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Flora and Fauna Impact Assessment: West Cliff Colliery Surface Gas Drainage

August 2007

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Natural & Cultural Heritage Consultants 15-17 Henrietta St Chippendale NSW 2008

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Report for

BHP Billiton Illawarra Coal

Flora and Fauna Impact Assessment: West Cliff Colliery Surface Gas Drainage

August 2007

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ABBREVIATIONS

BHPBIC	BHP Billiton Illawarra Coal
DECC	NSW Department of Environment and Climate Change, (formerly NSW Department of Environment and Conservation, DEC)
DEW	Commonwealth Department of Environment and Water Resources
DP	NSW Department of Planning
DNR	NSW Department of Natural Resources
EIS	Environmental Impact Statement
EP&A Act	NSW *Environmental Planning and Assessment Act* 1979
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999
LGA	Local Government Area
MNES	Matter of National Environmental Significance (under the EPBC Act)
NPWS	NSW National Parks and Wildlife Service (now part of DECC)
REF	Review of Environmental Factors
ROTAP	Rare or Threatened Australian Plant as listed by Briggs and Leigh (1995)
SIS	Species Impact Statement
SEPP	NSW State Environmental Planning Policy
TSC Act	NSW *Threatened Species Conservation Act* 1995
sp.	Species (singular)
spp.	Species (plural)
ssp.	Subspecies
var.	Variety

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1.0 SUMMARY

Biosis Research was commissioned by BHP Billiton Illawarra Coal (BHPBIC) to conduct a flora and fauna assessment for the proposed gas extraction installation above the West Cliff Colliery longwall workings.

The study area supports Shale Sandstone Transition Forest and Cumberland Plain Woodland in good to moderate condition, with disturbances such as the farming activities, roads and powerline easements fragmenting the existing bushland and resulting in weed invasion.

The proposal will involve clearing or modifying approximately 1 ha of native vegetation. Shale Sandstone Transition Forest and Cumberland Plain Woodland, listed as an Endangered Ecological Communities (EEC) on the TSC Act and EPBC Act were recorded in the study area.

No threatened plant species were recorded within the study area. However, potential habitat for five threatened species (*Grevillea parviflora* ssp. *parviflora*, *Persoonia bargoensis*, *Pimelea spicata*, *Pomaderris brunnea* and *Pultenaea pedunculata*) occurs within the study area.

The proposal is likely to remove or modify potential habitat for ten threatened animal species listed on the TSC Act (Black-chinned Honeyeater, Brown Treecreeper (eastern subspecies), Diamond Firetail, Hooded Robin, Eastern Freetail-bat, Grey-headed Flying Fox, Koala, Large-footed Myotis, Swift Parrot and Regent Honeyeater) and three threatened species (Grey-headed Flying Fox, Swift Parrot and Regent Honeyeater) listed on the EPBC Act.

Impact Assessments following the Part 3A Guidelines under the EP&A Act were carried out for the threatened biota occurring or with potential habitat in the study area. These assessments concluded that the proposal will have a minor impact, given that approximately 3,942 ha of Shale Sandstone Transition Forest and approximately 1,959 ha of Cumberland Plain Woodland has been mapped by NPWS (2002b) as occurring within the locality, and that none of the threatened species were recorded during surveys of the study area. Further, impact assessments following the EPBC Act Significant Impact Guidelines have been prepared for threatened biota listed under the EPBC Act with potential habitat in the study area. It was found that the proposal would not have a significant impact on threatened biota.

A Referral for Matters of National Significance (EPBC Act) is not considered necessary for any threatened biota within the study area.

Potential Koala habitat within the study area was assessed according to the SEPP 44 Policy. Habitat within the study area was considered Potential Habitat for

Koalas and not Core Habitat. Due to the moderate to poor quality of potential habitat within the study area and the extent of higher quality habitat within the locality, the proposal was found unlikely to significantly reduce the quality or extent of potential habitat for Koalas within the study area.

It is recommended that the following points be taken into consideration to minimise any disturbances on the ecological values of the study area:

- adjustment of the location of boreholes and access tracks to avoid native trees;
- where possible, trees with hollows should be retained;
- where possible, proposed boreholes and access tracks should be located within existing cleared areas;
- sediment and erosion control measures should be implemented on all sites to prevent erosion during and after construction;
- disturbance to native vegetation should be minimised, or, where disturbance is unavoidable, borehole sites should be rehabilitated using locally sourced tubestock and brush-matting;
- the spread of weeds into areas should be avoided;
- where clearing of native vegetation is unavoidable, native shrubs, logs and bush-rock should be stockpiled on the side of the proposed boreholes and access routes replaced following completion of the works;
- if required, bush regeneration and weed control should be undertaken to ensure flora and fauna of the local area is protected throughout the construction and operation phases of the proposal;
- any chemicals used on site will be taken off site after use and disposed of appropriately; and,
- relocation of three proposed borehole sites to nearby locations as detailed in Section 5.2.

2.0 INTRODUCTION

Biosis Research was commissioned by BHP Billiton Illawarra Coal (BHPBIC) to conduct a flora and fauna assessment for the proposed gas extraction installation above the West Cliff Colliery longwall workings. The installation involves the construction of surface infrastructure at 21 sites (referred to as the boreholes in this document), which are located approximately 1.5 km north of Appin (Figure 3). The proposed boreholes are a temporary installation, with the first being drilled late 2007 and then installed at a rate of approximately 1 every 7 weeks up to June 2010. They will be operational for approximately six weeks.

This assessment has been carried out for approval under Part 3A of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) with reference to threatened biota listed on the NSW *Threatened Species Conservation Act* 1995 (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

2.1 Aims

The specific aims of this assessment are to:

1. conduct a literature review and database search for the locality;
2. undertake targeted field surveys for habitat of threatened terrestrial flora and fauna species, populations or ecological communities that are listed on the TSC Act and the EPBC Act and have been identified as potentially occurring in the locality;
3. provide an assessment of the habitat values of the site;
4. undertake impact assessments for threatened biota listed on the TSC and/or EPBC Acts following the guidelines for threatened species assessment under Part 3A of the EP&A Act (DEC & DPI 2005) and the EPBC Act Significant Impact Guidelines (DEH 2006); and,
5. provide recommendations to minimise the environmental impacts of the proposal.

2.2 Definitions

The following terms are used frequently throughout the report:

- ***The proposal*** is the development, activity or action proposed. In this case the proposal is the installation of 21 gas extraction boreholes above the West Cliff longwall workings.

- ***Subject site*** is defined in *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC 2004b) and means the area directly affected by the proposal. In this case, the subject site is the combination of all 21 boreholes.
- ***Study area*** is defined in DECC (2004b) as the subject site and any additional areas that are likely to be affected by the proposal, either directly or indirectly.
- ***Subject species*** means those threatened species that are known or considered likely to occur in the study area.
- ***Affected subject species*** means subject species likely to be affected by the proposal.
- ***Abundance*** means a quantification of the population of the species or community.
- ***Regional*** means the area defined within the applicable IBRA Bioregion (Thackway and Cresswell 1995), i.e., The Sydney Basin Bioregion.
- ***Local population*** is defined in DECC (2004b) as the population of a species within the study area.
- ***Local occurrence*** is used in reference to endangered ecological communities and is defined in (Thackway and Cresswell 1995) as the community that occurs within the study area.
- ***Locality*** is the area within a 10 kilometre radius of the Study Area.
- ***Threatened biota*** refers to threatened species, populations and ecological communities as listed on the TSC Act and EPBC Act.

2.3 The proposal

The proposed West Cliff Mine Surface Gas Drainage Project will comprise:

- Borehole installation with appropriate drilling equipment and fit out to enable gas extraction,
- Gas extraction and ventilation facility, and,
- Gas flaring equipment located at a safe distance from the ventilation points

Where possible existing access tracks will be utilised and it may be necessary to construct further access tracks utilising a crushed rock base.

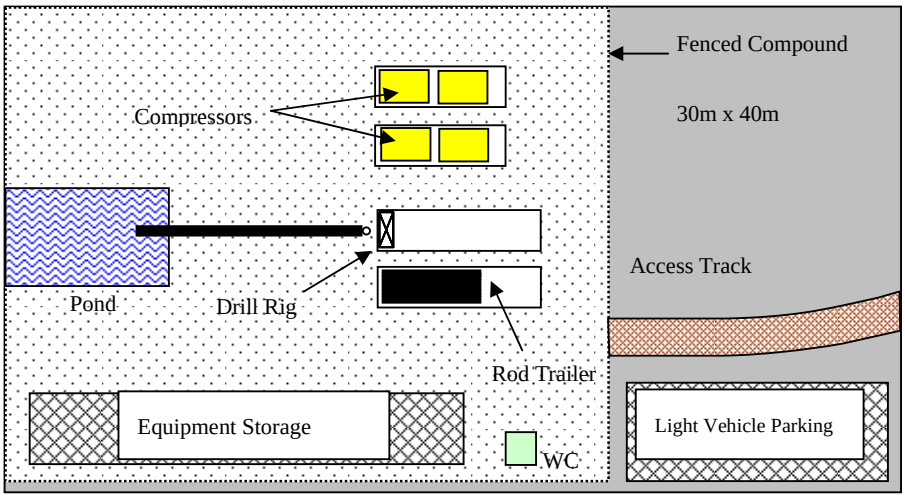
2.3.1 Borehole Installation

The boreholes will be installed using a specialised drilling rig that will be similar in appearance to those used by BHPIC in their exploration activities in the local region.

Figure 1 shows the generic layout of a drilling rig. A pond will be constructed to function as a drilling sump. The drilling mast will be 9m high and will be raised into

position as required. The holes will be located on the tailgate side of the Longwall panel and will generally be within 50 m of the side of the panel. This location minimises the consolidation effect on the borehole as mining subsidence progresses. The holes will be drilled to a depth of approximately 500 m, nominally 10 m above the Bulli Seam.

Figure 1: Generic layout of a drill rig



2.3.2 Gas Extraction and Ventilation

Gas will be extracted via the pre-drilled boreholes by a purpose-built mobile gas extraction plant. The plant consists of a PLC controlled liquid ring vacuum pump and associated pipe work, valves, monitoring control gear and genset all mounted on an 18 wheel semi-trailer. The vehicle has on-board water storage to service the liquid ring vacuum pump. This will minimise the number of times that water has to be delivered to the mobile plant.

The mobile plant will have an on-board generator to generate the power necessary to operate the equipment. The possibility of a gas-fired generator is under investigation. This diesel will be stored in a bunded tank adjacent to the mobile plant and will be connected by pipeline directly to the generator. One fuel delivery per week will be required.

The mobile vehicle will have an erectable vent stack approximately 9 m high. This stack will only be utilised when flaring is not occurring, or when the flares are located remote to the mobile plant. An on-board separator will reclaim the recycled sealing water, which will be redirected to an open recirculation tank.

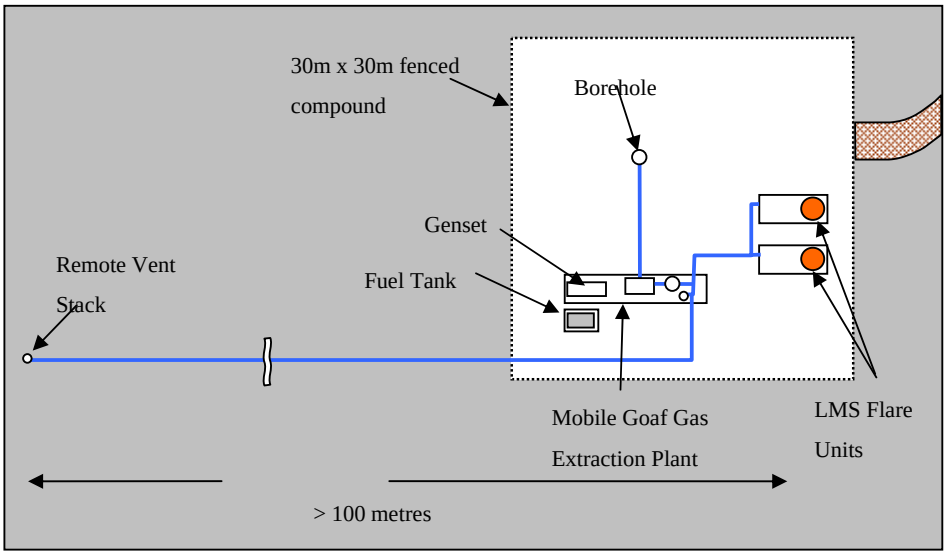
There is a safety requirement to separate the flare units from the vent by at least 100 m to minimise the risk of plume ignition. The vehicle will remain in position extracting gas until it is required to move to the next borehole in the longwall panel. It is expected that the mobile equipment will be located for approximately 6 weeks at each borehole before it is required to move to the next location to re-commence gas extraction.

Each borehole will be plugged and abandoned in accordance with requirements of the Department of Primary Industries (Mineral Resources).

2.3.3 Gas Flaring

When appropriate and possible, gas will be flared utilising two existing flaring units. The flares will be situated adjacent to the mobile goaf plant. Excess gas will be sent to a remote vent stack, situated at least 100 m away. This will achieve the minimum required separation between the flare units and the gas vent, whilst avoiding the need for a second pad to be constructed. Gas will be transported from the mobile plant to both the flares and the remote vent stack through surface laid 200 mm poly pipe. There will be power and control signal connection between the mobile plant and the gas flares. Figure 2 shows a typical plan view layout of the gas extraction borehole with all equipment in place.

Figure 2: Schematic view of gas extraction borehole and equipment layout.



2.3.4 Potential Impacts of The proposal

The disturbance footprint of each borehole site comprises a 30 X 40 metre compound with additional light vehicle parking for up to six vehicles. Additional construction of access tracks may be required. It is therefore assumed that a total area of 50 X 50 metres for all disturbed areas is adequate to consider all direct and indirect impacts associated with the proposal.

Direct impacts that may apply to this proposal and will therefore be considered in this assessment include:

- vegetation clearance;
- the removal of potential habitat; and,
- the fragmentation of potential habitat;

Indirect impacts that may apply to this proposal include:

- the potential for erosion;
- the provision of a suitable seed bed for exotic weed invasion; and,
- increased human activity within or adjacent to sensitive habitat areas.

Section 5.0 discusses the specific impacts associated with the proposal and the proposed amelioration measures. Direct impacts are usually unavoidable while indirect impacts are usually mitigated through amelioration measures.

2.4 The Study Area

The study area is located in the Wollondilly Shire Council and Camden Local Government Authority boundaries, approximately 1.5 km north of Appin. It lies between Appin Road in the east and the Sydney Water Supply canal in the west (Figure 3). The proposed boreholes follow the alignment of Longwalls Panels 32 to 34 of the West Cliff Mine in a north west to south east direction. The land within the study area is currently owned by a number of private land holders.

The study area is dissected east to west by Mallaty Creek and a number of smaller tributaries and drainage lines. Leafs Gully Creek transects the northern extent of the study area and Lilly Ponds Gully runs through the south western extent.

In recent years, the study area has been subject to ongoing pastoral and agricultural activities (including the construction of dams, buildings and other infrastructure), impacts from underground longwall mining activities, the

installation of the Eastern Gas (Moomba Sydney) Pipeline, a 330kV and 66kV transmission line easement and a race track. Appin Road and a number of smaller roads and tracks also extend across the study area. Such activities have resulted in moderate to high levels of disturbance in some areas.

2.4.1 Geology, Soils and Landform

Geographically, the study area transcends the transitional zone between the Woronora Plateau to the east dominated by sandstone ridges and gullies and the Cumberland Plain to the west which is dominated by shale influenced rolling hills and valleys. The most significant landscape feature of the study area is the east-west oriented Mallaty Creek, which flows from Appin Road towards the Nepean River.

Hazelton and Tille (1990) have defined two soil landscapes within the study area, they are the Blacktown (ba) and Luddenham (lu). Each soil landscape has distinct morphological and topological characteristics.

The Blacktown soil landscape is the predominant soil group in the study area, it is a residual landscape characterised by gentle undulating rises located on the Wianamatta Groups Shale. The local landscape also consists of broad rounded crests and ridges, and is almost completely cleared of the native eucalypt woodlands from agricultural activities in the area. (Hazelton & Tille 1990). Soil deposits in this area vary in depth and type. Only limited soil types in this region are considered fertile, such as the greyish brown loam that occurs in pockets near the top slopes and at the bottom of gullies, otherwise the topsoil is a hard setting brown clay that has become exposed from the clearing of the land and subsequent erosion. Depth of soil ranges from a maximum 150 mm of soil on crests and upper slopes, to 500 mm depth on lower side slopes and up to 2 m deep in drainage depressions and poor drainage areas (Hazelton & Tille 1990).

The Luddenham soil landscape is an erosional landscape located in the south eastern extent of the study area. It is characterised by undulating to rolling hills on Wianamatta Group Shales. Narrow ridges, hillcrests and valleys are the typical landform in this landscape. Native vegetation has been almost extensively cleared for agricultural activities. Soils vary from the shallow (<100 cm) shallow dark brown loam and clay deposits on the crests, to moderately deep brown clay loam overlaying clays on the slopes (70-150 cm). Lower slopes and drainage lines contain moderately deep soil deposits of greyish brown loam overlaying yellow sandy clay (<150 cm) (Hazelton & Tille 1990).

2.4.2 Climate

Average annual precipitation is 850 mm at Wedderburn (DEC 2006). At Campbelltown, 16 km to the north of West Cliff Colliery, the average maximum temperature is 23.3 degrees Celsius with a high of 28.4 degrees Celsius in February. The average minimum temperature is 10.4 degrees Celsius with a low of 3.1 degrees Celsius in July (BOM 2007).

2.4.3 Land Use History

Historical research has been undertaken by Biosis Research to identify the historical context of the Appin district (Biosis Research 2007). This history incorporates an understanding of land-use, building patterns, areas of disturbance, as well, as land owner histories.

The area around Appin was cleared for agriculture in the early 19th century to enhance Sydney's unreliable food supply. Cattle and wheat were the major produce early on with dairies, orchards and wineries being subsequently developed.

The increase in development such as was seen at settlements which had a railway station or siding, such as Picton, was not experienced at Appin. Urban growth has been slow and has not contributed to land clearance in the area.

The first mining leases were not established in the Appin region until the early 20th century, following the proclamation of the State Coal Mine Reserve in November 1926 (Wedderburn Parish Map 1972).

2.5 Planning Approvals

The proposal has been included as a Major project under Part 3A of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) and State Environmental Planning Policy (Major Projects) 2005.

The EP&A Act was amended in June 2005 to reform the land-use planning and development assessment and approval system, particularly as it relates to major infrastructure and other significant development. In the new Part 3A, the Act provides a single assessment and approval regime for all major infrastructure and other projects previously undertaken under Part 4 and/or Division 4 of Part 5 of the EP&A Act. The new Part applies to major State government infrastructure projects, development that was previously classified as State significant development and other projects, plans or programs declared by the Minister for Planning.

Provisions have been made in the amended Act for:

- Independent Hearings and Panel Assessments to strengthen the assessment process;
- Concept plans for complex projects, plans or programs so that the overall provisions can be evaluated prior to consideration of the details of the project(s). This provides for matters such as the suitability of the site/route and environmental issues to be resolved up-front and provides for the simplification of subsequent approvals where environmental impacts can be avoided or minimised; and,
- The Minister to declare projects to be 'critical infrastructure projects'. Prior to making such a declaration, a preliminary risk assessment will be required to consider the financial, economic, social and environmental risks of declaring the project a critical infrastructure project. These projects only require a concept approval and there are no appeal rights except if initiated by the Minister.

3.0 METHODS

3.1 Taxonomy

The plant taxonomy (method of classification) used in this report follows Harden (1992, 1993, 2000, 2002), Fairley and Moore (2000), Robinson (Robinson 2003) and subsequent advice from the National Herbarium of NSW. In the body of this report plants are referred to by their scientific names only. Common names where available have been included in the Appendices.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by Department of Environment and Heritage (DEH). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only. Common and scientific names are included in the Appendices.

3.2 Legislation

Federal and State Acts and Policies that apply to the study area with regard to terrestrial flora and fauna are listed below.

- Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act)
- NSW *Threatened Species Conservation Act* 1995 (TSC Act)
- NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act)
- NSW *Fisheries Management Act* 1994
- NSW State Environmental Planning Policy (SEPP) 44 – Koala Habitat Protection

3.3 Literature and Database Review

A list of documents used to prepare this report is located in *References*. Records of threatened species, populations and communities were obtained from the Department of Environment and Climate Change (DECC) *Atlas of NSW Wildlife* within a 10 km radius of the study area.

Potential occurrences of threatened species, populations and communities listed on the EPBC Act were obtained from the Department of Environment and Water Resources (DEW) *EPBC Online Database* within a 10 km radius of the study area. Database searches were conducted in June 2007.

3.4 Field Survey

The study area was inspected on the 12th and 13th of June 2007. The general condition of the site was assessed and observations of flora and fauna species and vegetation communities were made (as detailed below). During the site visit the weather was fine.

3.4.1 Flora

Information recorded during the flora survey at each of the 21 boreholes included; location (GPS), photograph, soil type, aspect, slope, horizon visibility, community structure and composition, the presence of threatened plants and ecological communities (or their potential habitat), fire history, condition (Section 3.4.2), flora species list and habitat description.

A compiled plant species list for the study area was entered into the NSW Flora Information System (Viridians 2003) and is included in Appendix 1.

3.4.2 Vegetation Condition Assessment

Vegetation condition was assessed according to the degree to which it resembles relatively natural, undisturbed vegetation. Vegetation was assessed as being in Good, Moderate or Poor condition or an unnatural landscape according to the following criteria:

- **species composition** (species richness, degree of weed invasion);
- **vegetation structure** (representation of each of the original layers of vegetation); and,
- **resilience** (This is the capacity of a site for natural regeneration. This is primarily linked to the degree to which the natural soil profile of the area has been disturbed).

