae | *Leptospermum polyanthum* | Slender Tea-tree | s | | | | | | | X | | | | | | X | | | | | | X | | | | | | |
| Magnoliidae | Oxalidaceae | *Oxalis perrenans* | Yellow-flowered Wood Sorrel | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Pittosporaceae | *Billardiera scandens* | Hairy Appleberry | v | | | | | | | | X | | | | | | | | | | | | | | | | | |
| Magnoliidae | Poaceae | *Dichondra repens* | Kidney Weed | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Banksia cunninghamii subsp. cunninghamii* | - | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Banksia marginata* | Silver Banksia | s | | X | X | X | | X | X | | X | | | X | X | X | X | X | X | X | X | X | | | | X | X |
| Magnoliidae | Proteaceae | *Grevillea acanthifolia subsp. acanthifolia* | Bog Grevillea | s | | | X | | X | X | | | X | X | X | X | | | X | X | X | X | X | | X | X | X | X | |
| Magnoliidae | Proteaceae | *Hakea dactyloides* | Broad-leaved Hakea | s | | X | | | | X | X | X | | | | | | | | | | X | X | X | | | | | X |
| Magnoliidae | Proteaceae | *Isopogon anemonifolius* | Flat-leaved Drumsticks | s | | | | | | | | | | | | | X | | | | | | X | | | | | | |
| Magnoliidae | Proteaceae | *Lomatia myricoides* | River Lomatia | s | | | | | | | | X | | | | | | X | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Lomatia silaifolia* | Crinkle Bush | s | | X | | | | | | X | | | | | | | | X | | | | | | | | | |
| Magnoliidae | Proteaceae | *Persoonia chamaepitys* | Mountain Geebung | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Persoonia recedens* | - | s | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Proteaceae | *Petrophile sessilis* | Conesticks | s | | | | | | | | X | | | | | X | | | | | X | X | | | | | | X |
| Magnoliidae | Ranunculaceae | *Clematis aristata* | Old Man's Beard | v | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Rubiaceae | *Galium gaudichaudii* | Rough Bedstraw | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnoliidae | Rutaceae | *Boronia microphylla* | Small-leaved Boronia | s | | | | | | | X | X | | | | | X | | | | | X | X | X | | | | | X |
| Magnoliidae | **Scrophulariaceae** | ***Derwentia blakelyi*** | **-** | **s** | **V** | | | | | | | **X** | | | | | | **X** | | | | | | **X** | | | | | |
| Magnoliidae | Scrophulariaceae | *Gratiola pedunculata* | Stalked Brooklime | g | | | | | | | | X | | | | | | | | | | | | | | | | | |
| Magnoliidae | Thymelaeaceae | *Pimelea linifolia* subsp. *linifolia* | Slender Rice Flower | g | | | | | | | | | | | | | | | | | | | X | | | | | | X |

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| Magnoliidae | Violaceae | *Viola betonicifolia* | Native Violet | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Cyperaceae | *Baumea rubiginosa* | Twig Rush | w | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Cyperaceae | *Gahnia grandis* | Black-fruit Saw-sedge | wg | | | X | | | | | | X | X | | X | | | X | | | X | | | X | | X | | |
| Liliidae | Cyperaceae | *Gahnia sieberiana* | Red-fruited Saw-sedge | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Cyperaceae | *Lepidosperma limicola* | - | wg | | | | | X | | | | | X | | X | | | X | | | X | | | X | | X | X | |
| Liliidae | Cyperaceae | *Lepidosperma* sp. | - | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Iridaceae | *Patersonia sericea* | Wild Iris | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Juncaceae | *Juncus continuus* | - | g | | | | X | X | X | | | | X | | | | | | X | | | | | | X | | | |
| Liliidae | Lomandraceae | *Lomandra filiformis* subsp. *coriacea* | Wattle Mat-rush | g | | X | | | | | X | X | | | | | X | X | | | | | X | X | | | | X |
| Liliidae | Lomandraceae | *Lomandra glauca* | Pale Mat-rush | g | | | | | | | X | | | | | | X | | | | | | X | | | | | X |
| Liliidae | Lomandraceae | *Lomandra multiflora* | Many-flowered Mat-rush | g | | | | | | | | | | | | | | | | | | | | | | | | | |
| Liliidae | Orchidaceae | *Eriochilus autumnalis* | Parson's Bands | g | | | | | | | X | | | | | | | | | | | | | | | | | | |
| Liliidae | Phormiaceae | *Dianella revoluta* var. *revoluta* | Spreading Flax Lily | g | | X | | | | | X | X | | | | | X | | | | | X | X | X | | | | X |
| Liliidae | Poaceae | *Poa labillardieri* var. *labillardieri* | Tussock Grass | g | | | | | | | | | | | | | X | | | | | | | | | | | | |
| Liliidae | Poaceae | *Poa sieberiana* var. *sieberiana* | Tussock Grass | g | | | | | | | X | | | | | | | X | | | | X | | | | | X | | |
| Liliidae | Poaceae | *Poa sieberiana* var. *cyanophylla* | - | g | | | | | | | | | | | | | | | | | | | | | | | | | X |
| Liliidae | Restionaceae | *Baloskion australe* | - | wg | | | X | | X | X | | | X | | X | | | | X | | X | X | | | X | | X | | |
| Liliidae | Restionaceae | *Empodisma minus* | - | w | | | X | | X | X | | | X | | X | X | | | X | | X | | | | X | X | X | X | |
| Liliidae | Xanthorrhoaceae | *Xanthorrhoea resinifera* | - | g | | | | | | | X | | | | | | | | | | | | | | | | | | |

# Appendix 4

## Fauna Lists

Below is a list of fauna species that could be *reasonably* expected to be found within the site at some occurrence. Such an approach has been taken given the unlikelihood to record *all* potentially occurring species within an area during formal fauna surveys (due to seasonality, climatic limitations, crypticism etc).

Family sequencing and taxonomy follow for each fauna class:

Birds – Christidis and Boles (1994).

Herpetofauna - Cogger (1996).

Mammals - Strahan (ed.) (1995) and Churchill (1998).

✓ - Species observed or indicated by scats, tracks etc. on site during this investigation.