The categories of vegetation conditions are as follows:

Good: containing a high number of indigenous species; no weeds present or weed invasion restricted to edges and track margins; vegetation community contains original layers of vegetation; vegetation layers (ground, shrub, canopy etc.) are intact, or if modified, natural soil profile remains intact;

Moderate: containing a moderate number of indigenous species; moderate level of weed invasion; weeds occurring in isolated patches or scattered throughout; one or more of original layers of vegetation are modified; vegetation layers (ground, shrub, canopy etc.) are largely intact, or if modified, natural soil profile

remains intact; able to be regenerated to Good condition with minimal level of management;

Poor: containing a low number of indigenous species; high level of weed invasion; weeds occurring in dense patches or scattered throughout; one or more of the original layers of vegetation are highly modified; one or more original vegetation layers (ground, shrub, canopy etc.) are modified or missing, but natural soil profile intact; able to be regenerated to Moderate or Good condition with substantial management; and,

Unnatural landscape: highly modified landscape containing few or no indigenous species; exotic species dominant; original native vegetation layers removed; natural soil profile disturbed; unable to be regenerated to natural condition; requires a high input of resources to achieve restoration goals.

3.4.3 Fauna

The fauna survey was undertaken as a habitat based assessment. Species encountered through observations were recorded and active searching and listening was carried out for birds and reptiles.

3.4.4 Fauna Habitat Assessment

The three categories used to evaluate habitat value were Good, Moderate or Poor, as detailed below:

Good: ground flora containing a high number of indigenous species; vegetation community structure, ground, log and litter layer intact and undisturbed; a high level of breeding, nesting, feeding and roosting resources available; a high richness and diversity of native fauna species.

Moderate: ground flora containing a moderate number of indigenous species; vegetation community structure, ground log and litter layer moderately intact and undisturbed; a moderate level of breeding, nesting, feeding and roosting resources available; a moderate richness and diversity of native fauna species.

Poor: ground flora containing a low number of indigenous species, vegetation community structure, ground log and litter layer disturbed and modified; a low level of breeding, nesting, feeding and roosting resources available; a low richness and diversity of native fauna species.

Other habitat features, such the value of the study area as a habitat corridor, the presence of remnant communities or unusual ecological vegetation community structure, were also used to assess habitat quality.

3.5 Limitations

This study was a habitat-based assessment. As such, no trapping, spotlighting, call playback or vegetation quadrat sampling techniques were used.

4.0 RESULTS

4.1 Plant Communities

Four plant communities were surveyed within the study area. They are listed and described below.

4.1.1 Exotic Pasture

Exotic pasture dominates the study area. It was present at the following sites:

PA01, PA04, CP01, CP02, CP06, CP07, CP08, CP09, CP10, CP11, CP12, CP13, CP14, CP15, CP16, CP17.

This plant community was characteristic of severely disturbed paddocks within the study area. Native vegetation was not present at any of these sites due to a land use history involving native vegetation clearance, tillage and pasture improvement. Currently some of these paddocks are being used as grease traps.

Structurally, this plant community grows as a single ground layer to a maximum height of 0.5 metres with a cover of at least 90 per cent. Occasionally *Xanthium* spp. or *Rubus fruticosus* grow to a height of 2 metres.

Dominant species included the weeds *Pennisetum clandestinum, Sida rhombifolia, Tagetes minuta, Phytolacca octandra, Senecio madagascarensis, Xanthium* spp., *Lolium* spp., *Sonchus oleraceus, Modiola caroliniana, Microlaena stipoides, Sporobolus africanus, Trifolium repens, Paspalum dilatatum* and *Chloris gayana*.

The condition of all of these sites was assessed as being an **unnatural landscape** with no regeneration potential or flora habitat value. This plant community does not constitute an endangered ecological community and is unlikely to provide potential habitat for threatened plants.

4.1.2 Native Pasture

Native pasture was present at CP03 and CP05.

This plant community was characteristic of paddocks within the study area in which native vegetation had been cleared but where minimal tillage or pasture improvement had taken place. The composition of the community suggested in places that over-grazing was a substantial historical impact.

Structurally, this plant community grows as a single ground layer to a maximum height of 0.5 metres with a cover of at least 90 per cent.

Dominant species included the native pasture grasses *Aristida vagans*, *Aristida ramosa*, *Cymbopogon refractus*, *Themeda australis*, *Eragrostis brownei* and the weed species *Senecio madegascariensis*, *Rubus fruticosus* and *Cirsium vulgare*.

Sites CP03 and CP05 were assessed as being in **poor** condition due to the lack of a tree, small tree and shrub layer and a limited capacity for regeneration. This plant community does not constitute an endangered ecological community due to its highly modified structure and is unlikely to provide potential habitat for threatened plants.

4.1.3 Cumberland Plain Woodland

Cumberland Plain Woodland was present at CP04.

Cumberland Plain Woodland at CP04 is represented by four distinct structural layers:

- **Upper**; Trees, 20-25 metres high with a foliage projective cover of 20 per cent. Dominant species included *Eucalyptus tereticornis* and *Eucalyptus moluccana*.
- **Mid**; Small trees, 7-10 metres high with a foliage projective cover of 30 per cent. Dominant species included immature *Eucalyptus tereticornis* and *Eucalyptus moluccana*.
- **Lower**; Shrubs, 1.5-3.0 metres high with a foliage projective cover of less than five per cent. Dominant species included juvenile *Eucalyptus tereticornis* and *Eucalyptus moluccana* and *Bursaria spinosa*.
- **Ground**; Herbs and grasses, 0-0.5 metres high with a foliage projective cover of 90 per cent. Dominant species included *Microlaena stipoides, Aristida vagans, Eragrostis brownei, Cymbopogon refractus, Sonchus oleraceus*, *Phytolacca octandra*, *Senecio madegascariensis* and *Plantago lanceolata*.

Site CP04 was assessed as being in **moderate** condition due to an altered vegetation structure and presence of weeds in the ground layer. However, the site had some regenerative potential due to minimised disturbance and it proximity to native woodland along Mallaty creek.

4.1.4 Shale Sandstone Transition Forest

Shale Sandstone Transition Forest was present at PA02 and PA03.

Site PA02

Shale Sandstone Transition Forest at PA02 is represented by three distinct structural layers due to the previous clearance of the mid-storey:

- **Upper**; Trees, 18-20 metres high with a foliage projective cover of 20 per cent. Dominant species included *Eucalyptus tereticornis, Eucalyptus eugenioides, Eucalyptus pilularis, Eucalyptus punctata, Eucalyptus fibrosa* and *Eucalyptus crebra*.
- **Mid**; absent due to previous clearance.
- **Lower**; Shrubs, 1.5-2.0 metres high with a foliage projective cover of 20 per cent. Dominant species included *Cassinia uncata, Kunzea ambigua, Gahnia aspera* and *Acacia floribunda*.
- **Ground**; Herbs and grasses, 0-0.5 metres high with a foliage projective cover of 50 per cent. Dominant species included *Microlaena stipoides, Digitaria parviflora, Eragrostis leptostachyus, Laxmannia gracilis, Stypandra glauca* and *Entolasia marginata*. A minor herbaceous weed infestation occurred at this site and included the weed species *Sonchus oleraceus, Senecio madegascariensis* and *Plantago lanceolata*.

Site PA02 was assessed as being in **moderate** condition due to low weed invasion and good resilience. The site had an undisturbed soil profile and was adjacent to native woodland. However, the ecological value of the site has been diminished as a result of an altered vegetation structure due to on-going management as an asset protection zone.

Site PA03

Shale Sandstone Transition Forest at site PA03 is represented by four distinct structural layers:

- **Upper**; Trees, 18-20 metres high with a foliage projective cover of 40 per cent. Dominant species included *Eucalyptus punctata* and *Eucalyptus fibrosa*.
- **Mid**; Small trees, 7-10 metres high with a foliage projective cover of 10 per cent. Dominant species included immature *Eucalyptus* spp.

- **Lower**; Shrubs, 2.0-3.0 metres high with a foliage projective cover of 60 per cent. Dominant species included *Kunzea ambigua* and *Persoonia linearis*.

- **Ground**; Herbs and grasses, 0-1.0 metres high with a foliage projective cover of 30 per cent. Dominant species included *Microlaena stipoides, Digitaria parviflora, Eragrostis leptostachyus, Laxmannia gracilis, Stypandra glauca* and *Gahnia aspera*.

Site PA03 was assessed as being in **good** condition due to an intact vegetation structure and composition. The site had good regenerative potential due to minimised disturbance to the soil profile and its proximity to adjacent native woodland.

4.2 Flora

A list of plant species recorded in the study area is provided in Appendix 1.

4.2.1 Threatened Flora

Database searches (DECC 2007, DEW 2007) revealed that 20 threatened flora species listed on the TSC Act and/or the EPBC Act have been either previously recorded or have potential habitat within the locality. Records from the Biosis Research Threatened Flora Database have also been included from previous work in the locality. The distribution of threatened plants derived from DECC (2007) is illustrated in Figure 6.

No threatened flora species were recorded within the study area. However, potential habitat exists within the study area for *Grevillea parviflora* ssp. *parviflora*, *Persoonia bargoensis*, *Pimelea spicata*, *Pomaderris brunnea* and *Pultenaea pedunculata*.

Table 1: Threatened flora within 10km of the study area.

Key: 1) Listed on the TSC Act as Endangered (E1), Extinct (E4) or Vulnerable (V); 2) Listed on the EPBC Act as Endangered (E) or Vulnerable (V)

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Acacia baueri ssp. *aspera*	-	V	Restricted to the Sydney region, occurring on the Kings Tableland in the central Blue Mountains and with sporadic occurrences on the Woronora Plateau in the Royal National Park, Mt. Keira district and at Wedderburn. Occurs in low, damp heathlands, often on exposed rocky outcrops. Appears to prefer open conditions; rarely observed where there is any shrub or tree canopy development; and many of the observations of this species have been made following fire, suggesting the species prefers early successional habitats. Peak flowering occurs December to March (DEC 2005g).	No

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Acacia bynoeana Bynoe's Wattle	V	E1	Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches (DEC 2005a).	No
Caladenia tessellata Tessellated Spider Orchid	V	E1	Low open forest with heath or sometimes grass understorey this species only grows in very dense shrubbery in coastal areas (Bishop 1996). Currently known from two disjunct areas: Braidwood on southern tablelands and three populations in Wyong area on the Central Coast (DEC 2005c).	No
Callistemon linearifolius	-	V	Occurs chiefly from Georges River to the Hawkesbury River where it grows in dry sclerophyll forest (Harden 2002), open forest, scrubland (Fairley and Moore 2000) or woodland on sandstone. Found in damp places, usually in gullies (Robinson 1994). Flowers in Spring.	No
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	This species typically grows in swamp-heath on sandy soils chiefly in coastal districts (Harden 1993) but has also been recorded on steep bare hillsides (Bishop 1996). Within the Central Coast bioregion, this species has been recorded within Coastal Plains Smooth-barked Apple Woodland (mu 30) and Coastal Plains Scribbly Gum Woodland (mu 31) (Bell 2001).	No
Cynanchum elegans White-flowered Wax Plant	E	E1	Rainforest gullies scrub and scree slopes in Gloucester and Wollongong districts (Harden 1992). Occurs mainly at the ecotone between dry subtropical rainforest and sclerophyll forest/woodland communities (NPWS 2002a). Has been recorded in dry subtropical rainforest, littoral rainforest, *Leptospermum laevigatum-Banksia integrifolia* Coastal scrub, *Eucalyptus tereticornis* forest and woodland, *Corymbia maculata* forest and woodland and *Melaleuca armillaris* scrub to open scrub (NPWS 2002a).	No
Epacris purpurascens var. *purpurascens*	-	V	Sclerophyll forest, scrub and swamps from Gosford and Sydney districts (Harden 1992) specifically this species is thought to require wet heath vegetation (T. James pers. comm.). Characteristically found in a range of habitat types, most of which have a strong shale soil influence. These include ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities (including Shale Sandstone Transition Forest). Also occurs in riparian zones draining into Sydney Sandstone Gully Forest, shale lenses within sandstone habitats and colluvial areas overlying or adjoining sandstone or tertiary alluvium. Has been recorded from Gosford, Narrabeen, Silverdale and Avon Dam vicinity (DEC 2005e).	No
Eucalyptus benthamii Nepean River Gum	V	V	Known from two main locations: Bents Basin and Kedumba Valley. A few scattered individuals are recorded from other sites on the sandy alluvial flats of the Kedumba/Cox/Nepean River system. Occurs only in wet open forest on sandy alluvial soils along valley floors at an elevation of 140-750 m. The soils are shallow to moderately deep and are well drained alluvial sands and gravels along stream channels, small terraces and alluvial flats (NPWS 2000b). Restricted but locally abundant (Harden 1991). ROTAP; 2Vi	No
Grevillea parviflora ssp. *parviflora* Small-flower Grevillea	V	V	Sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast and Cessnock and Kurri Kurri in the Lower Hunter. Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Often occurs in open, slightly disturbed sites such as along tracks. Flowering has been recorded between July to December as well as April-May (DEC 2005f).	YES. Previously Recorded within study area and locality.

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Leucopogon exolasius Woronora Beard-heath	V	V	Woodland on sandstone, restricted to the Woronora and Grose Rivers (Harden 1991). The plant occurs in woodland on sandstone and prefers rocky hillsides along creek banks (NPWS 1997). Flowering occurs in August and September.	No
Melaleuca deanei Dean's Melaleuca	V	V	Grows in wet heath on sandstone (Harden 1991). Occurs in two distinct areas of Sydney (Ku-Ring-Gai/Berowra and Holsworthy/Wedderburn) and has isolated occurrences in the Blue Mountains, Nowra and Central Coast areas (DEC 2005i). The species grows in heath on sandstone. Flowers appear in summer but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate.	No
Persoonia bargoensis Bargo Geebung	V	E1	Restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau. Its entire range falls between Picton, Douglas Park, Yanderra, Cataract River and Thirlmere. Occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravely soils typical of Shale Sandstone Transition Forest. Like most Geebungs this species seems to benefit from the reduced competition and increased light available on disturbance margins including roadsides (DEC 2005j).	YES. Previously recorded within locality, 2km to south of study area.
Persoonia hirsuta Hairy Geebung	E	E1	Occurs from Gosford to Royal NP and in the Putty district from Hill Top to Glen Davis where it grows in woodland to dry sclerophyll forest on sandstone (Harden 2002) or rarely on shale (NSW Scientific Committee 1998b). Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone and shale-sandstone transition areas (DEC 2005k).	No
Persoonia nutans Nodding Geebung	E	E1	Grows in Woodland to dry sclerophyll forest on clay soils and old alluviums on the Cumberland Plain (Robinson 1994, Harden 2002). It is restricted to Castlereagh Scribbly Gum Woodlands, Agnes Banks Woodland, Shale Gravel Transition Forest and Cooks River Castlereagh Ironbark Forest (NPWS 2003b). Peak flowering is from December to January with sporadic flowering all year round.	No
Pimelea spicata Spiked Rice-flower	E	E1	In western Sydney, *Pimelea spicata* is restricted to areas supporting, or that previously supported, Cumberland Plain Woodland. Pimelea spicata has been recorded from both shale hills and shale plains woodland. *Pimelea spicata* has also been recorded from highly degraded areas that no longer support native vegetation, but that would have supported CPW previously (DEC 2004a). In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a more well developed shrub and grass understorey.	YES. Potential habitat recorded in study area and species previously recorded within locality, 10 km to the north of the study area.
Pomaderris brunnea Rufous Pomaderris	V	V	Open forest confined to the Colo River & upper Nepean River (Harden 1990), on clay & alluvial soils (Fairley and Moore 1995). In the Hawkesbury/Nepean region, the species is known to be associated with Dry sclerophyll forests (Cumberland, Upper Riverina, Sydney Coastal, Sydney Hinterland, Sydney Sand Flats), Coastal Floodplain Wetlands and Coastal Valley Grassy Woodlands (DEC 2005l).	YES. Previously recorded within locality, 2km to south of study area.
Pterostylis saxicola Sydney Plains Greenhood	E	E1	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines (NSW Scientific Committee 1997). The vegetation communities that occur above the shelves are either shale/sandstone transition or shale communities. Often occurs near streams. Picnic Point to Picton (Harden 1993). Currently known from only 5 localities (NSW Scientific Committee 1997).	No
Pultenaea aristata Prickly Bush-pea	V	V	Restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt Kiera above Wollongong. The species occurs in either dry sclerophyll woodland or wet heath on sandstone. Flowering has been recorded in winter and spring (DEC 2005m).	No

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Pultenaea pedunculata Matted Bush-pea	-	E1	Restricted to the Cumberland Plain and near Merimbula where it grows in dry sclerophyll forest and disturbed sites (Harden 2002). In western Sydney it occurs in three locations: within industrial and residential areas at Villawood and Prestons, and north-west of Appin between the Nepean River and Devines Tunnel No. 2 (DEC 2005n). It occurs in clay or sandy clay soils (Blacktown soil landscape) on Wianamatta shale, close to localised patches of Tertiary alluvium (Liverpool) or the shale/sandstone influence (west of Appin) (DEC 2005n). At all sites there is a lateritic influence in the soil with characteristic ironstone gravels present (DEC 2005n). This species is known to occur in remnants of Cooks River Clay Plain Scrub Forest (James *et al.* 1999).	YES. Previously recorded within study area and locality.
Thesium australe Austral Toad-flax	V	V	Clay soils in grassy woodlands or coastal headlands (James *et al.* 1999). Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Often found in damp sites in association with Kangaroo Grass (Themeda australis). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass (DEC 2005s).	No

4.3 Fauna Habitats

Potential habitat for fauna species within the study area are considered below in three main habitat types: Exotic/Native Pastures, Woodland and Forest. General potential fauna habitats are discussed along with the value of these habitat types within the study area to threatened species.

4.3.1 Exotic/Native Pasture

Exotic pasture, in the form of highly tilled and grazed agricultural land, dominates the study area. It was present at the following sites: PA01, PA04, CP01, CP02, CP06, CP07, CP08, CP09, CP10, CP11, CP12, CP13, CP14, CP15, CP16 and CP17. Native pasture was present at CP03 and CP05. Both of these vegetation types are highly disturbed and are considered unnatural landscape. This habitat is therefore considered poor quality habitat for most species.

The exotic pastures provide habitat for some granivorous bird species like the Australian Pipit while blackberry bushes (*Rubus fruticosus*) growing in dense clumps within pasture areas, provide sheltering habitat for small woodland birds such as fairy wrens, silvereyes and thornbills.

Eagles and Kites may utilise the open and clear pastures as hunting grounds for small mammals or other birds, often roosting on artificial structures (eg. powerlines) or tall trees within otherwise cleared areas.

This plant community was characteristic of severely disturbed paddocks within the study area. Native vegetation was not present at any of these sites due to a

land use history involving land clearance, tillage and pasture improvement. Currently some of these paddocks are being used as grease traps.

Kangaroo and wallaby species may forage in the native pasture areas adjacent to woodland/forest stands.

The exotic/native pasture does not provide potential habitat for the threatened species which may occur within the study area or have potential habitat within the study area.

4.3.2 Woodland (Cumberland Plain Woodland)

Woodland habitat was dominated by the Cumberland Plain Woodland (EEC) vegetation type within the study area. Cumberland Plain Woodland was present at CP04. This vegetation community is represented in the study area in small sections along the creek which dissects the study area. It also occurs as part of fragmented stands within the north-west part of the study area as shown in Figure 5. There are also areas within the south-east of the study area which are mapped as Cumberland Plain Woodland but in fact, exist only as scattered canopy trees within cleared agricultural areas.

A detailed description of the floral components and structure of Cumberland Plain Woodland is provided in Section 4.1.

Tall canopy trees within the woodland contain a variety of hollows ranging from small to medium size. The smaller hollows are suitable as breeding sites for small birds, hollow-roosting bats and other small arboreal mammals, while the medium-sized hollows are suitable for larger birds (such as cockatoos) and larger arboreal mammals. Very large hollows, which can provide roosting or breeding opportunities for Owl species, were not recorded within the study area.

While leaf litter was present, the ground cover was dominated by native grass species with some exotic grass species also present. The bases of canopy trees were fairly clear and did not feature a build up of leaf litter which provides habitat for the Cumberland Plain Land Snail. The grass groundcover provides foraging resources for granivorous species such as kangaroo and wallaby species and the Diamond Firetail.

A build up of mid-layer shrub species, such as *Bursaria spinosa*, due to restricted burning episodes, makes the Woodland habitat unsuitable for the Bush-stone Curlew which prefers a low grassy groundcover in open woodland. However, may provide foraging/sheltering habitat for a range of small woodland birds.

Two dominant canopy trees, Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus moluccana*) provide nectar for a range of species including the

Regent Honeyeater and the Grey-headed Flying Fox. As the Forest Red Gum is a winter flowering species, it may provide non-breeding season feeding resources for these species. Additionally, the Forest Red Gum is a known feed tree for Koalas.

The site CP04 is approximately 75 metres from a creek making it a suitable roosting site for species which require proximity to water, such as the Large-footed Myotis. Some small logs are present and provide habitat for small reptiles, small scattered rocks are present but no outcropping occurs.

The woodland habitat at CP04 provides some roosting, breeding and foraging opportunities for native fauna as discussed above. However, is represented by a thin strip (~100 metres) and thus is subject to strong edge effects from the surrounding cleared agricultural land and roads. Altered fire regimes have also changed the structure of the community. It is therefore considered overall to be moderate to poor quality habitat.

4.3.3 Forest (Shale Sandstone Transition Forest)

Forest habitat was dominated by the Shale Sandstone Transition Forest (EEC) vegetation type within the study area. Shale Sandstone Transition Forest was present at PA02 and PA03. This plant community is represented in the study area as the dominant vegetation along the creek which dissects the study area (Mallaty Creek). It also occurs within fragmented stands within the north-west part of the study area as shown in Figure 5.