* - Indicates an introduced species

# Known and Expected Bird List

**Appendix Key:** **1** = Results of ecological investigations conducted within the study area
✓ = Species Detected
* = introduced species
(C) = listed as CAMBA species
(J) = listed as JAMBA species
(E) = listed as Endangered in NSW.
(V) = listed as Vulnerable in NSW.
(EV) = Species listed under the Commonwealth EPBC Act as Vulnerable
(EE) = Species listed under the Commonwealth EPBC Act as Endangered
(EM) = Species listed under the Commonwealth EPBC Act as Migratory
(EMa) = Species listed under the Commonwealth EPBC Act as Marine
Species indicated in **BOLD** font are those threatened species known from within Lithgow LGA (Atlas of NSW Wildlife data)

**Data Source:** ✓ = Species recorded during this survey

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Acanthizidae | *Acanthiza chrysorrhoa* | Yellow-rumped Thornbill | |
| | *Acanthiza lineata* | Striated Thornbill | ✓ |
| | *Acanthiza nana* | Yellow Thornbill | |
| | *Acanthiza pusilla* | Brown Thornbill | ✓ |
| | *Acanthiza reguloides* | Buff-rumped Thornbill | ✓ |
| | *Aphelocephala leucopsis* | Southern Whiteface | |
| | *Calamanthus pyrrhopygius* | Chestnut-rumped Heathwren | |
| | *Gerygone fusca* | Western Gerygone | |
| | *Gerygone mouki* | Brown Gerygone | |
| | *Gerygone olivacea* | White-throated Gerygone | |
| | *Origma solitaria* | Rockwarbler | |
| | *Pycnoptilus floccosus* | Pilotbird | |
| | ***Pyrrholaemus saggitatus*** | **Speckled Warbler (V)** | |
| | *Sericornis citreogularis* | Yellow-throated Scrubwren | |
| | *Sericornis frontalis* | White-browed Scrubwren | ✓ |
| | *Sericornis magnirostris* | Large-billed Scrubwren | |
| | *Smicrornis brevirostris* | Weebill | |
| Accipitridae | *Accipiter cirrocephalus* | Collared Sparrowhawk | |
| | *Accipiter fasciatus* | Brown Goshawk | ✓ |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| | *Accipiter novaehollandiae* | Grey Goshawk | |
| | *Aquila audax* | Wedge-tailed Eagle | |
| | *Elanus axillaris* | Black-shouldered Kite | |
| | *Haliaeetus leucogaster* | White-bellied Sea-Eagle | |
| | *Haliastur sphenurus* | Whistling Kite | |
| | *Hieraaetus morphnoides* | Little Eagle | |
| | ***Lophoictinia isura*** | **Square-tailed Kite (V)** | |
| Aegothelidae | *Aegotheles cristatus* | Australian Owlet-nightjar | |
| Alaudidae | *Alauda arvensis** | Eurasian Skylark | |
| | *Mirafra javanica* | Horsfield's Bushlark | |
| Alcedinidae | *Alcedo azurea* | Azure Kingfisher | |
| | *Dacelo novaeguineae* | Laughing Kookaburra | |
| | *Todiramphus sanctus* | Sacred Kingfisher | |
| Anatidae | *Anas gracilis* | Grey Teal | |
| | *Anas rhynchotis* | Australasian Shoveler | |
| | *Anas superciliosa* | Pacific Black Duck | |
| | *Aythya australis* | Hardhead | |
| | *Biziura lobata* | Musk Duck | |
| | *Chenonetta jubata* | Australian Wood Duck | |
| | *Cygnus atratus* | Black Swan | |
| | *Malacorhynchus membranaceus* | Pink-eared Duck | |
| | ***Oxyura australis*** | **Blue-billed Duck (V)** | |
| Apodidae | *Hirundapus caudacutus* | White-throated Needletail (EM) | |
| Ardeidae | *Ardea pacifica* | White-necked Heron | |
| | *Egretta novaehollandiae* | White-faced Heron | |
| | *Nycticorax caledonicus* | Nankeen Night Heron | |
| Artamidae | *Artamus cinereus* | Black-faced Woodswallow | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| | *Artamus cyanopterus* | Dusky Woodswallow | |
| | *Artamus leucorynchus* | White-breasted Woodswallow | |
| | *Artamus superciliosus* | White-browed Woodswallow | |
| | *Cracticus nigrogularis* | Pied Butcherbird | |
| | *Cracticus torquatus* | Grey Butcherbird | |
| | *Gymnorhina tibicen* | Australian Magpie | |
| | *Strepera graculina* | Pied Currawong | ✓ |
| | *Strepera versicolor* | Grey Currawong | |
| Cacatuidae | *Cacatua galerita* | Sulphur-crested Cockatoo | |
| | *Cacatua sanguinea* | Little Corella | |
| | ***Callocephalon fimbriatum*** | **Gang-Gang Cockatoo (V)** | |
| | *Calyptorhynchus funereus* | Yellow-tailed Black-Cockatoo | |
| | ***Calyptorhynchus lathami*** | **Glossy Black-Cockatoo (V)** | |
| | *Eolophus roseicapillus* | Galah | |
| Campephagidae | *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | |
| | *Coracina papuensis* | White-bellied Cuckoo-shrike | |
| | *Coracina tenuirostris* | Cicadabird | |
| | *Lalage tricolor* | White-winged Triller | |
| Caprimulgidae | *Eurostopodus mystacalis* | White-throated Nightjar | |
| Charadriidae | *Elseyornis melanops* | Black-fronted Dotterel | |
| | *Vanellus miles* | Masked Lapwing | |
| Cisticolidae | *Cisticola exilis* | Golden-headed Cisticola | |