A detailed description of the floristic components and structure of Shale Sandstone Transition Forest is provided in Section 4.1.

Tall canopy trees within the woodland contain a variety of hollows ranging from small to medium size. The smaller hollows are suitable as breeding sites for small birds, hollow-roosting bats and other small arboreal mammals, while the medium-sized hollows are suitable for larger birds (such as cockatoos) and larger arboreal mammals. Very large hollows, which can provide roosting or breeding opportunities for Owl species, were not recorded within the study area.

The canopy tree, the Forest Red Gum provides nectar for a range of species including the Regent Honeyeater. As the Forest Red Gum is a winter flowering species, it may provide non-breeding season feeding resources for these species. Additionally, the Forest Red Gum and Grey Gum (*Eucalyptus punctata*) are known feed trees for Koalas.

The borehole PA02 is approximately 100 metres from a large creek, making it a suitable roosting site for species which require proximity to water, such as the Large-footed Myotis. Fallen logs also provide good habitat in this area. Small

scattered rocks are present but no outcropping occurs, providing habitat mainly for small reptiles. Few fallen logs and rocks are present at PA03.

The forest habitat at PA02 and PA03 provides some roosting, breeding and foraging for native fauna as discussed above. However, thickness of these patches range from around 150 metres to 200 metres and while PA02 is directly connected to a larger expanse of vegetation to the west, PA03 is restricted to an isolated patch approximately four ha in area. This results in edge effects from the surrounding cleared agricultural land and roads. Altered fire regimes and possibly Bell Miner associated dieback have also changed the structure of the community. Lastly, the forest habitat surrounding borehole PA03 contains a very high abundance of Bell Miners, which has been associated to tree health decline and dieback (through an increase in leaf eating insects, psyllids) (Wardell-Johnson *et al.* 2006). Overall, the forest habitats within the study area are therefore considered to be moderate to poor quality habitat.

4.4 Fauna

A detailed fauna survey was not undertaken for this assessment. Incidental observations of fauna species utilising the study site are listed in Appendix 2 and include two amphibian species, 46 bird species (two introduced), and four mammal species (three introduced).

4.4.1 Significant Fauna

Thirty-eight threatened animal species listed on the TSC Act and 21 threatened animal species listed on the EPBC Act, or their habitat have been previously recorded within the local area (DECC Atlas of NSW Wildlife and DEH Online EPBC Protected Matters Database).

No threatened fauna were recorded during the current survey. However, the study area contains potential habitat for ten threatened species listed on the TSC Act (Black-chinned Honeyeater, Brown Treecreeper (eastern subspecies), Diamond Firetail, Hooded Robin, Eastern Freetail-bat, Grey-headed Flying Fox, Koala, Large-footed Myotis, Swift Parrot and Regent Honeyeater) and three threatened species listed on the EPBC Act (Grey-headed Flying Fox, Swift Parrot and Regent Honeyeater).

Table 2: Terrestrial fauna listed on the TSC Act or EPBC Act that may occur in the locality.

Key: 1) Listed on the TSC Act as Endangered (E), Vulnerable (V); 2) Listed on the EPBC Act as Endangered (E) or Vulnerable (V) or covered under migratory provisions (M) on the EPBC Act

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Giant Burrowing Frog *Heleioporus australiacus*	V	V	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creeks (Daly 1996, Recsei 1996). Can also occur within shale outcrops within sandstone formations. In the southern part of its range can occur in wet and dry forests, montane sclerophyll woodland and montane riparian woodland (Daly 1996). Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water (Barker *et al.* 1995).	No
Green and Golden Bell Frog *Litoria aurea*	V	E1	Found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes (NPWS 1999b). Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks (White and Pyke 1996, NPWS 1999b).	No
Littlejohn's Tree Frog *Litoria littlejohni*	V	V	Occurs in wet and dry sclerophyll forests associated with sandstone outcrops between 280 and 1000 m on the eastern slopes of the Great Dividing Range (Barker *et al.* 1995). Prefers rock flowing streams, but individuals have also been collected from semi-permanent dams with some emergent vegetation (Barker *et al.* 1995). Forages both in the tree canopy and on the ground, and has been observed sheltering under rocks on high exposed ridges during summer. It is not known from coastal habitats.	No
Red-crowned Toadlet *Pseudophryne australis*		V	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks that feed into larger semi-perennial streams. These creeks are characterised after rain by a series of shallow pools lined by dense grasses, ferns and low shrubs (Thumm and Mahony 1996, Thumm and Mahoney 1997).	No
Stuttering Frog *Mixophyes balbus*	V	E1	This species is usually associated with mountain streams, wet mountain forests and rainforests (Barker *et al.* 1995). It rarely wanders very far from the banks of permanent forest streams, although it will forage on nearby forest floors. Eggs are deposited in leaf litter on the banks of streams and are washed into the water during heavy rains (Barker *et al.* 1995).	No
Australian Painted Snipe *Rostratula benghalensis australis*	V	E1	The Australian Painted Snipe is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or temporarily filled. It nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats, taking invertebrates, such as insects and worms, and seeds. The Australian Painted Snipe is also possibly nomadic, appearing to temporarily occupy areas of suitable habitat	No
Barking Owl *Ninox connivens*		V	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country (Pizzey 1983).	No
Black-chinned Honeyeater *Melithreptus gularis gularis*		V	Found mostly in open forests and woodlands dominated by box and ironbark eucalypts (Higgins *et al.* 2001). It is rarerly recorded east of the Great Dividing Range (Higgins *et al.* 2001).	YES
Black-faced Monarch *Monarcha melanopsis*	M		A migratory species found during the breeding season in damp gullies in temperate rainforests. Disperses after breeding into more open woodland (Pizzey 1983).	No

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Black-necked Stork *Ephippiorhynchus asiaticus*		E1	Found in swamps, mangroves and mudflats. Can also occur in dry floodplains and irrigated lands and occasionally forages in open grassy woodland. Nests in live or dead trees usually near water (Pizzey 1983).	No
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*		V	Live in eucalypt woodlands, especially areas of relatively flat open woodland typically lacking a dense shrub layer, with short grass or bare ground and with fallen logs or dead trees present (Traill and Duncan 2000).	YES
Bush Stone-curlew *Burhinus grallarius*		E1	Lightly timbered open forest and woodland, or partly cleared farmland with remnants of woodland, with a ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present (Marchant and Higgins 1993).	No
Diamond Firetail *Stagonopleura guttata*		V	Found in a range of habitat types including open Eucalypt forest, mallee and acacia scrubs (Pizzey and Knight 1997). This species is granivorous, feeding mainly on seeds of grasses.	YES
Gang-gang Cockatoo *Callocephalon fimbriatum*		V	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests (Higgins 1999). Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest (Forshaw and Cooper 1981). In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas (Shields and Crome 1992). This species requires tree hollows, usually within tall mature sclerophyll forests in secluded gullies, to breed (Higgins 1999).	No
Glossy Black-cockatoo *Calyptorhynchus lathami*		V	Inhabits forest with low nutrients, characteristically with key Allocasuarina species. Tends to prefer drier forest types (NPWS 1999a) with a middle stratum of Allocasuarina below Eucalyptus or Angophora. Often confined to remnant patches in hills and gullies (Higgins 1999). Breed in hollows stumps or limbs, either living or dead (Higgins 1999).	No
Hooded Robin *Melanodryas cucullata*		V	This species lives in a wide range of temperate woodland habitats, and a range of woodlands and shrublands in semi-arid areas (Traill and Duncan 2000).	YES
Latham's Snipe *Gallinago hardwickii*	M		Typically found on wet soft ground or shallow water with good cover of tussocks. Often found in wet paddocks, seepage areas below dams (Pizzey and Knight 1997).	No
Powerful Owl *Ninox strenua*		V	Occupies wet and dry eucalypt forests and rainforests. Can occupy both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. It is most commonly recorded within Red Turpentine in tall open forests and Black She-oak within open forests (Debus and Chafer 1994). Large mature trees with hollows at least 0.5 m deep are required for nesting (Garnett 1992). Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials (Gibbons and Lindenmayer 1997). Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm (Gibbons and Lindenmayer 1997).	No
Regent Honeyeater *Xanthomyza phrygia*	E	E1	A semi-nomadic species occurring in temperate Eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forests associations and wet lowland coastal forests (Pizzey 1983, NPWS 1999c).	YES
Rufous Fantail *Rhipidura rufifrons*	M		Migratory species that prefers dense, moist undergrowth of tropical rainforests and scrubs. During migration it can stray into gardens and more open areas (Pizzey 1983).	No

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Satin Flycatcher *Myiagra cyanoleuca*	M		Migratory species that occurs in coastal forests, woodlands and scrubs during migration. Breeds in heavily vegetated gullies (Pizzey 1983).	No
Speckled Warbler *Pyrrholaemus sagittata*		V	This species occurs in eucalypt and cypress woodlands on the hills and tablelands of the Great Dividing Range. They prefer woodlands with a grassy understorey, often on ridges or gullies (Blakers *et al.* 1984) (NSW Scientific Committee 2001). The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds (Blakers *et al.* 1984) (NSW Scientific Committee 2001). Home ranges vary from 6-12 hectares (NSW Scientific Committee 2001).	No
Swift Parrot *Lathamus discolor*	E	E1	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects (Forshaw and Cooper 1981). The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW (Shields and Crome 1992). This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability (Pizzey 1983).	YES
Turquoise Parrot *Neophema pulchella*		V	Occurs in open woodlands and eucalypt forests with a ground cover of grasses and understorey of low shrubs (Morris 1980). Generally found in the foothills of the Great Divide, including steep rocky ridges and gullies (Higgins 1999). Nest in hollow-bearing trees, either dead or alive; also in hollows in tree stumps. Prefer to breed in open grassy forests and woodlands, and gullies which are moist (Higgins 1999).	No
White-bellied Sea-eagle *Haliaeetus leucogaster*	M		A migratory species that is resident to Australia. Found in terrestrial and coastal wetlands; favouring deep freshwater swamps, lakes and reservoirs; shallow coastal lagoons and saltmarshes (English and Predavec 2001).	No
White-throated Needletail *Hirundapus caudacutus*	M		An aerial species found in feeding concentrations over cities, hilltops and timbered ranges (Pizzey 1983).	No
Brush-tailed Rock-wallaby *Petrogale penicillata*	V	E1	Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves and crevices (Eldridge and Close 1995).	No
Common Bent-wing Bat *Miniopterus schreibersii bassanii*	C	V	Uses a broad range of habitats including rainforests, wet and dry sclerophyll forests, open woodlands and open grasslands (Churchill 1998). Roosts in caves, but can also use manmade structures such as mines and road culverts (Dwyer 1995, Churchill 1998). Specific caves are used as nursery caves, containing a large number of individuals, which can be used year after year (Dwyer 1995, Churchill 1998).	No
Eastern False Pipistrelle *Falsistrellus tasmaniensis*		V	Inhabit sclerophyll forests, preferring wet habitats where trees are more than 20 m high (Churchill 1998). Two observations have been made of roosts in stem holes of living eucalypts (Phillips 1995). There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain sedentary but enter torpor (Menkhorst and Lumsden 1995). This species also appears to be highly mobile and records showing movements of up to 12 km between roosting and foraging sites (Menkhorst and Lumsden 1995).	No
Eastern Freetail-bat *Mormopterus norfolkensis*		V	Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species habits (Allison and Hoye 1995, Churchill 1998).	YES

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Eastern Pygmy-possum *Cercartetus nanus*		V	Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Will often nest in tree hollows, but can also construct its own nest (Turner and Ward 1995). Because of its small size it is able to utilise a range of hollow sizes including very small hollows (Gibbons and Lindenmayer 1997). Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5ha area over a 5 month period (Ward 1990).	No
Greater Broad-nosed Bat *Scoteanax rueppellii*		V	Prefer moist gullies in mature coastal forests and rainforests, between the Great Dividing Range and the coast. They are only found at low altitudes below 500 m (Churchill 1998)In dense environments they utilise natural and human-made opening in the forest for flight paths. Creeks and small rivers are favoured foraging habitat (Hoye and Richards 1995). This species roosts in hollow tree trunks and branches (Churchill 1998).	No
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, Melaleuca swamps and Banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost (Tidemann 1995) although some individuals may travel up to 70 km (Augee and Ford 1999).	YES
Koala *Phascolarctos cinereus*		V	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall (Reed and Lunney 1990, Reed *et al.* 1990).	YES
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range (Hoye and Dwyer 1995). Can also be found on the edges of rainforests and in wet sclerophyll forests (Churchill 1998). This species roosts in caves and mines in groups of between 3 and 37 individuals (Churchill 1998).	No
Large-footed Myotis *Myotis adversus*		V	Occurs in most habitat types as long as they are near permanent water bodies, including streams, lakes and reservoirs. Commonly roost in caves, but can also roost in tree hollows, under bridges and in mines (Richards 1995, Churchill 1998).	YES
Long-nosed Potoroo *Potorous tridactylus*	V	V	Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy (Johnston 1995).	No
Southern Brown Bandicoot *Isoodon obesulus*	E	E1	Prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time (Braithwaite 1995). A mosaic of post fire vegetation is important for this species (Maxwell *et al.* 1996).	No
Spotted-tailed Quoll *Dasyurus maculatus*	E	V	Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests (Dickman and Read 1992). Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage (Edgar and Belcher 1995).	No
Squirrel Glider *Petaurus norfolcensis*		V	Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range (Suckling 1995). Requires abundant hollow bearing trees and a mix of eucalypts, banksias and acacias (Quin 1995). There is only limited information available on den tree use by Squirrel gliders, but it has been observed using both living and dead trees as well as hollow stumps (Gibbons and Lindenmayer 1997). Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked (Menkhorst *et al.* 1988).	No
Yellow-bellied Glider *Petaurus australis*		V	Restricted to tall native forests in regions of high rainfall. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows. Critical elements of habitat include sap-site trees, winter flowering eucalypts, mature trees suitable for den sites and a mosaic of different forest types (NPWS 1999d).	No

Species	EPBC Act	TSC Act	Habitat	Potential Habitat
Broad-headed Snake *Hoplocephalus bungaroides*	V	E1	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer (Webb 1996, Webb and Shine 1998).	No
Rosenberg's Goanna *Varanus rosenbergi*		V	This species is a Hawkesbury/Narrabeen sandstone outcrop specialist (Wellington and Wells 1985). Occurs in coastal heaths, humid woodlands and both wet and dry sclerophyll forests (Cogger 1992).	No
Cumberland Plain Land Snail *Meridolum corneovirens*		E1	Most likely restricted to Cumberland Plain, Castlereagh Woodlands and boundaries between River-flat Forest and Cumberland Plain Woodland. It is normally found beneath logs, debris and amongst accumulated leaf and bark particularly at the base of trees. May also use soil cracks for refuge (NPWS 2000a).	No

4.4.2 Koala Habitat (SEPP 44)

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas, ensuring a permanent free-living population over their present range and attempting to reverse the current trend of koala population decline.

The SEPP 44 policy applies to land within Local Government Areas (including Wollondilly) listed in SEPP 44, Schedule 1 for which a development application has been made (SEPP 44, Section 6) and Council is the determining authority. Under the policy the distinction is made between 'potential' and 'core' Koala habitat.

"Potential Koala habitat" means areas of native vegetation where the trees of the types listed in Schedule 2 of the Policy constitute at least 15 per cent of the total number of trees in the upper or lower strata of the tree component.

"Core Koala habitat" means an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young), recent sightings and historical records of a population.

Eucalyptus tereticornis (Forest Red Gum) and *Eucalyptus punctata* (Grey Gum) are listed Koala feed trees and are present in the study area. Forest Red Gum occurs in fragmented and disturbed stands of remnant Cumberland Plain Woodland in densities greater than 15 per cent. Grey Gum occurs in fragmented and disturbed stands of remnant Shale Sandstone Transition Forest in densities greater than 15 per cent. Shale Sandstone Transition Forest within the study area also contains Forest Red Gum trees, mainly in densities lower than 15 per cent. Within the study area, these two plant communities are therefore considered Potential Koala Habitat.

Koalas, or indirect evidence of them, were not observed during the current surveys. However, one Koala was recorded at the south-eastern extremity of the study area in 2002 (DECC Atlas of NSW Wildlife). This record is within a large, continuous stand of forest vegetation to the south-west of the study area. As this area of vegetation is over 300 metres from the nearest borehole site, it is highly unlikely to experience direct or indirect impacts as a result of the proposal.

Potential Koala habitat exists within the study area in small, degraded stands. Direct impacts resulting from the proposal (Within areas CP04, PA02 & PA03) are not expected to significantly reduce the quality or extent of potential Koala habitat (Appendix 3). For these reasons the area is not considered to be Core Koala Habitat and a Plan of Management under SEPP 44 is not recommended.

5.0 IMPACT ASSESSMENT

5.1 Predicted Impacts

The disturbance footprint of each borehole site comprises a 30 X 40 metre compound with additional light vehicle parking for up to six vehicles. Additional construction of access tracks may be required. It is therefore assumed that a total area of 50 X 50 metres (0.2 hectares) for all disturbed areas is adequate to consider all direct and indirect impacts associated with the proposal.

The direct impacts associated with the proposal include:

- The clearance of 0.5 hectares of Shale Sandstone Transition Forest at boreholes PA02 and PA03. This also represents the removal of potential habitat for a number of threatened plants. (Refer to Sections 5.3 and 5.4 for a discussion of the significance of this impact under the TSC Act and EPBC Act respectively).

- The fragmentation of Shale Sandstone Transition Forest at site PA03. This also represents fragmentation of potential habitat for a number of threatened plants. (Refer to Sections 5.3 and 5.4 for a discussion of the significance of this impact under the TSC Act and EPBC Act respectively).

- The clearance of 0.2 hectares of Cumberland Plain Woodland at borehole site CP04. (Refer to Sections 5.3 and 5.4 for a discussion of the significance of this impact under the TSC Act and EPBC Act respectively).

- Disturbance to 0.5 hectares of native pasture at borehole sites CP03 and CP04. Provided appropriate amelioration measures are implemented, this disturbance is not anticipated to have an impact on any issues of an ecological significance at either CP03 or CP04. This impact has not been considered further in this report.

- Disturbance to 4.0 hectares of exotic pasture at the remaining 16 borehole sites. Provided appropriate amelioration measures are implemented, this disturbance is not anticipated to have an impact on any issues of an ecological significance at any of these sites. This impact has not been considered further in this report.

The indirect impacts associated with the proposal include (in the absence of adequate amelioration measures):

- the potential for erosion during and after construction at all sites;

- the possible provision of suitable conditions for weed invasion, most significantly, at sites PA02 and PA03; and,
- increased human activity within or adjacent to sites PA02 and PA03.

5.2 Proposed Amelioration Measures

The following measures have been recommended in order to ameliorate the impacts of the proposal:

- adjustment of the location of boreholes and access tracks to avoid native trees;
- where possible, trees with hollows should be retained;
- where possible, proposed boreholes and access tracks should be located within existing cleared areas;
- sediment and erosion control measures should be implemented on all sites to prevent erosion during and after construction;
- disturbance to native vegetation should be minimised, or, where disturbance is unavoidable, borehole sites should be rehabilitated using locally sourced tubestock and brush-matting;
- the spread of weeds should be avoided;
- where clearing of native vegetation is unavoidable, native shrubs, logs and bush-rock should be stockpiled on the side of the proposed boreholes and access routes replaced following completion of the works;
- If required, bush regeneration and weed control should be undertaken to ensure the flora and fauna of the local area are protected throughout the construction and operation phases of the proposal; and,
- any chemicals used on site will be taken off site after use and disposed of appropriately.

It is recommended that boreholes CP04, PA02 and PA03 be relocated as they are currently located within areas of high ecological sensitivity, namely within patches of CPW and SSTF in good and moderate condition. The proposed new locations for these boreholes are as follows (Figure 4).

- CP04 moved to the south of its proposed location, closer to an existing road and within a cleared area, reducing impacts on CPW (GPS co-ordinates 294810 6217375);
- PA02 moved to the south-east of its proposed location, into a cleared area and away from SSTF, reducing the impacts on the SSTF (GPS co-ordinates 294033 6218373)

- PA03 moved to the south-east of its proposed location, into a relatively cleared area and away form the SSTF in good condition, reducing the impacts on SSTF in good condition including impacts of fragmentation (GPS coordinates 294449 6218083).

5.3 Part 3A Guidelines for Threatened Species Assessment (EP&A Act)

The impacts of the proposal on threatened biota listed under the TSC Act have been undertaken following the Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC & DPI 2005). Where threatened biota **is recorded** within a study area, an impact assessment is required under the EP&A Act. When threatened biota **is not recorded** during a survey, the presence of potential habitat for this species is used to determine the need to undertake an impact assessment under the EP&A Act. Where there is no potential habitat in the study area for threatened biota, there is unlikely to be any impact on these species and therefore these species are not required to be considered further.

The impact assessments included in Appendix 3 incorporate a consideration of the predicted impacts and amelioration measures as outlined in Sections 5.1 and 5.2 respectively.

5.3.1 Endangered Ecological Communities

The study area contains Cumberland Plain Woodland (site CP04) and Shale Sandstone Transition Forest (sites PA02 and PA03) which are listed as endangered ecological communities under the TSC Act. The impact of the proposal on each of these communities has been considered in Appendix 4.

5.3.2 Flora

Cumberland Plain Woodland (site CP04) provides potential habitat for the plant species *Pimelea spicata, Pomaderris brunnea,* and *Pultenaea pedunculata*.

Shale Sandstone Transition Forest (sites PA02 and PA03) provides potential habitat for the plant species *Grevillea parviflora* ssp. *parviflora*, *Persoonia bargoensis* and *Pultenaea pedunculata*. Note that potential habitat also exists for *Pultenaea pedunculata* in Cumberland Plain Woodland.

Each of these species is listed as threatened on the TSC Act and, as such, the impact of the proposal on these species has been considered in Appendix 4.