| Climacteridae | *Climacteris erythrops* | Red-browed Treecreeper | ✓ |
| | ***Climacteris picumnus victoriae*** | **Brown Treecreeper (eastern subspecies) (V)** | |
| | *Cormobates leucophaea* | White-throated Treecreeper | ✓ |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Columbidae | *Geopelia cuneata* | Diamond Dove | |
| | *Geopelia humeralis* | Bar-shouldered Dove | |
| | *Geopelia placida* | Peaceful Dove | |
| | *Leucosarcia melanoleuca* | Wonga Pigeon | |
| | *Macropygia amboinensis* | Brown Cuckoo-Dove | |
| | *Ocyphaps lophotes* | Crested Pigeon | |
| | *Phaps chalcoptera* | Common Bronzewing | |
| | *Phaps elegans* | Brush Bronzewing | |
| Coraciidae | *Eurystomus orientalis* | Dollarbird | |
| Corcoracidae | *Corcorax melanorhamphos* | White-winged Chough | |
| Corvidae | *Corvus coronoides* | Australian Raven | ✓ |
| | *Corvus mellori* | Little Raven | |
| Cuculidae | *Cacomantis flabelliformis* | Fan-tailed Cuckoo | |
| | *Cacomantis variolosus* | Brush Cuckoo | |
| | *Chalcites basalis* | Horsfield's Bronze-Cuckoo | |
| | *Chalcites lucidus* | Shining Bronze-Cuckoo | ✓ |
| | *Chalcites osculans* | Black-eared Cuckoo | |
| | *Cuculus pallidus* | Pallid Cuckoo | |
| | *Cuculus saturatus* | Oriental Cuckoo | |
| | *Eudynamys orientalis* | Pacific Koel | |
| | *Scythrops novaehollandiae* | Channel-billed Cuckoo | |
| Dicaeidae | *Dicaeum hirundinaceum* | Mistletoebird | ✓ |
| Dicruridae | *Grallina cyanoleuca* | Magpie-lark | |
| | *Monarcha melanopsis* | Black-faced Monarch | |
| | *Monarcha trivirgatus* | Spectacled Monarch | |
| | *Myiagra cyanoleuca* | Satin Flycatcher | |
| | *Myiagra inquieta* | Restless Flycatcher | |
| | *Myiagra rubecula* | Leaden Flycatcher | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| | *Rhipidura albiscapa* | Grey Fantail | ✓ |
| | *Rhipidura leucophrys* | Willie Wagtail | |
| | *Rhipidura rufifrons* | Rufous Fantail | |
| Estrildidae | *Lonchura castaneothorax* | Chestnut-breasted Mannikin | |
| | *Neochmia modesta* | Plum-headed Finch | |
| | *Neochmia temporalis* | Red-browed Finch | ✓ |
| | *Stagonopleura bella* | Beautiful Firetail | ✓ |
| | ***Stagonopleura guttata*** | **Diamond Firetail (V)** | |
| | *Taeniopygia bichenovii* | Double-barred Finch | |
| | *Taeniopygia guttata* | Zebra Finch | |
| Eupetidae | *Cinclosoma punctatum* | Spotted Quail-thrush | |
| | *Psophodes olivaceus* | Eastern Whipbird | ✓ |
| Falconidae | *Falco berigora* | Brown Falcon | |
| | *Falco cenchroides* | Nankeen Kestrel | |
| | *Falco longipennis* | Australian Hobby | |
| | *Falco peregrinus* | Peregrine Falcon | |
| | *Falco subniger* | Black Falcon | |
| Fringillidae | *Carduelis carduelis** | European Goldfinch | |
| Hirundinidae | *Cheramoeca leucosterna* | White-backed Swallow | |
| | *Hirundo neoxena* | Welcome Swallow | |
| | *Petrochelidon ariel* | Fairy Martin | |
| | *Petrochelidon nigricans* | Tree Martin | |
| Laridae | *Larus novaehollandiae* | Silver Gull | |
| Maluridae | *Malurus cyaneus* | Superb Fairy-wren | ✓ |
| | *Malurus lamberti* | Variegated Fairy-wren | |
| | *Stipiturus malachurus* | Southern Emu-wren | |
| Megapodiidae | *Alectura lathami* | Australian Brush-turkey | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Meliphagidae | *Acanthagenys rufogularis* | Spiny-cheeked Honeyeater | |
| | *Acanthorhynchus tenuirostris* | Eastern Spinebill | ✓ |
| | *Anthochaera carunculata* | Red Wattlebird | ✓ |
| | *Anthochaera chrysoptera* | Little Wattlebird | |
| | *Entomyzon cyanotis* | Blue-faced Honeyeater | |
| | *Epthianura albifrons* | White-fronted Chat | |
| | *Gliciphila melanops* | Tawny-crowned Honeyeater | |
| | ***Grantiella picta*** | **Painted Honeyeater (V)** | |
| | *Lichenostomus chrysops* | Yellow-faced Honeyeater | ✓ |
| | *Lichenostomus fuscus* | Fuscous Honeyeater | |
| | *Lichenostomus leucotis* | White-eared Honeyeater | ✓ |
| | *Lichenostomus melanops* | Yellow-tufted Honeyeater | |
| | *Lichenostomus penicillatus* | White-plumed Honeyeater | |
| | *Manorina melanocephala* | Noisy Miner | |
| | *Manorina melanophrys* | Bell Miner | |
| | *Meliphaga lewinii* | Lewin's Honeyeater | |
| | *Melithreptus brevirostris* | Brown-headed Honeyeater | ✓ |
| | ***Melithreptus gularis gularis*** | **Black-chinned Honeyeater (eastern subspecies) (V)** | |
| | *Melithreptus lunatus* | White-naped Honeyeater | ✓ |
| | *Myzomela sanguinolenta* | Scarlet Honeyeater | |
| | *Philemon citreogularis* | Little Friarbird | |
| | *Philemon corniculatus* | Noisy Friarbird | ✓ |
| | *Phylidonyris niger* | White-cheeked Honeyeater | |
| | *Phylidonyris novaehollandiae* | New Holland Honeyeater | ✓ |