5.3.3 Fauna

No threatened fauna were recorded during the current survey. However, the Eastern Freetail-bat, The Grey-headed Flying Fox, the Large-footed Myotis and the Koala were recorded within or on the edge of the study area boundary. Where there is potential habitat (foraging or breeding resources) for a threatened species in the study area, further consideration must be given to the potential impact of the proposal on these species.

The proposal may significantly impact threatened species by causing any of the following situations to arise:

- death or injury of individuals;
- loss or disturbance of limiting foraging resources; and
- loss or disturbance of limiting breeding resources.

Limiting resources are specialised habitat components that species are dependent on for their ongoing survival. Such limiting resources are predominantly associated with specialised breeding habitats (such as tree hollows or suitable nest/maternity roost sites) that occur at low densities, with high levels of competition from a range of species. However for some species, limiting resources include specialised foraging habitats that have a restricted distribution (such as Koalas feeding only on specific tree species).

The study area contains potential habitat for the Black-chinned Honeyeater, Brown Treecreeper (eastern subspecies), Diamond Firetail, Hooded Robin, Eastern Freetail-bat, Grey-headed Flying Fox, Koala, Large-footed Myotis, Swift Parrot and Regent Honeyeater.

Impact assessments have been prepared for these species in Appendix 3. The remaining 28 threatened species were not recorded within the study area and potential habitat for these species does not occur within the study area, therefore these species are not considered further.

5.3.4 Conclusions of the Impact Assessments

The impact assessments (Appendix 3) concluded that the proposal is likely to have a minor impact on threatened biota, as listed on the TSC Act, provided recommended ameliorative measures are adhered to.

5.3.5 Key Thresholds

The Part 3A Guidelines of the EP&A Act (DEC & DPI 2005) set out a number of key thresholds which need to be addressed to justify the impacts of the proposal

on threatened species, populations or ecological communities. The key thresholds are (DEC & DPI 2005):

- whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.
- whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.
- whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.
- whether or not the proposal will adversely affect critical habitat.

Provided that the amelioration measures detailed in Section 5.2 are implemented and boreholes CP04, PA02 and PA03 are relocated to reduce impacts on SSTF and CPW (Figure 4), the proposal is likely to maintain the biodiversity values of the local area.

Based on the impact assessments following the Part 3A Guidelines of the EP&A Act for Threatened Species Assessment (Appendix 3), the proposal is unlikely to reduce the long-term viability of, accelerate the extinction of and/or adversely affect critical habitat for threatened species and/or populations within the study area (Table 6).

Table 3: Assessment of Key Thresholds

Threatened Biota	Will the proposal reduce the long-term viability of a local population of the species, population or EEC?	Will the proposal accelerate the extinction of the species, population or EEC or place it at risk of extinction?	Will the proposal adversely affect critical habitat?
Endangered Ecological Communities			
Cumberland Plain Woodland	Unlikely	Unlikely	No
Shale Sandstone Transition Forest	Unlikely	Unlikely	No
Threatened Flora			
Grevillea parviflora ssp. *parviflora*	Unlikely	Unlikely	No
Persoonia bargoensis	Unlikely	Unlikely	No
Pimelea spicata	Unlikely	Unlikely	No
Pomaderris brunnea	Unlikely	Unlikely	No
Pultenaea pedunculata.	Unlikely	Unlikely	No
Threatened Fauna			
Grey-headed Flying Fox	Unlikely	Unlikely	No
Koala	Unlikely	Unlikely	No
Microchiropteran Bats	Unlikely	Unlikely	No

Threatened Biota	Will the proposal reduce the long-term viability of a local population of the species, population or EEC?	Will the proposal accelerate the extinction of the species, population or EEC or place it at risk of extinction?	Will the proposal adversely affect critical habitat?
Regent Honeyeater	Unlikely	Unlikely	No
Swift Parrot	Unlikely	Unlikely	No
Woodland Birds	Unlikely	Unlikely	No

5.4 Commonwealth Significance Impact Criteria (EPBC Act)

Under the Commonwealth EPBC Act, if the proposal has the potential to have an adverse impact on threatened biota listed on the Act, the proposal must be referred to the Federal Minister for the Environment for further consideration. The Significant Impact Criteria are used to assess the likelihood of impact.

The address of Significant Impact Criteria included in Appendix 4 incorporates a consideration of the predicted impacts and amelioration measures as outlined in Sections 5.1 and 5.2 respectively.

5.4.1 Endangered Ecological Communities

Two endangered ecological communities listed on the EPBC Act were recorded within the study area; Cumberland Plain Woodland (site CP04) and Shale Sandstone Transition Forest (sites PA02 and PA03). Significant Impact Criteria have been addressed for both of these Endangered Ecological Communities in Appendix 4.

5.4.2 Flora

Cumberland Plain Woodland (site CP04) provides potential habitat for the threatened flora species *Pimelea spicata* and *Pomaderris brunnea*.

Shale Sandstone Transition Forest (sites PA02 and PA03) provides potential habitat for *Grevillea parviflora* ssp. *parviflora* and *Persoonia bargoensis*.

These plants are listed as threatened on the EPBC Act and, as such, Significant Impact Criteria have been conducted for each of these species (Appendix 4).

5.4.3 Fauna

Twenty-one threatened fauna species were recorded within the locality (DEH online database). The study area contains potential habitat for the Grey-headed Flying Fox, Swift Parrot and the Regent Honeyeater.

Assessments of the Significance Impact Criteria have been prepared for these species in Appendix 4. Potential habitat for the remaining 18 threatened species recorded within the locality does not occur within the study area or is not limiting, and therefore Assessments of Significance are not required for these species.

5.4.4 Conclusions of the Significant Impact Criteria

The Significant Impact Criteria Assessments under the EPBC Act (Appendix 4) found that the proposal is not likely to have a significant impact on threatened species, endangered ecological communities or their habitats, as listed on the EPBC Act, provided recommended ameliorative measures are adhered to.

6.0 CONCLUSION

The study area is in good to moderate condition, with disturbances such as the farming activities, roads and powerline easments fragmenting the existing bushland and resulting in weed invasion.

The proposal will involve clearing approximately 1 ha of native vegetation, including Shale Sandstone Transition Forest and Cumberland Plain Woodland which are listed as Endangered Ecological Communities on the TSC Act and EPBC Act.

No threatened plant species were recorded within the study area. However, potential habitat for five threatened species (*Grevillea parviflora* ssp. *parviflora*, *Persoonia bargoensis*, *Pimelea spicata*, *Pomaderris brunnea* and *Pultenaea pedunculata*) occurs within the study area.

The proposal is likely to remove or modify potential habitat for ten threatened species: Black-chinned Honeyeater, Brown Treecreeper (eastern subspecies), Diamond Firetail, Hooded Robin, Eastern Freetail-bat, Grey-headed Flying Fox, Koala, Large-footed Myotis, Swift Parrot and Regent Honeyeater.

Impact Assessments following the Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC & DPI 2005) and Significant Impact Guidelines under the EPBC Act (DEH 2006) were carried out for threatened biota occurring or with potential habitat in the study area. It was found the impacts of the proposal are likely to be minor.

Potential Koala habitat within the study area was assessed according to the SEPP 44 Policy. Habitat within the study area was considered Potential Habitat for Koalas and not Core Habitat. Due to the moderate to poor quality of potential habitat within the study area and the extent of higher quality habitat within the locality, the proposal was found unlikely to significantly reduce the quality or extent of Potential Koala habitat within the study area.

A number of amelioration measures are recommended in Section 5.2 to reduce the potential impacts of the proposal on flora and fauna of the local area.

FIGURES

Figure 3: Location of the study area in a regional context.

Figure 4: The proposal

Figure 5: Vegetation communities within the vicinity of the study area.

Figure 6: Threatened flora listed on the TSC Act that have been recorded within 10 km of the study area.

Figure 7: Threatened fauna listed on the TSC Act that have been recorded within 10 km of the study area.

PLATES

Plate 1: Exotic Pasture, present at 16 of the sites.

Plate 2: Native Pasture at site CP03.

Plate 3: Cumberland Plain Woodland at site CP04.

Plate 4: Shale Sandstone Transition Forest at site PA03.

APPENDICES

APPENDIX 1

Flora Results

Scientific Name	Common Name	Weeds
Acacia floribunda	White Sally	
Acacia parramattensis	Parramatta Wattle	
Andropogon virginicus	Whisky Grass	*
Angophora floribunda	Rough-barked Apple	
Aristida vagans	Threeawn Speargrass	
Briza maxima	Quaking Grass	*
Bromus catharticus	Prairie Grass	*
Bursaria spinosa ssp. *spinosa*	Sweet Bursaria	
Calotis dentex		
Cassytha pubescens		
Centaurium tenuiflorum	Slender Centaury	*
Centella asiatica	Pennywort	
Cirsium vulgare	Spear Thistle	*
Cynodon dactylon	Common Couch	
Dichondra repens	Kidney Weed	
Echinopogon ovatus	Forest Hedgehog Grass	
Einadia hastata	Berry Saltbush	
Eucalyptus crebra	Narrow-leaved Ironbark	
Eucalyptus fibrosa	Red Ironbark	
Eucalyptus globoidea	White Stringybark	
Eucalyptus moluccana	Grey Box	
Eucalyptus punctata	Grey Gum	
Eucalyptus tereticornis	Forest Red Gum	
Exocarpos cupressiformis	Native Cherry	
Gahnia aspera		
Hypochaeris radicata	Catsear	*
Imperata cylindrica var. *major*	Blady Grass	
Kunzea ambigua	Tick Bush	
Lolium perenne	Perennial Ryegrass	*
Lomandra longifolia	Spiny-headed Mat-rush	
Lomandra multiflora ssp. *multiflora*	Many-flowered Mat-rush	
Microlaena stipoides var. *stipoides*	Weeping Grass	
Olea europaea	Common Olive	*
Oxalis perennans	Grassland Wood-sorrel	
Paspalum dilatatum	Paspalum	*
Persoonia linearis	Narrow-leaved Geebung	
Plantago lanceolata	Lamb's Tongues	*
Senecio madagascariensis	Fireweed	*
Sida rhombifolia	Paddy's Lucerne	*
Themeda australis	Kangaroo Grass	
Zieria smithii	Sandfly Zieria	

APPENDIX 2

Fauna Results

Common Name	Latin Name	Observation
Amphibians		
Common Eastern Froglet	*Crinia signifera*	W
Verreaux's Tree Frog	*Litoria verreauxii*	W
Birds		
Australasian Grebe	*Tachybaptus novaehollandiae*	O
Australian King-Parrot	*Alisterus scapularis*	OW
Australian Magpie	*Gymnorhina tibicen*	OW
Australian Pipit	*Anthus novaeseelandiae*	O
Australian Raven	*Corvus coronoides*	OW
Australian Wood Duck	*Chenonetta jubata*	O
Bell Miner	*Manorina melanophrys*	OW
Black Swan	*Cygnus atratus*	O
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O
Black-fronted Dotterel	*Elseyornis melanops*	O
Black-shouldered Kite	*Elanus axillaris*	O
Brown Thornbill	*Acanthiza pusilla*	OW
Common Myna*	*Acridotheres tristis*	OW
Common Starling*	*Sturnus vulgaris*	OW
Eastern Rosella	*Platycercus eximius*	OW
Eastern Whipbird	*Psophodes olivaceus*	W
Eastern Yellow Robin	*Eopsaltria australis*	W
Eurasian Coot	*Fulica atra*	O
Flame Robin	*Petroica phoenicea*	O
Galah	*Cacatua roseicapilla*	O
Grey Butcherbird	*Cracticus torquatus*	W
Grey Fantail	*Rhipidura fuliginosa*	OW
Grey Shrike-thrush	*Colluricincla harmonica*	W
Grey Teal	*Anas gracilis*	O
Jacky Winter	*Microeca fascinans*	W
Long-billed Corella	*Cacatua tenuirostris*	OW
Magpie-lark	*Grallina cyanoleuca*	OW
Masked Lapwing	*Vanellus miles*	OW
Nankeen Kestrel	*Falco cenchroides*	O
Noisy Miner	*Manorina melanocephala*	OW
Pacific Black Duck	*Anas superciliosa*	O
Pied Cormorant	*Phalacrocorax varius*	O
Pied Currawong	*Strepera graculina*	OW
Purple Swamphen	*Porphyrio porphyrio*	O
Red-rumped Parrot	*Psephotus haematonotus*	OW
Silvereye	*Zosterops lateralis*	OW
Spotted Pardalote	*Pardalotus punctatus*	W
Straw-necked Ibis	*Threskiornis spinicollis*	O
Striated Pardalote	*Pardalotus striatus*	W
Sulphur-crested Cockatoo	*Cacatua galerita*	OW

Common Name	Latin Name	Observation
Superb Fairy-wren	*Malurus cyaneus*	W
Welcome Swallow	*Hirundo neoxena*	OW
White-faced Heron	*Egretta novaehollandiae*	O
Willie Wagtail	*Rhipidura leucophrys*	OW
Yellow-faced Honeyeater	*Lichenostomus chrysops*	OW
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O
Mammals		
Cattle (domestic)*	*Bos taurus*	O
Fox*	*Vulpes vulpes*	O
Rabbit*	*Oryctolagus cuniculus*	O
Unidentified macropod	*Macropod sp.*	O

Key: **O:** Observed
W: Heard
***:** Introduced species

APPENDIX 3

Impact Assessment following the Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act

Ecological Communities

An impact assessment is included for two Endangered Ecological Communities occurring in the study area: Cumberland Plain Woodland and Shale Sandstone Transition Forest.

Cumberland Plain Woodland

Cumberland Plain Woodland (CPW) is listed as an Endangered Ecological Community in Part 3 of Schedule 1 of the TSC Act.

CPW occurs in the study area at and adjacent to borehole CP04. The condition of the vegetation at CP04 was assessed as being **moderate**. Approximately 0.2 hectares will be removed or modified by the proposal at borehole CP04.

Is the proposal likely to have an adverse effect on the extent or composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction?

The vegetation in the study area occurs within a rural area with expanding residential developments in the local area. The proposal will result in the removal or modification of approximately 0.2 ha of CPW in the study area. There is approximately 1,959 ha of Cumberland Plain woodland mapped as occurring within 10 km of the study area (NPWS 2002b). The impacted area amounts to 0.01 per cent of the local occurrence of CPW, which is not considered to be a significant amount. Therefore, it is **unlikely** that the proposal will have an adverse effect on the extent of CPW at CP04 such that its local occurrence is likely to be placed at risk of extinction.

The patch of CPW that will be removed as a result of the proposal is in a moderate condition with some regenerative potential due to minimal disturbance and its connectivity to similar woodland along Mallaty Creek. The site had also been previously impacted by historical logging, weed invasion, fire, and edge effects. Therefore, the ecosystem functioning of the CPW at CP04 has been diminished due to the variety of disturbances that the vegetation has been exposed to. While the CPW at CP04 has been assessed as being in a moderate condition, the structure and species composition has already been previously modified, with exotic species dominating the ground layer. Therefore, it is **unlikely** that the proposal will substantially and adversely modify the composition of CPW such that its local occurrence is likely to be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the ecological community?

The vegetation in the study area occurs within a rural area with expanding residential developments in the local area. The proposal will result in the removal or modification of approximately 0.2 ha of CPW in the study area. This amounts to 0.01 per cent of the local occurrence of CPW, which is not considered to be a significant amount.

The patch of CPW to be disturbed is currently part of a riparian corridor along Mallaty Creek and the 0.2 ha to be impacted occurs along the edge of this corridor. Therefore, while the extent of CPW in the study area will be reduced by 0.2 ha, the removal of this patch would not result in the isolation of any CPW.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The CPW within the study area is at the south-eastern limit of the distribution of this EEC.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the ecological community in the locality.

Given the moderate condition and the insignificant amount of the CPW to be removed or modified by the proposal, this patch of vegetation is not considered to be vital for the long term survival of the community in the locality.

Will the proposal impact critical habitat (either directly or indirectly)?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for CPW.

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

A recovery plan for CPW is currently being prepared.

DECC lists a number of recovery actions for Cumberland Plain Woodland. Those relevant to the proposal include (DEC 2005d):

- Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants of the community in the land use planning process, particularly development consents, rezonings and regional planning – approximately 0.2 ha of the ecological community will be cleared for the proposal.

- Protect habitat by controlling run-off entering the site if it would change water, nutrient or sediment levels or cause erosion – sedimentation and erosion control will be implemented as part of the proposal.

- Weed control – weed management will be implemented on the site.

- Undertake restoration including bush regeneration and revegetation – the site will be revegetated using a range of techniques post construction.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

The following Key Threatening Processes listed under the TSC Act may threaten CPW:

- Clearing of native vegetation – the proposal would result in the direct removal of approximately 0.2 ha of CPW;

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands – the proposal is not likely to significantly alter the hydrology of the area.

- Invasion of native plant communities by exotic perennial grasses – exotic perennial grasses should be targeted as a part of any weed management strategies.

- Predation, habitat destruction, competition and disease transmission by feral pigs – the proposal is not likely to increase the threat of feral pigs.

- Anthropogenic climate change – the proposal may indirectly increase the threat of anthropogenic climate change, as approximately 1 ha of native vegetation would be required to be removed or modified and some methane will be burnt and released to the atmosphere as a result of the installation. The overall increase in the threat of anthropogenic climate change is likely to be relatively minor.

- High frequency fire – the proposal is not likely to alter the fire regime of the locality.

- Exotic vines and Scramblers – no exotic vines were recorded in the study area.

- Lantana camara - The proposal is not likely to increase the threat of *Lantana camara* in the local area.

Conclusion

Given the size and condition of the patch of Cumberland Plain Woodland that will be impacted by the proposal, the impact of the proposal on the local occurrence of Cumberland Plain Woodland likely to be minor.

Shale Sandstone Transition Forest

Shale Sandstone Transition Forest (SSTF) is listed as an Endangered Ecological Community in Part 3 of Schedule 1 of the TSC Act.

Shale Sandstone Transition Forest occurs in the study area at boreholes PA02 and PA03. The condition of the vegetation at PA02 was assessed as being **moderate** while the condition of the vegetation at PA03 was assessed as being **good**. Approximately 0.5 hectares will be removed or modified by the proposal at both of these boreholes.

Is the proposal likely to have an adverse effect on the extent or composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction?

The vegetation in the study area occurs within a rural area with expanding residential developments in the local area. The proposal will result in the removal or modification of approximately 0.5 ha of SSTF in the study area. There is approximately 3,942 ha of SSTF mapped as occurring within 10 km of the study area (NPWS 2002b). The impacted area amounts to 0.01 per cent of the local occurrence of SSTF, which is not considered to be a significant amount. Therefore, it is **unlikely** that the proposal will have an adverse effect on the extent of SSTF such that its local occurrence is likely to be placed at risk of extinction.

The two patches of SSTF that will be removed or modified as a result of the proposal are in a moderate (PA02) and good (PA03) condition.

Site PA02 was assessed as being in **moderate** condition due to low levels of weed invasion and good resilience. The site had an undisturbed soil profile and was adjacent to native woodland. The ecological value of PA02 has been diminished as a result of an altered vegetation structure due to on-going

management as an asset protection zone. These disturbances have altered the structure and composition of the SSTF at borehole PA02 such that ecosystem function has been substantially diminished.

Site PA03 was assessed as being in **good** condition due to an intact vegetation structure and composition. The site had good regenerative potential due to minimised disturbance to the soil profile and its proximity to adjacent native woodland.

Both sites had previously been impacted by historical logging, weed invasion, fire, and edge effects.

It is **unlikely** that the proposal will substantially and adversely modify the composition of SSTF such that its local occurrence is likely to be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the ecological community?

The proposal will result in the removal or modification of approximately 0.5 ha of SSTF in the study area. This amounts to 0.01 per cent of the local occurrence of SSTF, which is not considered to be a significant amount.

The patch of SSTF to be impacted at PA02 occurs on the edge of a continuous piece of bushland within an asset protection zone behind a property with horse yards. Thus fragmentation is not likely in this location.

The construction of the borehole at PA03 will occur in the middle of a patch of SSTF that is in good condition. This site, while not likely to isolate a patch of SSTF will result in a minor fragmentation of this patch of bush.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The SSTF within the study area is at the south-eastern limit of the distribution of this EEC.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the ecological community in the locality.

Despite the removal and modification of 0.5 ha of SSTF within the study area and an insignificant amount of fragmentation at borehole PA03, the SSTF to be removed in the study area is not considered to be vital for the long term survival of the community in the locality.

Will the proposal impact critical habitat (either directly or indirectly)?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for SSTF.

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

A recovery plan for SSTF is currently being prepared, as part of the recovery planning for the endangered ecological communities of the Cumberland Plain. The endangered ecological community information for SSTF (DEC 2005p) lists the following priority actions to recover this ecological community:

- Promote public involvement in restoration activities;
- Apply necessary fire regimes to maintain appropriate floristic and structural diversity;
- Protect habitat by minimising further clearing. This requires recognition of the values of all remnants in the land use planning process, particularly development consents, rezonings and regional planning;
- Protect habitat by controlling run-off entering the site if it would change water, nutrient or sediment levels or cause erosion;
- Weed control; and,
- Undertake restoration including bush regeneration and revegetation.

The proposal is not likely to interfere with the recovery of this ecological community.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

The following Key Threatening Processes listed under Schedule 3 of the TSC Act may impact on SSTF in the study area:

- 'Clearing of native vegetation' - approximately 0.5 ha of SSTF will be cleared for the proposal.
- 'Ecological consequences of high frequency fires' – the proposal is not likely to increase the frequency of fires in the area.
- 'Invasion of native plant communities by exotic perennial grasses' – weed management strategies should target the invasion of exotic perennial grasses at boreholes PA02 and PA03.
- Anthropogenic climate change – the proposal may indirectly increase the threat of anthropogenic climate change, as native vegetation would be required to be removed or modified and some methane will be burnt and released to the atmosphere as a result of the installation. The overall increase in the threat of anthropogenic climate change is likely to be relatively minor.
- 'Exotic vines and scramblers' – no exotic vines were recorded in the study area. Weed management strategies should ensure that exotic vines and scramblers do not invade the borehole sites PA02 and PA03.