| | *Phylidonyris pyrrhoptera* | Crescent Honeyeater | |
| | *Plectorhyncha lanceolata* | Striped Honeyeater | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| | ***Xanthomyza phrygia*** | **Regent Honeyeater (E, E*)** | |
| Menuridae | *Menura novaehollandiae* | Superb Lyrebird | ✓ |
| Meropidae | *Merops ornatus* | Rainbow Bee-eater | |
| Motacillidae | *Anthus australis* | Australian Pipit | |
| Muscicapidae | *Turdus merula** | Eurasian Blackbird | |
| | *Zoothera lunulata* | Bassian Thrush | |
| **Neosittidae** | ***Daphoenositta chrysoptera*** | **Varied Sittella (V)** | |
| Oriolidae | *Oriolus sagittatus* | Olive-backed Oriole | |
| Pachycephalidae | *Colluricincla harmonica* | Grey Shrike-thrush | ✓ |
| | *Falcunculus frontatus* | Eastern Shrike-tit | |
| | *Pachycephala pectoralis* | Golden Whistler | ✓ |
| | *Pachycephala rufiventris* | Rufous Whistler | ✓ |
| Pardalotidae | *Pardalotus punctatus* | Spotted Pardalote | ✓ |
| | *Pardalotus striatus* | Striated Pardalote | ✓ |
| Passeridae | *Passer domesticus** | House Sparrow | |
| Pelecanidae | *Pelecanus conspicillatus* | Australian Pelican | |
| Petroicidae | *Eopsaltria australis* | Eastern Yellow Robin | ✓ |
| | *Melanodryas cucullata* | Hooded Robin | |
| | ***Melanodryas cucullata cucullata*** | **Hooded Robin (south-eastern form) (V)** | |
| | *Microeca fascinans* | Jacky Winter | |
| | ***Petroica boodang*** | **Scarlet Robin (V)** | ✓ |
| | *Petroica goodenovii* | Red-capped Robin | |
| | ***Petroica phoenicea*** | **Flame Robin** | ✓ |
| | *Petroica rosea* | Rose Robin | |
| Phalacrocoracidae | *Phalacrocorax carbo* | Great Cormorant | |
| | *Phalacrocorax melanoleucos* | Little Pied Cormorant | |
| | *Phalacrocorax sulcirostris* | Little Black Cormorant | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| | *Phalacrocorax varius* | Pied Cormorant | |
| Phasianidae | *Coturnix pectoralis* | Stubble Quail | |
| | *Coturnix ypsilophora* | Brown Quail | |
| Podargidae | *Podargus strigoides* | Tawny Frogmouth | |
| Podicipedidae | *Podiceps cristatus* | Great Crested Grebe | |
| | *Poliocephalus poliocephalus* | Hoary-headed Grebe | |
| | *Tachybaptus novaehollandiae* | Australasian Grebe | |
| Pomatostomidae | *Pomatostomus superciliosus* | White-browed Babbler | |
| | ***Pomatostomus temporalis temporalis*** | **Grey-crowned Babbler (eastern subspecies) (V)** | |
| Psittacidae | *Alisterus scapularis* | Australian King-Parrot | |
| | *Glossopsitta concinna* | Musk Lorikeet | |
| | *Glossopsitta pusilla* | Little Lorikeet | |
| | ***Lathamus discolor*** | **Swift Parrot (E,E*)** | |
| | *Melopsittacus undulatus* | Budgerigar | |
| | ***Neophema pulchella*** | **Turquoise Parrot (V)** | |
| | *Platycercus adscitus eximius* | Eastern Rosella | |
| | *Platycercus elegans* | Crimson Rosella | ✓ |
| | *Psephotus haematonotus* | Red-rumped Parrot | |
| | *Trichoglossus chlorolepidotus* | Scaly-breasted Lorikeet | |
| | *Trichoglossus haematodus* | Rainbow Lorikeet | |
| Ptilonorhynchidae | *Ptilonorhynchus violaceus* | Satin Bowerbird | |
| Pycnonotidae | *Pycnonotus jocosus** | Red-whiskered Bulbul | |
| Rallidae | *Fulica atra* | Eurasian Coot | |
| | *Gallinula tenebrosa* | Dusky Moorhen | |
| | *Gallirallus philippensis* | Buff-banded Rail | |
| | *Porphyrio porphyrio* | Purple Swamphen | |
| | *Pozana fluminea* | Australian Spotted Crake | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| | *Pozana pusilla* | Baillon's Crake | |
| | *Pozana tabuensis* | Spotless Crake | |
| | *Rallus pectoralis* | Lewin's Rail | |
| Scolopacidae | *Calidris acuminata* | Sharp-tailed Sandpiper (EM) | |
| | *Gallinago hardwickii* | Latham's Snipe (EM) | |
| Strigidae | *Ninox boobook* | Southern Boobook | |
| | ***Ninox connivens*** | **Barking Owl (V)** | |
| | ***Ninox strenua*** | **Powerful Owl (V)** | |
| Sturnidae | *Acridotheres tristis** | Common Myna | |
| | *Sturnus vulgaris** | Common Starling | |
| Sylviidae | *Acrocephalus australis* | Australian Reed-Warbler | |
| | *Cincloramphus cruralis* | Brown Songlark | |
| | *Cincloramphus mathewsi* | Rufous Songlark | |
| | *Megalurus gramineus* | Little Grassbird | |
| Threskiornithidae | *Platalea flavipes* | Yellow-billed Spoonbill | |
| | *Platalea regia* | Royal Spoonbill | |
| | *Threskiornis molucca* | Australian White Ibis | |
| | *Threskiornis spinicollis* | Straw-necked Ibis | |
| Turnicidae | *Turnix varia* | Painted Button-quail | |
| Tytonidae | *Tyto alba* | Barn Owl | |
| | ***Tyto novaehollandiae*** | **Masked Owl (V)** | |
| | ***Tyto tenebricosa*** | **Sooty Owl (V)** | |
| Zosteropidae | *Zosterops lateralis* | Silvereye | |

# Known and Expected Mammal List

**Appendix Key:** **1** = Results of ecological investigations conducted within the study area
✓ = Species Detected
* = introduced species
**(E)** = listed as Endangered in NSW.
**(V)** = listed as Vulnerable in NSW.
**(EV)** = Species listed under the Commonwealth EPBC Act as Vulnerable
**(EE)** = Species listed under the Commonwealth EPBC Act as Endangered
Species indicated in **BOLD** font are those threatened species known from within Lithgow LGA (NPWS, 2003)

**Data Source:** ✓ = Species recorded during this survey

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Acrobatidae | *Acrobates pygmaeus* | Feathertail Glider | |
| Bovidae | *Bos taurus** | European Cattle | |
| | *Capra hircus** | Goat | |
| Burramyidae | ***Cercartetus nanus*** | **Eastern Pygmy-possum (V)** | |
| Canidae | *Canis lupus familiaris** | Dog | |
| | *Canis lupus** | Dingo, domestic dog | |
| | *Vulpes vulpes** | Fox | |
| Cervidae | *Cervus sp.** | Unidentified Deer | |
| Dasyuridae | *Antechinus agilis* | Agile Antechinus | |
| | *Antechinus flavipes* | Yellow-footed Antechinus | |
| | *Antechinus stuartii* | Brown Antechinus | |
| | *Antechinus swainsonii* | Dusky Antechinus | |
| | *Antechinus/Sminthopsis sp.* | unidentified 'Marsupial Mouse' | |
| | *Dasyuridae sp.* | unidentified dasyurid | |
| | ***Dasyurus maculatus*** | **Spotted-tailed Quoll (V, V*)** | |
| Emballonuridae | ***Saccolaimus flaviventris*** | **Yellow-bellied Sheathtail-bat (V)** | |
| Equidae | *Equus caballus** | Horse | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Felidae | *Felis catus** | Cat | |
| Leporidae | *Lepus capensis** | Brown Hare | |
| | *Oryctolagus cuniculus** | Rabbit | |
| Macropodidae | *Macropus giganteus* | Eastern Grey Kangaroo | |
| | *Macropus robustus* | Common Wallaroo | |
| | *Macropus rufogriseus* | Red-necked Wallaby | |
| | ***Petrogale penicillata*** | **Brush-tailed Rock-wallaby (E, V*)** | |
| | *Wallabia bicolor* | Swamp Wallaby | |
| Molossidae | *Mormopterus "Species 2"* | Undescribed Freetail Bat | |
| | *Mormopterus norfolkensis* | Eastern Freetail-bat (V) | |
| | *Mormopterus planiceps* | Little Mastiff-bat | |
| | *Mormopterus sp.* | Mastiff-bat | |
| | *Tadarida australis* | White-striped Freetail-bat | |
| Muridae | *Hydromys chrysogaster* | Water-rat | |
| | *Mus musculus** | House Mouse | |
| | *Rattus fuscipes* | Bush Rat | |
| | *Rattus lutreolus* | Swamp Rat | |
| | *Rattus rattus** | Black Rat | |
| Ornithorhynchidae | *Ornithorhynchus anatinus* | Platypus | |
| Peramelidae | *Isoodon/Perameles sp.* | unidentified Bandicoot | |
| Petauridae | ***Petaurus australis*** | **Yellow-bellied Glider (V)** | |
| | *Petaurus breviceps* | Sugar Glider | |
| | ***Petaurus norfolcensis*** | **Squirrel Glider (V)** | |
| Phalangeridae | *Trichosurus caninus* | Short-eared Possum | |
| | *Trichosurus sp.* | Brushtail possum | |
| | *Trichosurus vulpecula* | Common Brushtail Possum | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Phascolarctidae | ***Phascolarctos cinereus*** | **Koala (V)** | |
| Potoroidae | *Bettongia gaimardi* | Tasmanian Bettong | |
| Pseudocheiridae | *Petauroides volans* | Greater Glider | |
| | *Pseudocheirus peregrinus* | Common Ringtail Possum | |
| Rhinolophidae | *Rhinolophus megaphyllus* | Eastern Horseshoe-bat | |
| Suidae | *Sus scrofa** | Pig | |
| Tachyglossidae | *Tachyglossus aculeatus* | Short-beaked Echidna | |
| Vespertilionidae | ***Chalinolobus dwyeri*** | **Large-eared Pied Bat (V, V*)** | |
| | *Chalinolobus gouldii* | Gould's Wattled Bat | |
| | *Chalinolobus morio* | Chocolate Wattled Bat | |
| | ***Falsistrellus tasmaniensis*** | **Eastern False Pipistrelle (V)** | |
| | ***Miniopterus australis*** | **Little Bentwing-bat (V)** | |
| | ***Miniopterus schreibersii oceanensis*** | **Eastern Bentwing-bat (V)** | |
| | ***Myotis adversus*** | **Large-footed Myotis (V)** | |
| | *Nyctophilus geoffroyi* | Lesser Long-eared Bat | |
| | *Nyctophilus gouldi* | Gould's Long-eared Bat | |
| | *Nyctophilus sp.* | Long-eared bat | |
| | ***Scoteanax rueppellii*** | **Greater Broad-nosed Bat (V)** | |
| | *Scotorepens balstoni* | Inland Broad-nosed Bat | |
| | *Scotorepens orion* | Eastern Broad-nosed Bat | |
| | *Vespadelus darlingtoni* | Large Forest Bat | |
| | *Vespadelus pumilus* | Eastern Forest Bat | |
| | *Vespadelus regulus* | Southern Forest Bat | |
| | *Vespadelus vulturnus* | Little Forest Bat | |
| Vombatidae | *Vombatus ursinus* | Common Wombat | |

# Known and Expected Reptile List

**Appendix Key:** **1** = Results of ecological investigations conducted within the study area
✓ = Species Detected
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**(E)** = listed as Endangered in NSW.
**(V)** = listed as Vulnerable in NSW.
**(EV)** = Species listed under the Commonwealth EPBC Act as Vulnerable
**(EE)** = Species listed under the Commonwealth EPBC Act as Endangered
**(EMa)** = Species listed under the Commonwealth EPBC Act as Marine
Species indicated in **BOLD** font are those threatened species known from within Lithgow LGA (NPWS, 2003)