Conclusion

The proposal is likely to have a minor impact on the local occurrence of SSTF as:

- The proposal is unlikely to have a major impact on the extent of SSTF within the locality.
- The proposal is unlikely to have a major impact on the composition of SSTF within the locality.
- 0.01 per cent of the local occurrence of SSTF is not considered to be a major amount of habitat.
- An minor amount of fragmentation will occur.
- The SSTF to be removed or modified not considered to be vital.
- No critical habitat has been declared for SSTF.
- The proposal is not likely to interfere with the recovery of this ecological community.

Flora

Impact assessments are undertaken for five threatened plant species with potential habitat in the study area:

- *Grevillea parviflora* spp. *parviflora*,
- *Persoonia bargoensis*,
- *Pimelea spicata*,
- *Pomaderris brunnea*, and
- *Pultenaea pedunculata*.

Grevillea parviflora ssp. *parviflora*

Grevillea parviflora ssp. *parviflora* is listed as Vulnerable on Schedule 2 of the TSC Act. This species is also listed as Vulnerable on the EPBC Act.

Grevillea parviflora subsp. *parviflora* is a low open to erect shrub, 0.3-1 m tall. It occurs in light clayey soils in woodlands and most plants appear capable of suckering from a rootstock (NSW Scientific Committee 1998a).

Grevillea parviflora ssp. *parviflora* was not recorded in the study area during the current surveys, however has previously been recorded in the south-eastern section of the study area along the Georges River (Figure 6). No works are proposed to be undertaken in this area. Potential habitat for the species exists in the SSTF in the study area, which occurs at boreholes PA02 and PA03. The condition of the vegetation at PA02 was assessed as being **moderate** while the condition of the vegetation at PA03 was assessed as being **good**. Approximately 0.5 hectares of potential habitat for *Grevillea parviflora* ssp. *parviflora* will be removed or modified by the proposal at both of these boreholes.

Is the proposal 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?

Grevillea parviflora ssp. *parviflora* is known to (DEC 2005f):

- occur in open, slightly disturbed sites such as along tracks.
- be capable of suckering from a rootstock and most populations demonstrate a degree of vegetative spread, particularly after disturbance such as fire.

- Flower between July to December as well as April-May. Flowers are insect-pollinated and seed dispersal is limited.

The proposal may impact the lifecycle of *G. parviflora* ssp. *parviflora* through habitat modification, disturbance to the soil seed bank and disrupting recruitment. However, this is unlikely as the species was not recorded in the impact area.

The proposal is not likely to alter the existing fire frequency of the local area.

The proposal is not likely to impact the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

The species is known to occur in a range of vegetation types from heath and shrubby woodland to open forest (DEC 2005f). SSTF in the study area is considered to be potential habitat for *G. parviflora* ssp. *parviflora.*

There are areas of known and potential habitat for *G. parviflora* ssp. *parviflora* in the local area, with:

- Thirteen previous recordings of the species within a 10 km radius of the study area (Figure 6);
- NPWS (2002b) mapping approximately 3,942 ha of similar potential habitat (SSTF) within a 10 km radius of the study area;

The proposal will result in the removal or modification of approximately 0.5 ha of potential habitat for *G. parviflora* spp. *parviflora* in the study area. This amounts to 0.01 per cent of the local occurrence of similar habitat (SSTF), which is not considered to be an significant amount.

The potential habitat for *Grevillea parviflora* spp. *parviflora* to be impacted at PA02 occurs on the edge of a continuous piece of bushland within an asset protection zone behind a property with horse yards. Thus fragmentation is not likely in this location.

The construction of the borehole at PA03 will occur in the middle of a patch of SSTF that is potential habitat for *Grevillea parviflora* spp. *parviflora* and considered to be in good condition. This site, while not likely to isolate a patch of SSTF will result in a minor fragmentation of this patch of bush.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The *Grevillea parviflora* ssp. *parviflora* population within the study area is not at the limit of the distribution for this species. *Grevillea parviflora* ssp. *parviflora* is sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast and Cessnock and Kurri Kurri in the Lower Hunter.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Despite the removal and modification of 0.5 ha of potential habitat for *Grevillea parviflora* spp. *parviflora* within the study area and an insignificant amount of fragmentation at borehole PA03, the SSTF to be removed in the study area is not considered to be vital for the long term survival of the community in the locality.

Will the proposal impact critical habitat (either directly or indirectly)?

Under the TSC Act, the Director-General of Department of Environment and Conservation maintains a Register of Critical Habitat. To date, no critical habitat has been declared for *G. parviflora* spp. *parviflora.*

The proposal will not have an adverse effect on critical habitat (directly or indirectly).

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

To date, no recovery plan has been prepared for this species. DECC (2005f) has listed four priority actions to help recover *G. parviflora* spp. *parviflora* in NSW:

- Liaise with land managers to encourage the preparation of site management plans and the implementation of appropriate threat abatement measures, particularly in fire management, bush regeneration, roadside management, weed control and fencing and signage.

- Monitor known populations, so that potential local extinctions are detected before they occur and mechanisms can be put in place to reverse trends.

- Conduct research into life history, genetic diversity of known populations, production and viability of seed, seed predation or germination rates and requirements.

- Identify and survey potential habitat to detect new populations.

The proposal is not likely to interfere with the recovery of the species.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

The following Key Threatening Processes listed under Schedule 3 of the TSC Act may impact on *Grevillea parviflora* ssp. *parviflora* in the study area:

- 'Clearing of native vegetation' - approximately 0.5 ha of potential habitat for *Grevillea parviflora* spp. *parviflora* will be cleared for the proposal.

- 'Ecological consequences of high frequency fires' – the proposal is not likely to increase the frequency of fires in the area.

- 'Invasion of native plant communities by exotic perennial grasses' – weed management strategies should target the invasion of exotic perennial grasses at boreholes PA02 and PA03.

- Anthropogenic climate change – the proposal may indirectly increase the threat of anthropogenic climate change, as native vegetation would be required to be removed or modified and some methane will be burnt and released to the atmosphere as a result of the installation. The overall increase in the threat of anthropogenic climate change is likely to be relatively minor.

- 'Exotic vines and scramblers' – no exotic vines were recorded in the study area. Weed management strategies should ensure that exotic vines and scramblers do not invade the borehole sites PA02 and PA03.

Conclusion:

The impact of the proposal on the local occurrence of *Grevillea parviflora* ssp. *parviflora* is likely to be minor as:

- The proposal is unlikely to have a major impact on the extent of lifecycle of *Grevillea parviflora* ssp. *parviflora* within the locality.
- The proposal is unlikely to have a major impact on the composition of potential habitat for *Grevillea parviflora* ssp. *parviflora* within the locality.
- 0.01 per cent of the local occurrence of potential habitat for *Grevillea parviflora* ssp. *parviflora* is not considered to be a major amount of habitat.
- An minor amount of fragmentation will occur.
- The potential habitat for *Grevillea parviflora* ssp. *parviflora* to be removed or modified is not considered to be vital.
- No critical habitat has been declared for *Grevillea parviflora* ssp. *parviflora*.
- The proposal is not likely to interfere with the recovery of this species.

Persoonia bargoensis

Persoonia bargoensis is listed as Endangered on the TSC Act.

Persoonia bargoensis is an erect bushy, shrub which grows to a height of 2.5 m (DEC 2005b). This species is known to occur within Shale Sandstone Transition Forest (SSTF).

Persoonia bargoensis was not recorded in the study area, however, suitable habitat does exist within SSTF in the study area. SSTF occurs at boreholes PA02 and PA03. The condition of the vegetation at PA02 was assessed as being **moderate** while the condition of the vegetation at PA03 was assessed as being **good**. Approximately 0.5 hectares of potential habitat for *Persoonia bargoensis* will be removed or modified by the proposal at both of these boreholes.

Is the proposal 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?

Persoonia bargoensis is known to (DEC 2005j):

- Occur in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravely soils.
- be likely killed by fire and recruitment is solely from seed.

- benefit from the reduced competition and increased light available on disturbance margins including roadsides.

The proposal may impact the lifecycle of *Persoonia bargoensis* through habitat modification, disturbance to the soil seed bank and disrupting recruitment. However, this is unlikely as the species was not recorded in the study area.

The proposal is not likely to alter the existing fire frequency of the local area.

The proposal is not likely to impact the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

SSTF in the study area is considered to be potential habitat for *P. bargoensis.*

There are areas of known and potential habitat for *P. bargoensis* in the local area, with:

- Twenty previous recordings of the species within a 10 km radius of the study area mostly to the south (Figure 4);
- NPWS (2002b) mapping approximately 3,942 ha of similar potential habitat (SSTF) within a 10 km radius of the study area;

The proposal will result in the removal or modification of approximately 0.5 ha of habitat for *P. bargoensis* in the study area. This amounts to 0.01 per cent of the local occurrence of similar habitat (SSTF), which is not considered to be an significant amount.

The potential habitat for *P. bargoensis* to be impacted at PA02 occurs on the edge of a continuous piece of bushland within an asset protection zone behind a property with horse yards. Thus fragmentation is not likely in this location.

The construction of the borehole at PA03 will occur in the middle of a patch of SSTF that is potential habitat for *P. bargoensis* and considered to be in good condition. This site, while not likely to isolate a patch of SSTF will result in a minor fragmentation of this patch of bush.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau. Its entire range falls between Picton, Douglas Park, Yanderra,

Cataract River and Thirlmere. The study area is at the north-eastern limit of the distribution of Persoonia bargoensis.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Despite the removal and modification of 0.5 ha of potential habitat for *P. bargoensis* within the study area and an insignificant amount of fragmentation at borehole PA03, the SSTF to be removed in the study area is not considered to be vital for the long term survival of the community in the locality.

Will the proposal impact critical habitat (either directly or indirectly)?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for *P. bargoensis.* The proposal is not likely to impact on critical habitat for this species (directly or indirectly).

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

To date, no recovery plan or threat abatement plan has been written for *P. bargoensis.* DEC (2005b) have listed 19 priority actions to assist in the recovery of this species:

- Assess the relative conservation significance of sites to determine recovery priorities;
- Advise and liaise with private land managers to facilitate the preparation and implementation of site management plans that address threatening processes;
- Incorporate best knowledge regarding appropriate fire regime into land management practices;
- Prepare species profile in accordance with contractual obligations with DEH by June 2006;
- Prepare EIA guidelines;

- Review classification of Crown land where sites occur to ensure appropriate classification and management for nature conservation;
- Ensure that council-managed land on which sites occur are appropriately classified and managed for conservation;
- Incorporate site-specific threat abatement measures for the species into Plans of Management for sites in Sydney Catchment Authority (SCA) areas;
- Prepare and implement site management plans for sites that are located on public land outside the NPWS/SCA estate;
- Develop and implement site-awareness and protection procedures for use by land owners/managers and public utilities and their contractors when undertaking road, trail, or easement maintenance;
- Restrict vehicular and pedestrian access to sites, where necessary;
- Fence sites and exclude livestock and/or feral animals, where required;
- Undertake targeted bush regeneration works, where required;
- Seek to increase the level of legislative protection for sites through land-use planning mechanisms and conservation agreements;
- Retain or re-establish vegetation and fauna movement linkages between sites;
- Prepare state and national priority recovery plan in accordance with contractual obligations between DECC and DEH by June 2006;
- Undertake management-focused ecological studies, including fire frequency requirements;
- Consider inclusion in SeedQuest NSW program for research on seed viability and requirements for successful conservation storage; and,
- Carry out targeted surveys in potential habitat, particularly freehold lands, Crown land that may be alienated, leasehold Crown land and council-managed lands.

The proposal is not likely to interfere with the recovery of this species.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

The following Key Threatening Processes listed under Schedule 3 of the TSC Act may impact on *P. bargoensis* in the study area:

- 'Clearing of native vegetation' - approximately 0.5 ha of potential habitat for *P. bargoensis* will be cleared for the proposal.
- 'Ecological consequences of high frequency fires' – the proposal is not likely to increase the frequency of fires in the area.
- 'Invasion of native plant communities by exotic perennial grasses' – weed management strategies should target the invasion of exotic perennial grasses at boreholes PA02 and PA03.
- Anthropogenic climate change – the proposal may indirectly increase the threat of anthropogenic climate change, as native vegetation would be required to be removed or modified and some methane will be burnt and released to the atmosphere as a result of the installation. The overall increase in the threat of anthropogenic climate change is likely to be relatively minor.
- 'Exotic vines and scramblers' – no exotic vines were recorded in the study area. Weed management strategies should ensure that exotic vines and scramblers do not invade the borehole sites PA02 and PA03.

Conclusion

The impact of the proposal on the local occurrence of *P. bargoensis* is likely to be minor as:

- The proposal is unlikely to have a major impact on the extent of lifecycle of *P. bargoensis* within the locality.
- The proposal is unlikely to have a major impact on the composition of potential habitat for *P. bargoensis* within the locality.
- 0.01 per cent of the local occurrence of potential habitat for *P. bargoensis* is not considered to be a major amount of habitat.
- A minor amount of fragmentation will occur.
- The potential habitat for *P. bargoensis* to be removed or modified is not considered to be vital.

- No critical habitat has been declared for *P. bargoensis*.
- The proposal is not likely to interfere with the recovery of this species.

Pimelea spicata

Pimelea spicata is listed as Endangered in Schedule 2 of the TSC Act.

Pimelea spicata is a small spreading or erect shrub growing to 50 cm (NPWS 2004). *Pimelea spicata* is known to occur in areas supporting or previously supporting Cumberland Plain Woodland.

Pimelea spicata was not recorded in the study area; however potential habitat does exist in the Cumberland Plain Woodland in the study area. CPW occurs in the study area at and adjacent to borehole CP04. The condition of the vegetation at CP04 was assessed as being **moderate**. Approximately 0.2 hectares of CPW will be removed or modified by the proposal.

Is the proposal 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?

The proposal may impact the lifecycle of *Pimelea spicata* through habitat modification, disturbance to the soil seed bank and disrupting recruitment. However, this is unlikely as the species was not recorded in the study area.

The proposal is not likely to impact the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

There are areas of known and potential habitat for *P. spicata* in the local area, with:

- Numerous previous recordings of the species within a 10 km radius of the study area, all occurring approximately 10 km to the north (Figure 4); and,
- DECC (NPWS 2002b) mapping approximately 1,959 ha of similar potential habitat (CPW) within a 10 km radius of the study area.

The vegetation in the study area occurs within a rural area with expanding residential developments in the local area. The proposal will result in the removal

or modification of approximately 0.2 ha of potential habitat for *Pimelea spicata* in the study area. This amounts to 0.01 per cent of the local occurrence of similar habitats (CPW), which is not considered to be a significant amount.

The potential habitat for *Pimelea spicata* to be disturbed is currently part of a riparian corridor along Mallaty Creek and the 0.2 ha to be impacted occurs along the edge of this corridor. Therefore, while the extent of potential habitat in the study area will be reduced by 0.2 ha, the removal of this patch would not result in the isolation of any potential habitat for *Pimelea spicata*.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Pimelea spicata has a distribution that is divided into two regional populations, one throughout the Cumberland Plain and the other throughout the Illawarra. The study area is at the south-eastern limit of the distribution of this species within the Cumberland Plain but is not at the limit of the distribution of the species as a whole.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Given the moderate condition and the insignificant amount of the potential habitat to be removed or modified by the proposal, this habitat is not considered to be vital for the long term survival of *Pimelea spicata* in the locality.

Will the proposal impact critical habitat (either directly or indirectly)?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for *Pimelea spicata.*

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

A draft recovery plan has been prepared for *Pimelea spicata* (DEC 2004a). The overall objective of this recovery plan is to ensure the continued and long-term survival of *P. spicata* in the wild by promoting the *in-situ* conservation of the species across its natural range. Specific recovery objectives include:

- conserve *P. spicata* using land-use and conservation planning mechanisms;
- identify and minimise the operation of threats at sites where *P. spicata* occurs;
- develop and implement a survey and monitoring program that will provide information on the extent and viability of *P. spicata*;
- provide the community with information that assists in conserving the species;
- raise awareness of the species and involve the community in the recovery program; and,
- conduct research that will assist future management decisions.

Since *Pimelea spicata* is not known to occur at the site, the removal of 0.2 ha of potential habitat is not considered to be inconsistent with the objectives or actions of the recovery plan.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

The following Key Threatening Processes listed under the TSC Act may threaten *Pimelea spicata*:

- Clearing of native vegetation – the proposal would result in the direct removal of potential habitat for the species;
- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands – the proposal is not likely to significantly alter the hydrology of the area.
- 'Invasion of native plant communities by exotic perennial grasses' – weed management strategies should target the invasion of exotic perennial grasses.
- Predation, habitat destruction, competition and disease transmission by feral pigs – the proposal is not likely to increase the threat of feral pigs.
- High frequency fire – the proposal is not likely to alter the fire regime of the locality.

- Anthropogenic climate change – the proposal may indirectly increase the threat of anthropogenic climate change, as native vegetation would be required to be removed or modified and some methane will be burnt and released to the atmosphere as a result of the installation. The overall increase in the threat of anthropogenic climate change is likely to be relatively minor.

- Exotic vines and Scramblers – no exotic vines were recorded in the study area. Weed management strategies should ensure that exotic vines and scramblers do not invade the borehole sites.

- *Lantana camara* - The proposal is not likely to increase the threat of *Lantana camara* in the local area. Weed management strategies should ensure that *Lantana camara* does not invade the borehole sites.

Conclusion:

Given the size and condition of the patch of potential habitat for *Pimelea spicata* (CPW) that will be impacted by the proposal, it is considered **unlikely** that the proposal will have a major impact on a local occurrence of this species.

Pomaderris brunnea

Pomaderris brunnea is listed as Vulnerable on the TSC Act.

Pomaderris brunnea is a shrub to three metres tall that has distinctively hairy stems. It grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines (DEC 2005l).

Pomaderris brunnea was not recorded in the study area, however, potential habitat for the species exists in CPW in the study area. CPW occurs in the study area at and adjacent to borehole CP04. The condition of the vegetation at CP04 was assessed as being **moderate**. Approximately 0.2 hectares will be removed or modified by the proposal at borehole CP04.

Is the proposal 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?

Pomaderris brunnea (DEC 2005l):

- Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.

- Flowers in September and October.

The proposal may impact the lifecycle of *Pomaderris brunnea* through habitat modification, disturbance to the soil seed bank and disrupting recruitment. However, this is unlikely as the species was not recorded in the study area.

The proposal is not likely to impact the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

There are areas of known and potential habitat for *P. brunnea* in the local area, with:

- Five previous recordings of the species within a 10 km radius of the study area mostly to the north-west (Figure 4); and,
- DECC (NPWS 2002b) mapping approximately 1,959 ha of similar potential habitat (CPW) within a 10 km radius of the study area.

The vegetation in the study area occurs within a rural area with expanding residential developments in the local area. The proposal will result in the removal or modification of approximately 0.2 ha of potential habitat for this species in the study area. This amounts to 0.01 per cent of the local occurrence of similar habitats (CPW), which is not considered to be a significant amount.

The potential habitat for *Pomaderris brunnea* to be disturbed is currently part of a riparian corridor along Mallaty Creek and the 0.2 ha to be impacted occurs along the edge of this corridor. Therefore, while the extent of potential habitat in the study area will be reduced by 0.2 ha, the removal of this patch would not result in the isolation of any potential habitat for *Pomaderris brunnea*.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The study area is at the south-eastern limit of the distribution of *Pomaderris brunnea* within the Cumberland Plain, however, regionally this species has a broader distribution than the Cumberland Plain. It is therefore considered that the study area is not at the limit of the distribution for this species.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Given the moderate condition and the insignificant amount of the potential habitat to be removed or modified by the proposal, this habitat is not considered to be vital for the long term survival of *Pomaderris brunnea* in the locality.

Will the proposal impact critical habitat (either directly or indirectly)?

Under the TSC Act, the Director-General of Department of Environment and Conservation maintains a Register of Critical Habitat. To date, no critical habitat has been declared for *P. brunnea.*

The proposal will not have an adverse effect on critical habitat (directly or indirectly).

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

To date, no recovery plan or threat abatement plan has been prepared for this species. DECC (DEC 2005l) has listed eight priority actions to help recover *P. brunnea*:

- Undertake review of conservation status to assess whether upgrading to endangered is warranted.
- Ensure personnel undertaking hazard reduction burns can identify species and are aware of its habitat and habitat requirements re fire intervals.
- Prepare species profile and EIA guidelines and distribute to relevant authorities.
- Negotiate with private landholders and public authorities to prepare and implement site management statements to address threats at sites on their land.
- Prepare and implement site management statements to address threats on sites on DECC estate.
- Negotiate with private landholders and public authorities to increase protection status of sites outside conservation areas.
- Undertake biological and ecological research, particularly in regard to response to fire and other disturbances.

- Undertake surveys in potential habitat.

The proposal is not likely to interfere with the recovery of this species.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

Key Threatening Processes listed on Schedule 3 the TSC Act relevant to the proposal that may impact on potential habitat for *P. brunnea* include:

- 'Clearing of native vegetation' - the proposal will result in the removal of potential habitat for this species.
- 'Ecological consequences of high frequency fires' – the proposal is not likely to alter the fire frequency of the area.
- 'Infection of native plants by *Phytophthora cinnamomi*' – the proposal is not likely to increase this KTP in the study area. As a precaution, all vehicles should be washed down prior to use on site.
- 'Invasion of native plant communities by exotic perennial grasses' – weed management strategies should target the invasion of exotic perennial grasses.
- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands – the proposal is not likely to significantly alter the hydrology of the area.
- Predation, habitat destruction, competition and disease transmission by feral pigs – the proposal is not likely to increase the threat of feral pigs.
- Anthropogenic climate change – the proposal may indirectly increase the threat of anthropogenic climate change, as native vegetation would be required to be removed or modified and some methane will be burnt and released to the atmosphere as a result of the installation. The overall increase in the threat of anthropogenic climate change is likely to be relatively minor.
- Exotic vines and Scramblers – no exotic vines were recorded in the study area. Weed management strategies should ensure that exotic vines and scramblers do not invade the borehole sites.
- *Lantana camara* - The proposal is not likely to increase the threat of *Lantana camara* in the local area. Weed management strategies should ensure that *Lantana camara* does not invade the borehole sites.