**Data Source:** ✓ = Species recorded during this survey

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Agamidae | *Amphibolurus muricatus* | Jacky Lizard | |
| | *Amphibolurus nobbi* | Nobbi | |
| | *Physignathus lesueurii* | Eastern Water Dragon | |
| | *Pogona barbata* | Bearded Dragon | |
| | *Rankinia diemensis* | Mountain Dragon | ✓ |
| Chelidae | *Chelodina longicollis* | Eastern Snake-necked Turtle | |
| Elapidae | *Austrelaps ramsayi* | Highland Copperhead | |
| | *Austrelaps superbus* | Lowland Copperhead | |
| | *Cryptophis nigrescens* | Eastern Small-eyed Snake | |
| | *Drysdalia rhodogaster* | Mustard-bellied Snake | |
| | *Furina diadema* | Red-naped Snake | |
| | ***Hoplocephalus bungaroides*** | **Broad-headed Snake (E, V*)** | |
| | *Notechis scutatus* | Tiger Snake | |
| | *Parasuta dwyeri* | Dwyer's Snake | |
| | *Parasuta spectabilis* | Mallee Black-headed Snake | |
| | *Pseudechis guttatus* | Spotted Black Snake | |
| | *Pseudechis porphyriacus* | Red-bellied Black Snake | |
| | *Pseudonaja textilis* | Eastern Brown Snake | |
| | *Vermicella annulata* | Bandy-bandy | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Gekkonidae | *Diplodactylus vittatus* | Wood Gecko | |
| | *Oedura lesueurii* | Lesueur's Velvet Gecko | |
| | *Phyllurus platurus* | Broad-tailed Gecko | |
| | *Underwoodisaurus milii* | Thick-tailed Gecko | |
| Pygopodidae | *Pygopus lepidopodus* | Common Scaly-foot | |
| Scincidae | *Acritoscincus duperreyi* | Eastern Three-lined Skink | |
| | *Acritoscincus platynota* | Red-throated Skink | |
| | *Carlia tetradactyla* | Southern Rainbow-skink | |
| | *Cryptoblepharus virgatus* | Cream-striped Shinning-skink | |
| | *Ctenotus robustus* | Robust Ctenotus | |
| | *Ctenotus taeniolatus* | Copper-tailed Skink | |
| | *Egernia cunninghami* | Cunningham's Skink | |
| | *Egernia saxatilis* | Black Rock Skink | |
| | *Egernia saxatilis intermedia* | | |
| | *Egernia striolata* | Tree Skink | |
| | *Egernia whitii* | White's Skink | |
| | *Eulamprus heatwolei* | Yellow-bellied Water-skink | ✓ |
| | ***Eulamprus leuraensis*** | **Blue Mountains Water skink (E, E*)** | |
| | *Eulamprus quoyii* | Eastern Water-skink | |
| | *Eulamprus tenuis* | Barred-sided Skink | |
| | *Eulamprus tympanum* | Southern Water-skink | |
| | *Hemiergis decresiensis* | Three-toed Earless Skink | |
| | *Lampropholis delicata* | Dark-flecked Garden Sunskink | |
| | *Lampropholis guichenoti* | Pale-flecked Garden Sunskink | |
| | *Lampropholis sp.* | unidentified grass skink | |
| | *Lerista bougainvillii* | South-eastern Slider | |
| | *Lygisaurus foliorum* | Tree-base Litter-skink | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| | *Morethia boulengeri* | South-eastern Morethia Skink | |
| | *Pseudemoia entrecasteauxii* | Tussock Cool-skink | |
| | *Pseudemoia pagenstecheri* | Tussock Skink | ✓ |
| | *Saiphos equalis* | Three-toed Skink | |
| | *Saproscincus mustelinus* | Weasel Skink | |
| | *Tiliqua nigrolutea* | Blotched Blue-tongue | |
| | *Tiliqua scincoides* | Eastern Blue-tongue | |
| Typhlopidae | *Ramphotyphlops nigrescens* | Blackish Blind Snake | |
| Varanidae | ***Varanus rosenbergi*** | **Rosenberg's Goanna (V)** | |
| | *Varanus sp.* | Unidentified Goanna | |
| | *Varanus varius* | Lace Monitor | |

# Known and Expected Frog List

**Appendix Key:** **1** = Results of ecological investigations conducted within the study area
✓ = Species Detected
* = introduced species
**(E)** = listed as Endangered in NSW.
**(V)** = listed as Vulnerable in NSW.
**(EV)** = Species listed under the Commonwealth EPBC Act as Vulnerable
**(EE)** = Species listed under the Commonwealth EPBC Act as Endangered
Species indicated in **BOLD** font are those threatened species known from Within Lithgow LGA (NPWS, 2003)

**Data Source:** ✓ = Species recorded during this survey

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Hylidae | ***Litoria booroolongensis*** | **Booroolong Frog (E, E*)** | |
| | *Litoria caerulea* | Green Tree Frog | |
| | *Litoria citropa* | Blue Mountains Tree Frog | |
| | *Litoria dentata* | Bleating Tree Frog | |
| | *Litoria ewingii* | Brown Tree Frog | |
| | *Litoria fallax* | Eastern Dwarf Tree Frog | |
| | *Litoria latopalmata* | Broad-palmed Frog | |
| | *Litoria lesueuri* | Lesueur's Frog | |
| | *Litoria peronii* | Peron's Tree Frog | |
| | *Litoria phyllochroa* | Leaf-green Tree Frog | |
| | *Litoria sp.* | Unidentified Tree Frog | |
| | *Litoria verreauxii* | Verreaux's Frog | |
| | *Litoria wilcoxii* | | |
| Myobatrachidae | *Crinia parinsignifera* | Eastern Sign-bearing Froglet | |
| | *Crinia signifera* | Common Eastern Froglet | |
| | ***Heleioporus australiacus*** | **Giant Burrowing Frog (V, V*)** | |
| | *Limnodynastes dumerilii* | Eastern Banjo Frog | |
| | *Limnodynastes fletcheri* | Long-thumbed Frog | |
| | *Limnodynastes ornatus* | Ornate Burrowing Frog | |
| | *Limnodynastes peronii* | Brown-striped Frog | |
| | *Limnodynastes tasmaniensis* | Spotted Grass Frog | |

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| | ***Mixophyes balbus*** | **Stuttering Frog (E, V*)** | |
| | *Neobatrachus sudelli* | Sudell's Frog | |
| | ***Pseudophryne australis*** | **Red-crowned Toadlet (V)** | |
| | *Pseudophryne bibronii* | Bibron's Toadlet | |
| | *Pseudophryne coriacea* | Red-backed Toadlet | ✓ |
| | *Uperoleia laevigata* | Smooth Toadlet | |

# Known and Expected Insects List

**Appendix Key:** **1** = Results of ecological investigations conducted within the study area
✓ = Species Detected
* = introduced species
**(E)** = listed as Endangered in NSW.
**(V)** = listed as Vulnerable in NSW.
**(EV)** = Species listed under the Commonwealth EPBC Act as Vulnerable
**(EE)** = Species listed under the Commonwealth EPBC Act as Endangered
Species indicated in **BOLD** font are those threatened species known from within Lithgow LGA (NPWS, 2003)

**Data Source:** ✓ = Species recorded during this survey

| Family Name | *Scientific Name* | Common Name | Recorded |
|---|---|---|---|
| Keroplatidae | *Arachnocampa richardsae* | Glow Worm | |
| Lycaenidae | *Candalides hyacinthina hyacinthina* | Varied Dusky Blue | |
| | *Paralucia aurifera* | Bright Copper | |
| | ***Paralucia spinifera*** | **Bathurst Copper Butterfly (E, E*)** | |
| Papilionidae | *Graphium macleayanus* | Macleay's swallowtail | |
| Petaluridae | ***Petalura gigantea*** | **Giant Dragonfly (E)** | |
| Saturniidae | *Opodiphthera eucalypti* | Emperor Gum Moth | |

# Appendix 5

## Transect Photographs

## Transect 1

T1 East View
Swamp Edge
Vegetation

T1 East View
Swamp Centre
Vegetation

T1 West View
Swamp Centre
Vegetation

T1 West View
Swamp Edge
Vegetation

## Transect 2

T2 East View
Swamp Centre
Vegetation

T2 East View
Swamp Edge
Vegetation

T2 West View
Swamp Centre
Vegetation

T2 West View
Swamp Edge
Vegetation

## Transect 3

T3 East View
Swamp Centre
Vegetation

T3 East View
Swamp Edge
Vegetation

T3 West View
Swamp Centre
Vegetation

T3 West View
Swamp Edge
Vegetation

## Transect 4

T4 East View
Swamp Edge
Vegetation

T4 West View
Swamp Centre
Vegetation

T4 West View
Swamp Edge
Vegetation

## Transect 5

T5 Centre to East Swamp Edge Vegetation

T5 Centre to West Swamp Edge Vegetation

East Centre
Swamp
Vegetation

T5 West Centre
Swamp
Vegetation

## Transect 6

Centre to East Swamp Edge Vegetation

Centre to West Swamp Edge Vegetation

T6 East Centre
Swamp
Vegetation

T6 West Centre
Swamp
Vegetation

## Transect 7

T7 Centre to East Swamp Edge Vegetation

T7 Centre to West Swamp Edge Vegetation

T7 East Centre
Swamp
Vegetation

T7 West Centre
Swamp
Vegetation

## Transect 8

T8 Centre to East Swamp Edge Vegetation

T8 Centre to West Swamp Edge Vegetation

T8 East Centre
Swamp
Vegetation

T8 West Centre
Swamp
Vegetation

# Appendix 6

## Staff Qualifications

# Curriculum Vitae

| | |
|---|---|
| **Name:** | Toby Lambert |
| **Office:** | RPS Harper Somers O'Sullivan |
| **Position in Company:** | Senior Ecologist |
| **Qualifications / Memberships:** | Bachelor of Environmental Science<br>Ecological Consultants Association of NSW<br>NSW Driver's Licence (Class C)<br>OH&S Induction Training (Green Card)<br>NPWS Scientific Investigation Licence<br>NSW Animal Ethics Research Authority |

**Areas of Expertise:**

- Environmental and ecological impact assessment reporting
- Flora, fauna and habitat survey methodology design and management
- Detailed understanding of threatened species legislation and issues
- Terrestrial fauna surveys
- Renewable energy assessment
- Bushland and vegetation management
- Complex holistic project management
- Local, State and Commonwealth project co-ordination
- Dispute resolution and mediation

**Recent Experience Includes:**

Toby has over twelve years experience in undertaking and managing a diverse array of ecological and environmental surveys and assessments. Toby has produced ecological and environmental documentation for private and public projects ranging in complexity. These include a number of wind farms throughout Australia and New Zealand, coal mines and a range of infrastructure projects within the Hunter region. Toby has also managed ecological masterplanning for residential projects in Sydney, the Central Coast and the Hunter. Toby is also currently the project manager for the environmental component of the development of the Hunter Economic Zone industrial estate at Kurri Kurri, the largest industrial estate in NSW.

Toby's fields of special competence are Environmental Impact Assessment and mediation, flora, fauna and habitat survey method, design and identification, detailed understanding of legislation and threatened species issues, terrestrial fauna surveys and project management.

# Curriculum Vitae

**Name:** Allan Richardson

**Office:** RPS Harper Somers O'Sullivan

**Position in Company:** Senior Ecologist

**Qualifications / Awards**

B.Env.Sc. (Environmental Management)
B.Env.Sc. (Hons) (Biology) – Migratory Wading Bird Study
2002 Hunter Environmental Institute Scholarship
Waterways Authority Boating Licence
OH&S Induction Training (Green Card)
NSW Driver's Licence (Class C)
NPWS Scientific Licence
NSW Animal Ethics Research Authority
St John Ambulance Senior First Aid Certificate

**Memberships:**

Hunter Bird Observers Club
Victorian Wader Study Group

**Areas of Expertise:**

- Ornithological Surveys and Research
- Targeted and general Terrestrial flora and fauna surveys
- Threatened Flora & Fauna Assessment, Reporting and Legislation
- GPS Survey and GIS Mapping Projects
- High Level Nature Photography
- Tertiary and General Ecological Tutoring, Demonstrating and Presenting

**Recent Experience Includes:**

Allan Richardson has broad range of Ecological Assessment reporting experience underpinned by over 27 years of ecological field experience. Over four and a half years of project experience has primarily included a range of flora and fauna assessment disciplines as required by a wide range of corporate and domestic client requirements. Allan has a strong grounding in threatened species ecology in both coastal and western NSW regional areas, with specialist migratory wader studies expertise in Central NSW and Roebuck Bay in North Western Australia.

Allan's wide ranging interest across different ecological disciplines, has been a central part of important threatened species projects, including, the Critically Endangered North Rothbury Persoonia, Hunter Estuary Green and Golden Bell Frog populations, Migratory Wader habitat usage surveys, seasonal Swift Parrot movements and specialised Avifauna Wind Farm Surveys on the east and west coast. Allan's broad ecological experience also represents an important part of RPS HSO's threatened flora and vegetation community mapping, targeted fauna survey works and threatened species habitat assessments over both small and large spatial areas for a range of client needs. His depth of experience and a strong knowledge of Australian fauna and regional vegetation contribute strongly to RPS HSO's ability to meet the consultation and regulatory needs of the development community.

# Appendix 7

## Excerpts from the Geophysical Investigation Scope of Works

## Objectives of Geophysical Investigation

The objectives of the Geophysical Investigation within the overall project are to:

1) Determine depth and profile between the peat and the sandstone / valley floor.

2) Determine the existence of pipes (voids that allow transmission of water) within the peat.

3) If pipes exist, then determine the size and map the extent of these pipes.

4) Determine any major structures within the sandstone underlying the peat, e.g. faults as outlined in figure 1 (proposing an investigational depth of approximately 20m).

5) Interpretation of findings to aid in the geotechnical assessment.

## Scope

The scope of the survey is to use Geophysical techniques to delineate the base of the peat layer within East Wolgan Swamp. Further to this; delineating of structures within the peat layer, and the underlying sandstone is required, eg. soil pipes, voids, jointing systems and faults. The major purpose of the investigation is to create a 3D model of the peat layer within the study area, also mapping features both within and below the peat layer.