Conclusion:

Given the size and condition of the patch of potential habitat for *P. brunnea* (CPW) that will be impacted by the proposal, it is considered **unlikely** that the proposal will have a major impact on a local occurrence of this species.

Pultenaea pedunculata

Pultenaea pedunculata is listed as Endangered on the TSC Act.

Pultenaea pedunculata is a shrub that forms carpets 1 m or more wide (DEC 2005h). This species is known to occur in clay or sandy clay on Wianamatta shale, close to localised patches of Tertiary alluvium or the shale/sandstone influence (west of Appin) (DEC 2005n).

Pultenaea pedunculata was not recorded in the study area during the current surveys, however the species has previously been recorded in the study area in the vicinity of borehole PA02. Potential habitat does exist in the SSTF and CPW in the study area. Approximately 0.7 ha of potential habitat for *P. pedunculata* will be cleared or modified as part of the proposal.

Is the proposal 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?

Pultenaea pedunculata is known to (DEC 2005n):

- Occur in a range of habitats. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.
- Colonise bare ground in many parts of its range due to the creeping stems and rooting nodes.
- Flower in spring.

The proposal may impact the lifecycle of *Pultenaea pedunculata* through habitat modification, disturbance to the soil seed bank and disrupting recruitment. However, this is unlikely as the species was not recorded in the impact area.

The proposal is not likely to impact the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

Shale Sandstone Transition Forest and CPW in the study area are considered to be potential habitat for *P. pedunculata.*

There are areas of known and potential habitat for *P. pedunculata* in the local area, with:

- Five previous recordings of the species within a 10 km radius of the study area, all occurring in close proximity to the north-western section of the study area (Figure 3); and,
- DECC (NPWS 2002b) have mapped approximately 5,901 ha of SSTF and CPW within a 10 km radius of the study area.

The vegetation in the study area occurs within a rural area with expanding residential developments in the local area. Within the study area, there is approximately 5,901 ha of potential habitat for *P. pedunculata* (CPW and SSTF). The proposal will result in the removal or modification of approximately 0.7 ha of this habitat in the study area. The impacted area amounts to 0.01 per cent of the local occurrence of similar habitats (CPW and SSTF), which is not considered to be a significant amount.

The potential habitat for *P. pedunculata* to be disturbed is:

- part of a riparian corridor along Mallaty Creek, with the impacted area occurring along the edge of this corridor. Therefore the removal of this patch would not result in the isolation of any potential habitat for *P. pedunculata*.
- on the edge of a continuous piece of bushland within an asset protection zone behind a property with horse yards. Thus fragmentation is not likely in this location.
- in the middle of a patch of SSTF that is considered to be in good condition. This site, while not likely to isolate a patch of SSTF will result in a minor fragmentation of this patch of bush.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Pultenaea pedunculata is distributed from Gunnedah to Eden. The study area is not at the limit of the distribution for this species.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Despite the removal and modification of 0.7 ha of potential habitat for *P. pedunculata* within the study area and an insignificant amount of fragmentation, the potential habitat to be removed in the study area is not considered to be vital for the long term survival of the species in the locality.

Will the proposal impact critical habitat (either directly or indirectly)?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for *P. pedunculata.*

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

To date, no recovery plan or threat abatement plan has been written for *P. pedunculata*. The DECC (2005n) list nine priority actions to assist in the recovery of this species:

- Collect seed from the Villawood population for long term storage and insurance against population loss.
- Liaise with landholders of the Villawood, Prestons and Appin populations regarding management.
- Liase and negotiate with other landholders of other freehold populations regarding appropriate management.
- Review against the criteria for critically endangered.
- Install protective measures (fencing, signs, etc), if necessary, at Villawood, Appin and Prestons sites.
- Install structures to prevent accidental destruction, such as roadside signage or fencing within grazed paddocks.
- Conduct soil conservation works to prevent further erosion, where appropriate.

- Re-survey Appin, Villawood and Prestons populations to assess status.
- Prepare a regional recovery plan for this and other threatened species in the Bungonia Windellama area.

The proposal is not likely to interfere with the recovery of this species.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

Key Threatening Processes listed on Schedule 3 the TSC Act relevant to the proposal that may impact on potential habitat for *P. pedunculata* include:

- 'Clearing of native vegetation' - the proposal will result in the removal of potential habitat for this species.
- 'Ecological consequences of high frequency fires' – the proposal is not likely to alter the fire frequency of the area.
- 'Infection of native plants by *Phytophthora cinnamomi*' – the proposal is not likely to increase this KTP in the study area. As a precaution, all vehicles should be washed down prior to use on site.
- 'Invasion of native plant communities by exotic perennial grasses' – weed management strategies should target the invasion of exotic perennial grasses.
- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands – the proposal is not likely to significantly alter the hydrology of the area.
- Predation, habitat destruction, competition and disease transmission by feral pigs – the proposal is not likely to increase the threat of feral pigs.
- Anthropogenic climate change – the proposal may indirectly increase the threat of anthropogenic climate change, as native vegetation would be required to be removed or modified and some methane will be burnt and released to the atmosphere as a result of the installation. The overall increase in the threat of anthropogenic climate change is likely to be relatively minor.
- Exotic vines and Scramblers – no exotic vines were recorded in the study area. Weed management strategies should ensure that exotic vines and scramblers do not invade the borehole sites.

- Lantana camara - The proposal is not likely to increase the threat of *Lantana camara* in the local area. Weed management strategies should ensure that *Lantana camara* does not invade the borehole sites.

Conclusion

Given the size of the patch of potential habitat for *P. pedunculata* that will be impacted by the proposal, it is considered **unlikely** that the proposal will have a major impact on a local occurrence of this species.

Fauna

Impact assessments are undertaken for ten threatened animal species with potential habitat in the study area:

- Grey-headed Flying-fox
- Koala
- Microchiropteran Bats – hollow-dependant species
    - Eastern Freetail-bat
    - Large-footed Myotis
- Swift Parrot
- Regent Honeyeater
- Woodland Birds
    - Black-chinned Honeyeater (eastern subspecies),
    - Brown Treecreeper (eastern subspecies),
    - Diamond Firetail,
    - Hooded Robin (south-eastern form),

Grey-headed Flying-fox	***Pteropus poliocephalus***

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable on Schedule 2 of the TSC Act and as Vulnerable on the EPBC Act. This species congregates in large numbers at roosting sites (camps) in a wide range of vegetation types. Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring. Grey-headed Flying-foxes are known to travel up to 50 km from their camps to forage (NPWS 2001a). The diet of the Grey-headed Flying-fox is varied, encompassing a wide range of fruits and blossoms from both native and non-native trees (Strahan 1995).

Three Grey-headed Flying-fox camps have been recorded within approximately 50 km of the study area. These include a camp in Cabramatta (approximately 50 km from study area), Mt Kembla (approximately 30 km from study area) and Jamberoo (approximately 50 km from study area). The Grey-headed Flying-fox was not recorded during the current survey but has been recorded in the past within the study area (DECC Atlas of NSW Wildlife). Potential foraging habitat

for this species occurs within the woodland and forest habitat where flowering eucalypts provide potential foraging resources.

The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). The area to be modified or cleared as part of the proposal represents 0.01 per cent of the broader distribution of these habitat types within the locality (5,901 ha). Given the mobility of this species, the lack of camps within the study area (or the locality) and the extent of higher quality potential habitat within the locality and within the adjacent Dharawal State Conservation Area, it is unlikely that the proposal would have a significant impact on the habitats for this species.

Is the proposal 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?

The Grey-headed Flying-fox has been recorded once in the north-eastern corner of the study area and at other locations within the locality. The proposal will remove 0.7 ha of potential foraging habitat for this species in the form of woodland and forest habitats containing flowering, nectar producing eucalypts, such as Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus moluccana*). Potential habitat for the Grey-headed Flying-fox occurs in the study area in small, fragmented stands within agricultural areas. Potential habitat occurs in larger, continuous, higher quality stands of vegetation within the locality (such as in the Dharawal State Conservation Area). The total extent of similar habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for this species within the locality.

No camps have been recorded within the study area, the nearest known camp is located approximately 30 km south, it is therefore unlikely that the proposal would interfere with breeding of the Grey-headed Flying-fox.

Given the mobility of this species, the lack of camps within the study area (or the locality) and the extent of higher quality potential habitat within the locality, it is unlikely that the proposal would disrupt the lifecycle of the Grey-headed Flying-fox such that a viable local population of Grey-headed Flying-fox would be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

The proposal would remove 0.7 ha of potential Grey-headed Flying-fox foraging habitat of moderate to poor quality within woodland and forest habitats in the study area, representing 0.01 per cent of potential habitat within the locality. This potential habitat contains flowering, nectar producing eucalypts that may provide the species with foraging opportunities. Large areas of continuous, higher quality stands of vegetation are present outside the study area within the locality such as in the Dharawal State Conservation Area.

The proposal will not fragment any stands of vegetation which present potential habitat for the Grey-headed Flying-fox into two or more fragments. The Grey-headed Flying-fox may forage at a distance of up to 50 km from its camp each night (NPWS 2001a). Given the mobility of this species, and the fact that there have been no camps recorded in the locality, it is unlikely that the proposal would fragment or isolate any areas of potential habitat or movement corridors for this species.

The proposal is likely to result in a reduction of quality of the potential habitat surrounding borehole PA03. This stand is already isolated and experiencing edge effects, and the proposal for the borehole PA03, located in the centre of this vegetation stand, would exacerbate these effects. However, other areas in the study area which would be directly impacted by the proposal (PA02 & CP04) are unlikely to experience much reduction in habitat quality as only edges will be cleared within stands which have existing edge effects.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. The study area is not at the limit of the distribution for this species.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Larger, higher quality areas of potential habitat occur within the locality and as such it is unlikely that the habitat to be removed is important to the long-term survival of the species.

Will the proposal impact critical habitat (either directly or indirectly)?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species (DECC Threatened Species Unit).

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

To date, there is no recovery plan or threat abatement plan for the Grey-headed Flying-fox.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

Key Threatening Processes (KTP) are listed under Schedule 3 of the TSC Act. The proposal would involve the operation of the KTP 'Clearing of Native Vegetation'.

The proposal would result in the clearing of 0.7 ha of potential foraging habitat for the Grey-headed Flying-fox, which represents 0.01 per cent of potential habitat within the locality. This potential habitat occurs in the study area in small, fragmented stands within agricultural areas and is thus considered to be of moderate to poor quality. Potential habitat occurs within the locality in larger, continuous, higher quality stands of vegetation such as in the Dharawal State Conservation Area.

As such, it is unlikely that the operation of the KTP Clearing of Native Vegetation caused by the proposal will have a significant impact on the Grey-headed Flying-fox.

Conclusion

The Grey-headed Flying-fox has been recorded in the study area and in the locality. No camps have been recorded within the locality. The proposal would remove 0.7 ha of potential Grey-headed Flying-fox habitat of moderate to poor

quality from within woodland and forest habitats in the study area. Potential habitat for the Grey-headed Flying-fox exists elsewhere in the locality in larger, more continuous stands and of higher quality. The total extent of similar habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for this species within the locality. In addition, impacts on potential habitat by the proposal will be minimised with mitigation measures discussed in Section 5.2.

As such, it is **unlikely** that the proposal would have a major impact on the local population of Grey-headed Flying-fox or affect the long-term survival of a local population of the Grey-headed Flying-fox.

Koala ***Phascolarctos cinereus***

The Koala (*Phascolarctos cinereus*) is listed as Vulnerable on Schedule 2 of the TSC Act. It is an arboreal folivore feeding almost exclusively on the leaves of *Eucalyptus*, *Corymbia* and *Angophora* species, although it has been recorded feeding from other tree species including, on occasions, exotic species.

Koalas are known to forage on leaves from a variety of tree species, but they have 'preferred' species for certain regions. The Study Area contains eucalypt species Forest Red Gum (*Eucalyptus tereticornis*) and Grey Gum (*Eucalyptus punctata*) that are listed as Koala feed trees in Schedule 2 of SEPP 44. A Koala has been recorded on the south-eastern margin of the study area in 2002 (DECC Atlas of NSW Wildlife). Large populations have also been recorded in the Dharawal State Conservation Area and adjacent continuous vegetation the north-east of the study area, within the locality. Potential Koala habitat exists in the study area within woodlands and forests where feed trees occur.

The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). The area to be modified or cleared as part of the proposal represents 0.01 per cent of the broader distribution of these habitat types within the locality (5,901 ha). Given the extent of higher quality potential habitat within the locality and within the adjacent Dharawal State Conservation Area, it is unlikely that the proposal would have a significant impact on the habitats for this species.

Is the proposal 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?

The Koala has been recorded in the study area. A large population occurs in the Dharawal State Conservation Area within the locality. The proposal would involve clearing of 0.5 ha of Shale Sandstone Transition Forest and 0.2 ha of Cumberland Plain Woodland within the study area. These forest types contain the Koala feed trees Forest Red Gum and Grey Gum. Effects of the proposal on Koala feed trees will be mitigated, as clearing of native vegetation and mature trees will be minimised and indirect impacts would be controlled (see mitigation measures).

Movement of Koalas between fragments is resticted by the risk of predation by feral species (e.g. dogs) and road associated fatalities. The potential habitat within the study area occurs mainly in small, degraded stands, fragmented by agricultural uses and roads. These factors make it less likely that the study area supports a population of Koalas.

The only Koala record within the study area occurs within a large, continuous stand of forest vegetation in the south-east of the study area. As this area of vegetation is over 300 m from the nearest borehole site, it is highly unlikely to experience direct or indirect impacts as a result of the proposal.

Considering the above, it is unlikely that the proposal would have an adverse effect on a viable local Koala population or place this population at risk of extinction, if such a population is present in the study area.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

The proposal would involve clearing of 0.5 ha of Shale Sandstone Transition Forest and 0.2 ha of Cumberland Plain Woodland within the study area. These forest types contain the Koala feed trees Forest Red Gum and Grey Gum. The total extent of similar habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for this species within the locality. In addition, effects of the proposal on Koala feed trees will be mitigated, as clearing of native vegetation and mature trees will be minimised and indirect impacts would be controlled (Section 5.2).

The proposal would not directly fragment any existing vegetation stands into two or more fragments. However, thinning of Koala habitat and reduction of quality due to edge effects at borehole CP04 could reduce the possibility that the

vegetation along Mallaty Creek could be used as a movement corridor between Koala populations occurring in the east and west of the locality. However, this potential corridor is already fragmented and mitigation measures are expected to minimise further impacts.

The proposal is likely to result in a reduction of quality of the potential habitat surrounding borehole PA03. This stand is already isolated and experiencing edge effects, and the proposed borehole PA03, located in the centre of this vegetation stand, would exacerbate these effects.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands. The study area is not at the limit of the distribution of the Koala.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

As there are no records of Koalas utilising this habitat, and stable populations exist elsewhere in the locality, it is unlikely that the habitat to be removed would have an effect on the long-term survival of the species.

Will the proposal impact critical habitat (either directly or indirectly)?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been for this species (DECC Threatened Species Unit).

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

A draft recovery plan has been developed for the Koala (NPWS 2003a). The relevant actions of the draft recovery plan are listed below:

- show regard for the regional Koala feed tree species lists when assessing the potential impacts on Koalas as a result of proposals or activities;
- consider any development or activity involving the loss of primary or secondary (class A or B) Koala habitat, where Koalas are present, to be potentially significant and require the preparation of a Species Impact Statement; and,
- assess the potential impacts of a development or activity on tertiary Koala habitat, including buffers, links/movement corridors and refuge habitat and the likely impact of the proposal on Koala movement across the landscape (see Section 7).

These actions have been taken into account in this assessment. Although clearing of potential habitat is identified as a threat to the recovery of the Koala, the proposed area to be cleared is a small percentage (0.01 per cent) of the broader distribution of potential habitat in the locality. In addition, the potential habitat within the study area is considered to be of moderate to poor quality, with higher quality, continuous potential habitat existing elsewhere in the locality. This is reinforced by the high abundance of Koala records in areas of continuous vegetation outside the study area. For these reasons it is unlikely that the proposal would interfere with the recovery of the Koala.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

Key Threatening Processes (KTPs) are listed under Schedule 3 of the TSC Act. The proposal will involve the operation of the KTP ‘Clearing of Native Vegetation’.

Clearing of Native Vegetation would result in the loss of Koala feed trees from the study area. Potential foraging for the Koala within the study area occurs mainly within small fragmented stands. The area to be modified or cleared as part of the proposal is 0.7 ha and represents 0.01 per cent of the broader distribution of these habitat types within the locality (5,901 ha). As such, it is unlikely that the operation of the KTP Clearing of Native Vegetation caused by the proposal will have a significant impact on the Koala.

In addition, the Koala is listed on the Predation by the Red Fox – Threat abatement Plan (NPWS 2001b). However, the proposal is unlikely to increase the threat of the Red Fox on a population of Koalas within the study area.

Conclusion

Koalas have been recorded in the study area and in the locality. The proposal would remove 0.7 ha of potential Koala habitat of moderate to poor quality within woodland and forest habitats in the study area. Potential habitat for Koalas exists elsewhere in the locality in larger, more continuous stands and of higher quality. The potential Koala habitat to be cleared is estimated to represent only a small percentage of potential Koala habitat in the locality. In addition, impacts on potential Koala habitat by the proposal will be minimised with mitigation measures discussed in Section 5.2.

As such, it is **unlikely** that the proposal would have a major impact on the local population of Koalas or affect the long-term survival of a local population of Koalas.

Microchiropteran Bats – Hollow-dependant Species

The Large-footed Myotis (*Myotis adversus*) and the Eastern Freetail-bat (*Mormopterus norfolkensis*) are listed as Vulnerable on Schedule 2 of the TSC Act. These two species have been grouped for the purpose of this assessment on the basis of their similar habitat requirements and local recordings. Both species use tree-hollows as primary roosting and maternity habitat (other structures may provide similar microhabitat components) and are therefore dependent upon them for their survival (Churchill 1998). Both species forage within forest and woodland habitat, although the Large-footed Myotis utilises mainly water sources for foraging (Churchill 1998). The Eastern Freetail-bat is fast flying and clutter sensitive and is therefore associated with open or edge habitats foraging mostly in dry eucalypt forest and woodland (Lloyd *et al.* 2006). The Large-footed Myotis is currently being separated into three divisions. Of these, the southern subspecies, Southern Myotis *Myotis macropus*, is discussed in this assessment.

Both species have been recorded once in the north-eastern corner of the study area and at other locations within the locality. Potential habitat for these species occurs within the study area in woodland and forest vegetation types. These habitats contain suitable roosting habitat and foraging habitat as well as proximity to water sources in the form of creeks and farm dams (within 200 metres) where the Southern Myotis may forage.

The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). The area to be modified or cleared as part of the proposal represents 0.01 per cent of the broader distribution of these habitat types within the locality (5,901 ha). Given the mobility of these species and the extent of higher quality potential habitat within the locality (including the adjacent Dharawal State Conservation Area), it is unlikely that the proposal would have a significant impact on the habitats for these species.

Is the proposal 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?

The Southern Myotis and the Eastern Freetail-bat have been recorded in the study area and elsewhere within the locality (DECC Atlas of NSW Wildlife). Factors likely to disrupt the life cycle of these bat species include the loss, disruption or modification of roost sites, particularly "maternity roosts" and loss of foraging habitat. The proposal will remove 0.7 ha of potential foraging and roosting habitat for these species in the form of woodland and forest habitats. These habitats are close to water sources (creeks and farm dams) which provide foraging opportunities for the Southern Myotis and contain mature, hollow bearing trees suitable for maternity roosts for both species.

The potential habitat occurs in the study area in small, fragmented stands within agricultural areas. Larger, continuous, higher quality stands of vegetation providing similar habitat features occur within the locality (such as in the Dharawal State Conservation Area).

Given the mobility of these species and the extent of higher quality potential habitat within locality, it is unlikely that the proposal would disrupt the lifecycle of the Southern Myotis or the Eastern Freetail-bat such that a viable local population would be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

The proposal would remove 0.7 ha of potential foraging and roosting habitat of moderate to poor quality from within woodland and forest habitats in the study area. This potential habitat contains trees with hollows suitable for maternity roosts for both species and open/edge areas within forest/woodland suitable for foraging by the Eastern Freetail-bat. In addition, the study area is near to water resources, which provide foraging habitat for the Southern Myotis. Large areas of continuous, higher quality stands of vegetation are present outside the study

area within the locality such as in the Dharawal State Conservation Area. The total extent of similar habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for these species within the locality.

The proposal will not fragment any stands of vegetation which present potential habitat for these species into two or more fragments. Furthermore, given the mobility of these species, it is unlikely that the proposal would fragment or isolate any areas of potential habitat or movement corridors for these species.

The proposal is likely to result in a reduction of quality of the potential habitat surrounding borehole PA03. This stand is already isolated and experiencing edge effects, and the proposed borehole PA03, located in the centre of this vegetation stand, would exacerbate these effects. However, other areas in the study area which would be directly impacted by the proposal (PA02 & CP04) are unlikely to experience much reduction in habitat quality as only edges will be cleared within stands which have existing edge effects.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.

The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.

The study area is not at the limit of the distribution of either of these species.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Larger, higher quality areas of potential habitat are present within the locality and as such it is unlikely that the habitat to be removed is important to the long-term survival of these species.

Will the proposal impact critical habitat (either directly or indirectly)?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species (DECC Threatened Species Unit).

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

To date, there is no recovery plan or threat abatement plan for the Southern Myotis or the Eastern Freetail-bat.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

Key Threatening Processes (KTPs) are listed under Schedule 3 of the TSC Act. The proposed activities will involve the operation of the KTP 'Clearing of Native Vegetation' and the proposed KTP 'Loss of Hollow-bearing Trees'. In addition, both species are listed as being reliant on tree hollows in the preliminary determination for the proposed KTP declaration for 'Loss of Hollow-bearing Trees'.

Clearing of native vegetation results in the loss of potential foraging and roosting habitat for these species and also results in the loss of habitat for important insect prey items. The loss of hollow-bearing trees results in the loss of important roosting habitat, including maternity roosts for these species. However, the proposed area to be cleared represents a small percentage of potential habitat with the locality (0.01 per cent). As such, it is unlikely that the operation of the KTP Clearing of Native Vegetation caused by the proposal will have a significant impact on the Southern Myotis or the Eastern Freetail-bat.

Conclusion

The Southern Myotis and Eastern Freetail-bat have been recorded within the study area and within the locality. The proposal would modify and/or remove approximately 0.7 ha of potential habitat of moderate to poor quality within woodland and forest habitats in the study area. Potential habitat for these species exists elsewhere in the locality in larger, more continuous stands and of higher quality. The potential habitat to be cleared represents 0.01 per cent of potential habitat available in the locality (5,901 ha). In addition, impacts on potential habitat by the proposal will be minimised with mitigation measures discussed in Section 5.2.

As such, it is **unlikely** that the proposal would have a major impact on the local population of Southern Myotis or Eastern Freetail-bat or affect the long-term survival of a local population of the Southern Myotis or Eastern Freetail-bat.

Swift Parrot ***Lathamus discolor***

The Swift Parrot (*Lathamus discolor*) is listed as Endangered on Schedule 2 of the TSC Act and as Endangered on the EPBC Act. The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW the species mostly occurs on the coast and south west slopes (DEC 2005r).

When migrating during the non-breeding season, the Swift Parrot can occur on the mainland in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis* (DEC 2005r).

The Swift Parrot was not recorded during the current survey or within the study area but has been recorded on two occasions within the locality in 1996 and 2005 (DECC Atlas of NSW Wildlife). Potential foraging habitat exists in the study area in woodlands and forests where lerp infested Grey Box occur. However, given the lack of preferred foraging trees within the study area it is unlikely to constitute prime or core habitat for this species. It is possible that the Swift Parrot would use the resources within the study area on occasion however it is unlikely to be dependant on them.

The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). Given this represents only 0.01 per cent of the broader distribution of these habitats within the locality, it is unlikely that the proposal would have a significant impact on the habitats for this species.

Is the proposal 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?

It is highly unlikely that the study area supports a local population of the Swift Parrot. The species breeds in Tasmania and may occasionally forage within the

locality and study area. However, given the lack of records within the locality; that the majority of the study area is cleared; the lack of preferred feed trees within the study area; and the species' high mobility, it is unlikely that the Swift Parrot would be dependant on the habitat resources within the study area for continued survival. Therefore it is unlikely the removal and/or modification of 0.7 ha of potential habitat (0.01 per cent of available habitat within the locality) would place a viable population of this species at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

The proposal would remove 0.7 ha of potential Swift Parrot foraging habitat of moderate to poor quality from within woodland and forest habitats in the study area. This potential habitat contains one preferred lerp feed tree, Grey Box, which may provide foraging opportunities for the Swift Parrot. This habitat type is widely distributed within the locality (5,901 ha), meaning the proposal would clear 0.01 per cent of potential foraging habitat for the Swift Parrot within the locality.

The proposal will not fragment any stands of vegetation which present potential habitat for the Swift Parrot into two or more fragments. Given this, the mobility of the species, and the extent of similar potential foraging habitat in the locality, it is unlikely that the proposal would fragment or isolate any areas of potential foraging habitat or movement corridors for this species.

The potential foraging habitat for the Swift Parrot within the study area is considered to be of moderate to poor quality. This is because it does not contain many preferred feed trees and it exists in small, fragmented stands, surrounded by agricultural areas. The proposal is likely to result in a further reduction of quality of the potential habitat surrounding borehole PA03. This stand is already isolated and experiencing edge effects, and the proposed borehole PA03, located in the centre of this vegetation stand, would exacerbate these effects. However, other areas in the study area which would be directly impacted by the proposal (PA02 & CP04) are unlikely to experience much reduction in habitat quality as only edges will be cleared within stands which have existing edge effects.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs

on the coast and south west slopes. The study area is not at the limit of the distribution of the Swift Parrot.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Larger, higher quality areas of potential habitat occur within the locality and as such it is unlikely that the habitat to be removed is important to the long-term survival of the species.

Will the proposal impact critical habitat (either directly or indirectly)?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for the Swift Parrot.

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

The Department of Environment and Water Resources has a recovery plan for the Swift Parrot. The proposal would result in the clearing of 0.7 ha of potential foraging habitat for the Swift Parrot. Although clearing of potential habitat is identified as a threat to the recovery of the Swift Parrot in the plan, the proposed area to be cleared is estimated to be a small percentage (0.01 per cent) of the broader distribution of potential habitat in the locality (5,901 ha). In addition, potential habitat within the study area is considered to be of moderate to poor quality and contains no breeding sites. Considering the above, it is unlikely that the proposal would interfere with the recovery of the Swift Parrot.

To date, there is no threat abatement plan for the Swift Parrot.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

Key Threatening Processes (KTPs) are defined under Schedule 3 of the TSC Act. The proposal will involve the operation of the KTP ‘Clearing of Native Vegetation’.

Clearing of native vegetation would remove a small proportion of the potential foraging habitat for the Swift Parrot within the locality (0.01 per cent). As the potential foraging habitat contains only one preferred lerp feed tree and is of moderate to poor quality and no breeding sites are known within the area, it is unlikely that the operation of the KTP Clearing of Native Vegetation caused by the proposal will have a significant impact on the Swift Parrot.

Conclusion

Potential habitat within the study area is not considered to be prime or core habitat for the Swift Parrot given the lack of preferred winter flowering trees. It is possible that this species would utilise the resources in the woodland and forest habitat within the study area, however it is unlikely to be dependant on them for survival. The proposal is likely to remove approximately 0.01 per cent of the available habitat for this species within the locality; given the mobility of this species this is unlikely to have a significant impact on the Swift Parrot.

It is considered **unlikely** that the proposal would have a major impact on a local population of the Swift Parrot or affect the long-term survival of a local population of the Swift Parrot.

Regent Honeyeater ***Xanthomyza phrygia***

The Regent Honeyeater (*Xanthomyza phrygia*) is listed as Endangered on Schedule 2 of the TSC Act and as Endangered on the EPBC Act. The Regent Honeyeater has a patchy distribution throughout a large geographic range. The species is known to breed at a small number of sites containing a variety of key *Eucalyptus* spp., particularly Mugga Ironbark (*E. sideroxylon*), Yellow Box (*E. melliodora*) and White Box (*E. albens*), Swamp Mahogany (*E. robusta*), but also River Red Gum (*E. tereticornis*) and Grey Box (*E. moluccana*) (Schedvin 1996; Webster & Menkhorst 1992; Franklin *et al*. 1989).

The Regent Honeyeater was not recorded during the current survey or within the study area but has been recorded on three occasions within the locality, although the most recent recording is from 1984 (DECC Atlas of NSW Wildlife). Potential foraging habitat exists in the study area in woodlands and forests where feed trees River Red Gum and Grey Box occur. However, given the lack of preferred foraging trees within the study area it is unlikely to constitute prime or core habitat for this species. It is possible that the Regent Honeyeater would use the resources within the study area, however it is unlikely to be dependant on them.

The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). Given this represents only 0.01 per cent of the broader distribution of these habitats within the locality, it is unlikely that the proposal would have a significant impact on the habitats for this species.

Is the proposal 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?

It is highly unlikely that the study area supports a local population of the Regent Honeyeater. The particular box-ironbark woodlands usually associated with breeding are absent and there are no known breeding sites within the locality. All three records of the species within the locality are over twenty years old.

It is possible that the Regent Honeyeater utilises the woodland and forest habitats within the study area to forage. These habitat types are widely distributed throughout the locality (5,901 ha). Given that this species is highly mobile and the extent of potential habitat within the locality, it is unlikely that the Regent Honeyeater would be dependant on the habitat resources within the study area for continued survival. Therefore it is unlikely the removal and/or modification of 0.7 ha of potential habitat (0.01 per cent of available habitat within the locality) would place a viable population of this species at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

The proposal would remove 0.7 ha of potential Regent Honeyeater foraging habitat of moderate to poor quality from within woodland and forest habitats in the study area. This potential habitat contains two potential feed trees, the winter flowering River Red Gum and the summer flowering Grey Box which may provide foraging opportunities for the Regent Honeyeater. These habitat types are widely distributed within the locality (5,901 ha), meaning the proposal would clear 0.01 per cent of potential foraging habitat for the Regent Honeyeater within the locality.

The proposal will not fragment any stands of vegetation which present potential habitat for the Regent Honeyeater into two or more fragments. Given the mobility of this species, and the extent of similar potential foraging habitat in the locality, it is unlikely that the proposal would fragment or isolate any areas of potential foraging habitat or movement corridors for this species.

The potential foraging habitat for the Regent Honeyeater within the study area is considered to be of moderate to poor quality. This is because it does not contain the preferred feed trees and it exists in small, fragmented stands, surrounded by agricultural areas. The proposal is likely to result in a further reduction of quality of the potential habitat surrounding borehole PA03. This stand is already isolated and experiencing edge effects, and the proposed borehole PA03, located in the centre of this vegetation stand, would exacerbate these effects. However, other areas in the study area which would be directly impacted by the proposal (PA02 & CP04) are unlikely to experience much reduction in habitat quality as only edges will be cleared within stands which have existing edge effects.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years non-breeding flocks converge on flowering coastal woodlands and forests. The study area is not at the limit of the distribution for the Regent Honeyeater.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Larger, higher quality areas of potential habitat occur within the locality and as such it is unlikely that the habitat to be removed is important to the long-term survival of the species.

Will the proposal impact critical habitat (either directly or indirectly)?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for the Regent Honeyeater.

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

There is a recovery plan for the Regent Honeyeater (DEW). Recovery Actions identified in the plan include:

- Action 1. Organisational arrangement including continued use of the Regent Honeyeater Recovery team to guide and review progress as well as close liaison with the Regent Honeyeater Recovery team, state agencies and other groups.
- Action 2. Active management including preparation of regional work plans in four key regions by Operations Groups.
- Action 3. Monitor population levels and changes in distribution.
- Action 4. Conduct research on post-breeding movements, isolation between population, habitat availability and resource use.
- Action 5. Maintain and develop community participation and awareness.
- Action 6. Maintain and improve captive population management.

In addition, with relation to Regent Honeyeater habitat, Objective 2 of the recovery plan states: 'Maintain and enhance the value of Regent Honeyeater habitat at the key sites and throughout the former range'.

The proposal would result in the clearing of 0.7 ha of potential foraging habitat for the Regent Honeyeater. Although maintaining an enhancing Regent Honeyeater habitat is listed as a Specific Objective in the recovery of the Regent Honeyeater in the plan, the proposed area to be cleared is estimated to be a small percentage (0.01 per cent) of the broader distribution of potential habitat in the locality (5,901 ha). In addition, potential habitat within the study area is considered to be of moderate to poor quality and contains no breeding sites. Considering the above, it is unlikely that the proposal would interfere with the recovery of the Regent Honeyeater.

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

Key Threatening Processes (KTPs) are defined under Schedule 3 of the TSC Act. The proposal will involve the operation of the KTP 'Clearing of Native Vegetation'.

Clearing of native vegetation would remove a small proportion of the potential foraging habitat for the Regent Honeyeater within the locality (0.01 per cent). As the potential foraging habitat does not contain the preferred feed trees and is of moderate to poor quality and no breeding sites are known within the area, it is unlikely that the operation of the KTP Clearing of Native Vegetation caused by the proposal will have a significant impact on the Regent Honeyeater.

Conclusion

Potential habitat within the study area is not considered to be prime or core habitat for the Regent Honeyeater given the lack of preferred winter flowering trees. It is possible that this species would utilise the resources in the woodland and forest habitat within the study area, however it is unlikely to be dependant on them for survival. The proposal is likely to remove approximately 0.01 per cent of the available habitat for this species within the locality; given the mobility of this species this is unlikely to have a significant impact on the Regent Honeyeater.

It is considered **unlikely** that the proposal would have a major impact on the local population of the Regent Honeyeater or affect the long-term survival of a local population of the Regent Honeyeater.

Woodland Birds

Four species of woodland bird, listed as Vulnerable on Schedule 2 of the TSC Act, are considered as a group in this assessment on the basis of similar habitat preferences and potential for impact. Bird species considered as woodland birds in this assessment are: Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*); Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*); Diamond Firetail (*Stagnopleura guttata*) and Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*). These species inhabit a broad range of woodland and forest types and forage within these environments, although specific foraging requirements vary between species. Breeding requirements, within the woodland and forest habitats also differ between species.

None of these species were recorded during the current survey or within the study area, although all four species have been previously recorded within the locality (DECC Atlas of NSW Wildlife). Potential habitat for these species occurs within the study area in woodland and forest vegetation types. These habitats contain suitable roosting habitat and foraging habitat for these species.

The study area contains trees with hollows and a variety of foraging habitats including areas of shrubby midstorey and grassy understorey.

The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). The total extent of similar habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for these species within the locality. Given the mobility of these species and the extent of higher quality potential habitat within the locality (including the adjacent Dharawal State Conservation Area), it is unlikely that the proposal would have a significant impact on the habitats for these species.

Is the proposal 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?

None of the four species were detected during current surveys or within the study area. All four species have been recorded within the locality (DECC Atlas of NSW Wildlife).

The Black-chinned Honeyeater constructs nests in tall trees, usually Ironbark or Box species, the Brown Treecreeper utilises hollows for breeding (Higgins *et al.* 2001), the Diamond Firetail and Hooded Robin utilise a range of vegetative structures within the woodland and forest habitat including horizontal forks, horizontal branches, mistletoe and saplings for nest sites, constructing nests mainly of grass, rootlets, bark and other materials (Higgins and Peter 2002, Higgins *et al.* 2006).

Factors likely to disrupt the life cycle of the Brown Treecreeper include the destruction of limited breeding sites such as hollow trees. The loss of suitable foraging areas and isolation and removal of habitat can also disrupt the life cycle of these species.

The proposal would remove or modify approximately 0.7 ha of potential foraging and breeding habitat for these species in the form of woodland and forest vegetation types. These vegetation types contain hollow bearing trees, and tall trees (approximately 20 m high) of the Box and Ironbark variety. The habitats also contain a variety of feeding resources utilised by these species.

The potential habitat occurs in the study area in small, fragmented stands within agricultural areas. Larger, continuous, higher quality stands of vegetation

providing similar habitat features occur within the locality (such as in the Dharawal State Conservation Area) with a total area of 5,901 ha.

Given the mobility of these species and the extent of higher quality potential habitat within locality, it is unlikely that the proposal would disrupt the lifecycle of any of these four bird species such that a viable local population would be placed at risk of extinction.

Is the proposal likely to remove, modify, fragment or isolate the habitat for the threatened species?

The proposal would remove 0.7 ha of potential foraging and roosting habitat of moderate to poor quality within woodland and forest habitats in the study area. This potential habitat contains trees with hollows suitable for breeding for the Brown Treecreeper, tall trees of the Box and Ironbark variety for suitable for breeding sites for the Black-chinned Honeyeater and other vegetative structures suitable for breeding and foraging for the other species. Large areas of continuous, higher quality stands of similar vegetation are present outside the study area within the locality (such as in the Dharawal State Conservation Area) covering a total area of 5,901 ha. As such, the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for these species within the locality.

The proposal will not fragment any stands of vegetation which present potential habitat for these species into two or more fragments. Furthermore, given the mobility of these species and the proximity of larger stands of vegetation, it is unlikely that the proposal would fragment or isolate any areas of potential habitat or movement corridors for these species.

The proposal is likely to result in a reduction of quality of the potential habitat surrounding borehole PA03. This stand is already isolated and experiencing edge effects, and the proposed borehole PA03, located in the centre of this vegetation stand, would exacerbate these effects. However, other areas in the study area which would be directly impacted by the proposal (PA02 & CP04) are unlikely to experience much reduction in habitat quality as only edges will be cleared within stands which have existing edge effects.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The **Black-chinned Honeyeater (eastern subspecies)** is widespread, from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great

Dividing Range, although it is regularly observed in the Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions. The study area is not at the limit of the distribution of this species.

The **Brown Treecreeper (eastern subspecies)** lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys. The western boundary of the species range runs approximately through Wagga Wagga, Temora, Forbes, Dubbo and Inverell. The study area is not at the limit of the distribution of this species.

The **Diamond Firetail** is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Cental and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW. Also found in the Australian Capital Territory, Queensland, Victoria and South Australia. The study area is not at the limit of the distribution of this species.

The **Hooded Robin (south-eastern form)** is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. The study area is not at the limit of the distribution of this species.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the study area.

The importance of the impacted habitat to the long-term survival of the threatened species in the locality.

Larger, higher quality areas of potential habitat are present within the locality and as such it is unlikely that the habitat to be removed is important to the long-term survival of these species.

Will the proposal impact critical habitat (either directly or indirectly)?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for the Black-chinned Honeyeater (eastern subspecies), Brown Treecreeper (eastern subspecies), Diamond Firetail or the Hooded Robin (south-eastern form) (DECC Threatened Species Unit).

Is the proposal consistent with the objectives or actions of a recovery plan or threat abatement plan?

To date, there is no recovery plan for the Black-chinned Honeyeater (eastern subspecies), Brown Treecreeper (eastern subspecies), Diamond Firetail or the Hooded Robin (south-eastern form).

Does the proposal result in the operation of, or increase the impact of, a key threatening process?

Key Threatening Processes (KTPs) are listed under Schedule 3 of the TSC Act. The proposed activities will involve the operation of the KTP 'Clearing of Native Vegetation' and the proposed KTP 'Loss of Hollow-bearing Trees'. Clearing of native vegetation is identified as a threat for all these species of woodland birds. Loss of hollow-bearing trees is identified as a threat to the Brown Treecreeper.

Clearing of native vegetation would remove a small proportion of the potential breeding and foraging habitat for these Woodland Bird species while loss of hollow-bearing trees would remove a small proportion of potential breeding habitat for the Brown Treecreeper within the locality (0.01 per cent). The potential foraging habitat is considered to be of moderate to poor quality, the species are highly mobile and only a small area of hollow-bearing trees would be impacted by the proposal. It is therefore considered unlikely that the operation of the KTP Clearing of Native Vegetation or the proposed KTP Loss of Hollow-bearing Trees caused by the proposal would have a significant impact on the Woodland Bird species.

Conclusion

None of the four Woodland bird species have been recorded within the study area, although all have been recorded within the locality. The proposal would modify and/or remove approximately 0.7 ha of potential habitat of moderate to poor quality within woodland and forest habitats in the study area. Potential habitat for these species exists elsewhere in the locality in larger, more

continuous stands and are of higher quality. The potential habitat to be cleared is estimated to represent a negligible amount of potential habitat available in the locality. In addition, impacts on potential habitat by the proposal will be minimised with mitigation measures discussed in (section 5.2).

As such, it is **unlikely** that the proposal would have a major impact on the local population of Black-chinned Honeyeater (eastern subspecies), Brown Treecreeper (eastern subspecies), Diamond Firetail or the Hooded Robin (south-eastern form).

APPENDIX 4

EPBC Act Significant Impact Criteria

Significant Impact Guidelines

The EPBC Act Significant Impact Guidelines (DEH 2006) list Significant Impact Criteria for matters of national environmental significance that should be taken into consideration to determine whether a proposal is likely to have a significant impact on threatened species, populations or ecological communities that are known to occur or potentially occur in the study area.

Under the EPBC Act, if the proposal has the potential to have an adverse impact on a threatened species, population or ecological community listed on the Act, the proposal must be referred to the Federal Minister for the Environment for further consideration.

Endangered Ecological Communities

Two Endangered Ecological Communities (EEC) as listed on the EPBC Act were present in the study area; Cumberland Plain Woodland and Shale Sandstone Transition Forest. The potential impacts of the proposal on this EEC are assessed against the Significant Impact Criteria of the EPBC Act below.

Cumberland Plain Woodland

Cumberland Plain Woodland (CPW) is listed as an Endangered Ecological Community on the EPBC Act. This community was recorded within the study area and will be impacted by the proposal.

Is the action likely to reduce the extent of a community?

The proposal will result in the removal of approximately 0.2 ha of CPW in the study area. DECC (NPWS 2002b) have mapped approximately 1,959 ha of CPW within 10 km of the study area. This mapping also shows the vegetation community generally occurs as small disturbed remnants within agricultural land and developed land. The removal of 0.2 ha of CPW is not likely to have an adverse effect on the extent of the ecological community.

Is the action likely to fragment or increase fragmentation of an ecological community?

The patch of CPW to be disturbed is currently part of a riparian corridor along Mallaty Creek and the 0.2 ha to be impacted occurs along the edge of this corridor. Therefore, while the area of CPW in the study area will be reduced by

0.2 ha, the removal of this patch would not result in the fragmentation of any CPW.

Is the action likely to adversely affect habitat critical to the survival of an ecological community?

'Habitat critical to the survival of a species or ecological community' is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

The Threatened Species Scientific Committee and the Minister for the Environment and Heritage maintain a register of critical habitat. To date, there is no critical habitat listed for Cumberland Plain Woodland.

The CPW in the study area is not likely to be critical habitat, given the small size and moderate condition of the area to be impacted.