The depth of the bedrock within the confines of East Wolgan Swamp is believed to vary from 2 to 7m.

Overall the clients request is for the geophysical investigation to supply a data set and interpretation, for use in combination with the results from other disciplines to enable confirmation or rejection of the three theories postulated for the slumping.

The survey area is located within the Newnes Plateau to the North North East of Lithgow, NSW.

If these sites are investigated, Ground Penetrating Radar (GPR) and Resistivity Profiling are believed to be the most appropriate techniques. Both techniques have been effective in mapping layer thickness in peat swamps (Gibbins, 2003; Bristow and Jol, 2003; Garman and Purcell, 2004; Trafford, 2009). Further, the use of GPR has also been useful in mapping subsurface piping in peat (Holden, Burt and Vilas, 2002). Due to the possibility of mapping piping, it is recommended that GPR would be the technique of choice for delineation of the base of the peat layer and mapping structures within the peat in this investigation. As Resistivity Profiling would enable an investigation depth of 20 plus metres, Alpha Geoscience recommends the combined use of both Resistivity Profiling and GPR for this task.

Refraction or refection seismics would define the base of the peat layer. However the seismic techniques should only be used if other techniques produce inconclusive results. The techniques are more disruptive to the environs than either GPR or Resistivity, due to the mass of the equipment and the use of a hammer and plate as an energy source. There is also the problem of imparting sufficient energy into the subsurface to undertake the investigation. If the peat is dry there may not be sufficient energy transfer to achieve worthwhile results, unless explosives are employed. A further consideration is that, in previous studies, (Parkin 2002 and Gibbins, 2003) layering within the swamp material was not identified using seismic techniques. The layer of peat and the base layer of the swamp (usually a sand or sandy gravel (Young 1986)) were only defined as one layer.

Also the cost of undertaking a seismic survey, even a shallow investigation, would be at least three times that of resistivity profiling.

Conductivity mapping using Frequency Domain Electromagnetics (FDEM) would most probably only map the lateral extent of the swamp deposits, and possibly the central valley channel. Modelling of FDEM data usually results in modelled layers that approximate the layers but may be only effective in attaining an average thickness to within a metre (Gibbins, 2003).

**SPECIFICATION**

***Investigation Stage One: Trial of GPR and Resistivity Profiling***

As there are limitations on the use of both techniques it is believed that a limited staged trial be undertaken. This would enable direct assessment of the usefulness of the techniques and limit unnecessary disturbance to the sites. Below are the proposed trial specifications.

On completion of the trial a brief report would be made outlining; results, comments, interpretations and recommendations for further geophysical work.

The use of GPR will enable the collection of high density profile data which is viewable in real time. The ability to view the data in real time allows the operator to make rapid evaluations of the data quality and the effectiveness of the technique at the given location. Thus reducing time lost from the collection of data that is of questionable use.

Resistivity profiling will enable collection of data to a depth of up to 25 metres.

The use of a combined technique approach to the project should return a data set of high density data (from the GPR) for the investigation of the small structures expected within the peat and just below the base of the peat layer, combined with a lower density deeper data set (from the Resistivity profiling). The combined approach is believed to be the best approach to gain the required information to enable interpretations for use in the solution of the problems in evidence within the swamp.

The major foreseeable problems and limitations associated with the use of GPR for this investigation are:

1. Disturbance to the swamp. As the antennas are ground coupled they have to be dragged across the surface of the swamp. There is thus a requirement for the clearing of lanes for the collection of the data profiles. See below for details of width lane and height of vegetation.
2. Organic matter, clays and high ion levels in the water table will limit the penetration achieved with GPR. This is an unknown factor at this point in time. The undertaking of the trial will enable the evaluation of the penetration and detail expected to be achieved in the survey.

The major foreseeable problems and limitations associated with the use of Resistivity Profiling for this investigation are:

1. Disturbance to the swamp. As the technique involves the laying out of cables and placement of electrodes some disturbance will be necessary. To limit the amount of clearing and overall disturbance to the swamp it is envisaged that the Resistivity profiles would be collected along the same lanes as cleared for the collection of GPR data.
2. The resolution of a resistivity is orders of magnitude below that of GPR. Both in depth and special resolution. Smaller structures and thin beds may not be visible within the data.
3. Collection of Resistivity profiling data is much slower than GPR and hence a more expensive technique to employ.

***Trial of GPR and Resistivity Profiling on Narrow Swamp site.***

Clearing of lanes for the acquisition of the Geophysical data will be necessary for the undertaking of the investigation. For the trial, lanes of 1.2 metre width will need to be cleared. This width will enable the use of all the proposed GPR equipment and the deployment of the Resistivity system. The lane width required for the major study will be dependent on the results of the trial. If the 100MHz GPR antenna is required then the lanes will need to be 1.2 metres wide. However if the survey is to be undertaken with the 250MHz antenna then a lane of 1 metre width will be required.

## METHODOLOGY

The following describes the methodology that is proposed to be used in undertaking the geophysical survey:

***Stage One: Testing of techniques at Site 1, 2 and 3: as per Table 2, below.***

1. A minimum of 3 data profiles will be collected at each site, using GPR and Resistivity, as discussed with Rob Oliver of Springvale Coal (9/9/2009). If time permits extra data profiles can be collected.
2. Data will be processed and interpreted using applicable software, the bottom of the peat layer will be picked and anomalies will be marked and recorded for further investigation.
3. To calibrate the GPR velocity, in order to enable depth calculations, it is proposed that a Dynamic Cone Penetrometer (DCP) be used to probe to the bedrock to give a number of calibration points.
4. If time permits, further investigation will be undertaken on the main site with the instrumentation.
5. A verbal report will be made, on the morning following the test program, with written confirmation, to follow. The report will include, full details of the survey, pseudoocolour plot images of the data over the site, positions of anomalies and any other pertinent information regarding the survey. All interpretations will be plotted to a CAD drawing.
6. Co-ordinates of anomalies will be given in AMG Zone 55 (Australian Datum 1984) and in rectified Latitudes and Longitudes if required.
7. Recommendations regarding further work will be made.
8. The results of this test programme will be incorporated into the final report.
9. Full data sets will be available to the client as, the raw and final processed data and as an xyz file of the depth to the base of the peat. A GPR viewing program will be made available if requested.