Is the action likely to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

The proposal will result in the removal of 0.2 ha of CPW that is in moderate condition. The proposal is not likely to significantly alter the hydrology of the area. The action is not likely to modify or destroy abiotic factors that are necessary for the survival of the remaining patches of CPW in the vicinity of the study area.

Is the action likely to cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

The patch of CPW that will be removed as a result of the proposal is in a moderate condition due to some regenerative potential due to minimal disturbance and its connectivity to similar woodland along Mallaty Creek. The site had also been previously impacted by historical logging, weed invasion, fire, and edge effects. Therefore, the ecosystem functioning of the CPW has been diminished due to the variety of disturbances that the vegetation has been exposed to. While the CPW has been assessed as being in a moderate condition, the structure and species composition has already been previously modified, with exotic species dominating the ground layer. Therefore, it is **unlikely** that the proposal will substantially and adversely modify the composition of CPW such that its local occurrence is likely to be placed at risk of extinction.

Amelioration measures have been proposed to reduce the threat of weed invasion, such as weed management strategies targeting the invasion of exotic perennial grasses and other invasive weed species.

Is the action likely to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

– assisting invasive species, that are harmful to the listed ecological community, to become established; or

– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?

Currently, the patch of vegetation in the study area that will be removed by the proposal is in moderate condition. It is recommended that weed management strategies are implemented in order to minimise weed invasion.

The proposal is not likely to cause mobilisation of fertilisers, herbicides or other chemicals or pollutants. The weed management strategies may require the use of some herbicides to control weed species in the study area, however the use of such chemicals should be minimised and used by suitably qualified personnel only.

Is the action likely to interfere with the recovery of an ecological community?

No Recovery Plan as published by DEH is available for CPW. Currently the Recovery Plan for CPW is in preparation (DEH 2005).

Conclusion

Based on the above assessment, CPW is unlikely to be significantly impacted by the activity and, as such, a referral under the provisions of the EPBC Act is not recommended for this ecological community.

Shale Sandstone Transition Forest

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

• reduce the extent of an ecological community;

The proposal will result in the removal of approximately 0.5 ha of SSTF in the study area. DECC (NPWS 2002b) have mapped approximately 3,942 ha of SSTF within 10 km of the study area. This mapping also shows the vegetation community generally occurs as small disturbed remnants within agricultural land and developed land. The removal of 0.5 ha of SSTF is not likely to have an adverse effect on the extent of the ecological community.

• fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;

The patch of SSTF to be impacted at PA02 occurs on the edge of a continuous piece of bushland within an asset protection zone behind a property with horse yards. Thus fragmentation is not likely in this location.

The construction of the borehole at PA03 will occur in the middle of a patch of SSTF that is in good condition. This site, while not likely to isolate a patch of SSTF will result in a minor fragmentation of this patch of bush.

• adversely affect habitat critical to the survival of an ecological community;

'Habitat critical to the survival of a species or ecological community' is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or

- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

To date, no critical habitat for SSTF has been listed on the Register of Critical Habitat. A recovery plan has not yet been prepared under this EEC under the EPBC Act. Under the TSC Act, a recovery plan for SSTF is currently being prepared, as part of the recovery planning for the endangered ecological communities of the Cumberland Plain.

The proposal is not likely to impact on habitat critical to the survival of this EEC.

• modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;

The proposal will result in the clearing or modification of approximately 0.5 ha of SSTF. The proposed will not further modify or destroy abiotic factors necessary to the EECs survival, provided mitigation measures, such as erosion and sedimentation control, are implemented.

• cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;

The two patches of SSTF that will be removed or modified as a result of the proposal are in a moderate (PA02) and good (PA03) condition.

Site PA02 was assessed as being in **moderate** condition due to low levels of weed invasion and good resilience. The site had an undisturbed soil profile and was adjacent to native woodland. The ecological value of PA02 has been diminished as a result of an altered vegetation structure due to on-going management as an asset protection zone. These disturbances have altered the structure and composition of the SSTF at borehole PA02 such that ecosystem function has been substantially diminished.

Site PA03 was assessed as being in **good** condition due to an intact vegetation structure and composition. The site had good regenerative potential due to minimised disturbance to the soil profile and its proximity to adjacent native woodland.

Both sites had previously been impacted by historical logging, weed invasion, fire, and edge effects.

It is **unlikely** that the proposal is unlikely to cause a substantial change in the species composition of SSTF in the study area, provided ameliorative measures, such as weed management strategies, are implemented.

• cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

– assisting invasive species, that are harmful to the listed ecological community, to become established; or

– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or

Currently, the patch of vegetation in the study area that will be removed by the proposal is in moderate – good condition. It is recommended that weed management strategies are implemented in order to minimise weed invasion.

The proposal is not likely to cause mobilisation of fertilisers, herbicides or other chemicals or pollutants. The weed management strategies may require the use of some herbicides to control weed species in the study area, however the use of such chemicals should be minimised and used by suitably qualified personnel only.

• interfere with the recovery of an ecological community.

A recovery plan has not yet been prepared under this EEC under the EPBC Act. Under the TSC Act, a recovery plan for SSTF is currently being prepared, as part of the recovery planning for the endangered ecological communities of the Cumberland Plain. The proposal is not likely to interfere with the recovery of this EEC.

Conclusion

Based on the above assessment, SSTF is unlikely to be significantly impacted by the proposal and as such a referral under the provisions of the EPBC Act is not recommended for this EEC.

Endangered Species

Flora

Potential habitat occurs within the study area for one Endangered plant species listed on the EPBC Act: *Pimelea spicata.* The potential impacts of the proposal on this species are assessed against the Significant Impact Criteria of the EPBC Act below.

This species was not recorded within the study area during the current survey.

Pimelea spicata

Potential habitat for *Pimelea spicata* occurs in Cumberland Plain Woodland (CPW) in the study area. Cumberland Plain Woodland will be impacted by the proposal.

Is the action likely to lead to a long-term decrease in the size of a population of a species?

Pimelea spicata was not recorded in the study area. The proposal is therefore not likely to lead to a long-term decrease in the size of a population of the species.

Is the action likely to reduce the area of occupancy of the species?

Pimelea spicata was not recorded in the study area. The removal or modification of 0.2 ha of vegetation that is potential habitat for *Pimelea spicata* is not likely to reduce the area of occupancy of the species.

Is the action likely to fragment an existing population into two or more populations?

No populations of *Pimelea spicata* were recorded in the study area. The proposal is therefore not likely to fragment an existing population into two or more populations.

Is the action likely to adversely affect habitat critical to the survival of a species?

'Habitat critical to the survival of a species or ecological community' is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

Critical habitat for *Pimelea spicata* has not been identified in the recovery plan for the species (DEC 2004a). However, the recovery plan identifies the habitat features and locations that would contain habitat that is critical to the survival of the species, as required by the EPBC Act (DEC 2004a). These include 28 known locations throughout the species known distribution. The study area is not one of these known locations.

To date, there is no critical habitat listed by the Minister for the Environment and Heritage for *Pimelea spicata*.

The potential habitat in the study area is not an area considered to be necessary for breeding, dispersal or succession; to maintain genetic diversity; or for the reintroduction of populations or recovery of the species. Therefore, the proposal will not impact on habitat critical to the survival of *Pimelea spicata.*

Is the action likely to disrupt the breeding cycle of a population?

Pimelea spicata was not recorded in the study area. The proposed modification of a total of 0.2 ha of vegetation that is potential habitat for *Pimelea spicata* is considered unlikely to disrupt the breeding cycle of a population.

Is the action likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Pimelea spicata was not recorded in the study area. Potential habitat for *Pimelea spicata* in the study area occurs in CPW. The proposal will remove or modify approximately 0.2 ha of vegetation that is potential habitat for *Pimelea spicata.*

At least 1,959 ha of CPW has been mapped in the locality (within 10 km of the study area) (NPWS 2002b). The area of habitat to be removed or modified as part of the proposal equates to 0.01 per cent of similar vegetation that exists in the locality.

The potential habitat for *Pimelea spicata* to be disturbed is currently part of a riparian corridor along Mallaty Creek and the 0.2 ha to be impacted occurs along the edge of this corridor. Therefore, while the extent of potential habitat in the study area will be reduced by 0.2 ha, the removal of this patch would not result in the isolation of any potential habitat for *Pimelea spicata*.

The proposal is not likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is the action likely to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat?

There is potential for the proposal to result in an increase in invasive species in areas of potential habitat for *Pimelea spicata*. Amelioration measures, such as implementation of weed management strategies, have been recommended to reduce this threat.

Is the action likely to introduce disease that may cause the species to decline?

The removal or modification of 0.2 ha of potential habitat for *Pimelea spicata* is not likely to introduce disease that may cause the species to decline. However as a precaution, vehicles should be washed prior to use on site.

Is the action likely to interfere with the recovery of the species?

A draft recovery plan has been prepared for *Pimelea spicata* (DEC 2004a). The overall objective of this recovery plan is to ensure the continued and long-term survival of *P. spicata* in the wild by promoting the *in-situ* conservation of the species across its natural range. Specific recovery objectives include:

- conserve *P. spicata* using land-use and conservation planning mechanisms;
- identify and minimise the operation of threats at sites where *P. spicata* occurs;
- develop and implement a survey and monitoring program that will provide information on the extent and viability of *P. spicata*;
- provide the community with information that assists in conserving the species;
- raise awareness of the species and involve the community in the recovery program; and,
- conduct research that will assist future management decisions.

Since *Pimelea spicata* is not known to occur at the site, the removal of 0.2 ha of potential habitat is not considered to be inconsistent with the objectives or actions of the recovery plan.

Conclusion

Based on the above assessment, *Pimelea spicata* is unlikely to be significantly impacted by the proposal and as such a referral under the provisions of the EPBC Act is not recommended for this species.

Fauna

Potential habitat occurs within the study area for two Endangered animal species listed on the EPBC Act, the Swift Parrot and the Regent Honeyeater. The potential impacts of the proposal on these species are assessed against the Significant Impact Criteria of the EPBC Act below.

Swift Parrot (*Lathamus discolor*)

The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW the species mostly occurs on the coast and south west slopes (DEC 2005r).

When migrating during the non-breeding season, the Swift Parrot can occur on the mainland in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis* (DEC 2005r).

The Swift Parrot was not recorded during the current survey or within the study area but has been recorded on two occasions within the locality in 1996 and 2005 (DECC Atlas of NSW Wildlife). Potential foraging habitat exists in the study area in woodlands and forests where lerp infested Grey Box occur. However, given the lack of preferred foraging trees within the study area it is unlikely to constitute prime or core habitat for this species. It is possible that the Swift Parrot would use the resources within the study area on occasion however it is unlikely to be dependant on them.

The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). Given this represents only 0.01 per cent of the broader distribution of these habitats within the locality, it is unlikely that the proposal would have a significant impact on the habitats for this species.

Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of a population of a species?

The study area does not contain breeding habitat and only one of the species' key feed trees (if infested with lerp). Given the range and mobility of this species it is unlikely to be wholly dependent upon resources within the study area. Additionally, the species has been recorded only on two occasions within the locality (DECC Atlas of NSW Wildlife). Given the above, it is unlikely that the proposal would lead to a long-term decrease in the size of a population of the Swift Parrot.

Is there a real chance or a possibility that the action will reduce the area of occupancy of the species?

The proposal would not impact breeding sites (which exist in Tasmania only), although foraging habitat (flowering eucalypts and lerp infested trees) for this species may be affected. The total extent of similar foraging habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for this species within the locality.

Therefore, it is unlikely that the proposal would reduce the area of occupancy of a population of the Swift Parrot.

Is there a real chance or a possibility that the action will fragment an existing population into two or more populations?

The study area is already fragmented by existing agricultural practices and roads. Considering the mobility of the species and that the proposed boreholes are not located in such a way as to further fragment vegetation stands, the proposal is unlikely to fragment an existing population of the Swift Parrot into two or more populations.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?

The Commonwealth Environment Minister may identify and list habitat critical to the survival of a listed threatened species or ecological community. Details of this identified habitat will be recorded in a Register of Critical Habitat. To date no areas of critical habitat have been listed for Swift Parrot.

Is there a real chance or a possibility that the action will disrupt the breeding cycle of a population?

Swift Parrots breed in Tasmania. Following winter on the mainland they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum *E. globulus* (DEC 2005r).

The study area does not contain any breeding habitat for the Swift Parrot. Therefore the proposal is unlikely to disrupt the breeding cycle of a population of the Swift Parrot.

Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposal is likely to directly impact approximately 0.7 ha of potential foraging habitat which represents 0.01 per cent of the distribution of similar potential habitat within the locality (5,901 ha). The potential habitat within the study area exists in small stands, fragmented by agricultural uses, roads and electricity easements. Given the range of this species, extent of potential habitat within the locality, the moderate to low quality of the potential habitat and lack of breeding sites within the study area, it is unlikely that the proposal would decrease the availability or quality of habitat to the extent that the Swift Parrot is likely to decline.

Is there a real chance or a possibility that the action will result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat?

Potential habitat within the study area has been previously disturbed and is subject to ongoing disturbance, due to adjacent agricultural practices and roads, including weed invasion. It is possible that the proposal will exacerbate the existing weed invasion in the impacted patches of vegetation, with increased edge effects. However with suitable mitigation measures as outlined in Section 5.2, any impacts on the potential habitat will be minimised.

Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?

Diseases have not been identified as a threat to populations of the Swift Parrot (DEC 2005r).

Clearing vegetation and the associated construction works have the potential to introduce or increase incidence of external diseases into vegetation or fauna populations. However, as the potential habitat for the Swift Parrot in the study area is already degraded and fragmented by existing roads and agricultural uses, it is unlikely that the proposal would introduce new diseases into the area which could result in the species' decline.

Is there a real chance or a possibility that the action will interfere with the recovery of the species?

The Australian Government Minister for the Department of Environment and Water Resources may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species) and threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

There is a recovery plan for the Swift Parrot (DEW). Recovery Actions identified in the plan include:

- Action 1. Identify the extent and quality of foraging habitat.
- Action 2. Manage Swift Parrot habitat at a landscape scale.
- Action 3. Reduce the incidence of collisions.
- Action 4. Population and habitat monitoring.
- Action 5. Community education and information.
- Action 6. Manage the recovery process through a recovery team.

The proposal would result in the clearing of 0.7 ha of potential foraging habitat for the Swift Parrot. Although clearing of potential habitat is identified as a threat to the recovery of the Swift Parrot in the plan, the proposed area to be cleared is estimated to be a small percentage (0.01 per cent) of the broader distribution of potential habitat in the locality (5,901 ha). In addition, potential habitat within the study area is considered to be of moderate to poor quality and contains no breeding sites. Considering the above, it is unlikely that the proposal would interfere with the recovery of the Swift Parrot.

Conclusion

Based on the above assessment, the Swift Parrot is **unlikely** to be significantly impacted by the proposal, and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Regent Honeyeater (*Xanthomyza phrygia*)

The Regent Honeyeater has a patchy distribution throughout a large geographic range. The species is known to forage on a variety of key *Eucalyptus* spp., particularly Mugga Ironbark (*E. sideroxylon*), Yellow Box (*E. melliodora*) and White Box (*E. albens*), Swamp Mahogany (*E. robusta*). The Regent Honeyeater will also utilise River Red Gum (*E. tereticornis*) and Grey Box (*E. moluccana*) for foraging (Schedvin 1996; Webster & Menkhorst 1992; Franklin *et al*. 1989).

This species is known to nest solitarily or in small colonies within three key breeding locations in northern NSW, western NSW and north-eastern Victoria (Higgins *et al.* 2001). None of these breeding sites are near the locality.

Potential foraging habitat exists in the study area in woodlands and forests where the feed trees River Red Gum and Grey Box occur. However, given the lack of preferred foraging trees within the study area it is unlikely to constitute prime or core habitat for this species. It is possible that the Regent Honeyeater would use the resources within the study area, however it is unlikely to be dependant on them for survival.

Potential foraging habitat for this species occurs within the woodland and forest habitat where flowering eucalypts provide potential foraging resources. The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). The total extent of similar habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for this species within the locality.

Given the mobility of this species, the lack of known breeding sites within the locality and the extent of higher quality potential habitat within the locality (including within the adjacent Dharawal State Conservation Area), it is unlikely that the proposal would have a significant impact this species.

Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of a population of a species?

The study area does not contain known breeding sites or the species' key feed trees. Given the range and mobility of this species it is unlikely to be wholly dependent upon resources within the study area. Additionally, the species has been recorded within the locality on three occasions, the most recent record being from 1984. It is therefore possible that the species no longer utilises the

area. Given the above, it is unlikely that the proposal would lead to a long-term decrease in the size of a population of the Regent Honeyeater.

Is there a real chance or a possibility that the action will reduce the area of occupancy of the species?

The proposal is unlikely to impact breeding sites, although foraging habitat (flowering eucalypts) for this species may be affected. The total extent of similar foraging habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for this species within the locality.

Therefore, it is unlikely that the proposal would reduce the area of occupancy of a population of the Regent Honeyeater.

Is there a real chance or a possibility that the action will fragment an existing population into two or more populations?

The study area is already fragmented by existing agricultural practices and roads. Considering the mobility of the species and that the proposed boreholes are not located in such a way as to further fragment vegetation stands, the proposal is unlikely to fragment an existing population of the Regent Honeyeater into two or more populations.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?

The Commonwealth Environment Minister may identify and list habitat critical to the survival of a listed threatened species or ecological community. Details of this identified habitat will be recorded in a Register of Critical Habitat. To date no areas of critical habitat have been listed for Regent Honeyeater.

Is there a real chance or a possibility that the action will disrupt the breeding cycle of a population?

Breeding of this species is well known (Higgins *et al.* 2001) and the study area does not contain any known breeding sites. Therefore the proposed action is unlikely to disrupt the breeding cycle of a population of the Regent Honeyeater.

Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposal is likely to directly impact approximately 0.7 ha of potential foraging habitat which represents 0.01 per cent of the distribution of similar potential habitat within the locality (5,901 ha). The potential habitat within the study area exists in small stands, fragmented by agricultural uses, roads and electicity easements. Given the range of this species, extent of potential habitat within the locality, the moderate to low quality of the potential habitat and lack of breeding sites within the study area, it is unlikely that the proposal would decrease the availability or quality of habitat to the extent that the Regent Honeyeater is likely to decline.

Is there a real chance or a possibility that the action will result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat?

Potential habitat within the study area has been previously disturbed and is subject to ongoing disturbance, due to adjacent agricultural practices and roads, including weed invasion. It is possible that the proposal will exacerbate the existing weed invasion in the impacted patches of vegetation, with increased edge effects. However with suitable mitigation measures as outlined in Section 5.2, any impacts on the potential habitat will be minimised.

Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?

Diseases have not been identified as a threat to populations of the Regent Honeyeater (DEC 2005o).

Clearing vegetation and the associated construction works have the potential to introduce or increase incidence of external diseases into vegetation or fauna populations. However, as the potential habitat for the Regent Honeyeater in the study area is already degraded and fragmented by existing roads and agricultural uses, it is unlikely that the proposal would introduce new diseases into the area which could result in the species' decline.

Is there a real chance or a possibility that the action will interfere with the recovery of the species?

The Australian Government Minister for the Department of Environment and Water Resources may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species)

and threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

There is a recovery plan for the Regent Honeyeater (DEW). Recovery Actions identified in the plan include:

- Action 1. Organisational arrangement including continued use of the Regent Honeyeater Recovery team to guide and review progress as well as close liaison with the Regent Honeyeater Recovery team, state agencies and other groups.
- Action 2. Active management including preparation of regional work plans in four key regions by Operations Groups.
- Action 3. Monitor population levels and changes in distribution.
- Action 4. Conduct research on post-breeding movements, isolation between population, habitat availability and resource use.
- Action 5. Maintain and develop community participation and awareness.
- Action 6. Maintain and improve captive population management.

In addition, with relation to Regent Honeyeater habitat, Objective 2 of the recovery plan states: 'Maintain and enhance the value of Regent Honeyeater habitat at the key sites and throughout the former range'.

The proposal would result in the clearing of 0.7 ha of potential foraging habitat for the Regent Honeyeater. Although maintaining an enhancing Regent Honeyeater habitat is listed as a Specific Objective in the recovery of the Regent Honeyeater in the plan, the proposed area to be cleared is estimated to be a small percentage (0.01 per cent) of the broader distribution of potential habitat in the locality (5,901 ha). In addition, potential habitat within the study area is considered to be of moderate to poor quality and contains no breeding sites. Considering the above, it is unlikely that the proposal would interfere with the recovery of the Regent Honeyeater.

Conclusion

Based on the above assessment, the Regent Honeyeater is **unlikely** to be significantly impacted by the proposal, and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Vulnerable Species

Flora

Potential habitat occurs within the study area for three Vulnerable plant species listed on the EPBC Act *Grevillea parviflora* spp. *parviflora, Persoonia bargoensis* and *Pomaderris brunnea*. The potential impacts of the proposal on these species are assessed against the Significant Impact Criteria of the EPBC Act below.

Grevillea parviflora ssp. *parviflora*

An 'important population' is defined by DEH (2006) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

Grevillea parviflora ssp. *parviflora* was not recorded in the study area in the current surveys. The species has previously been recorded in the study area, but occurs outside the impact area (Figure 6).

The main occurrence of the species is centred around Picton, Appin and Bargo (DEC 2005q). The study area is near the limit of distribution for the species.

The proposal is not likely to impact on an important population of *Grevillea parviflora* ssp. *parviflora* since the species was not recorded in the impact area and therefore no individuals will be removed. Potential habitat for this species exists in the study area in Shale Sandstone Transition Forest, which will be impacted by the proposal.

Is the action likely to lead to a long-term decrease in the size of an important population of a species?

Grevillea parviflora ssp. *parviflora* was not recorded in the study area in the current surveys. The species has previously been recorded in the study area, but occurs outside the impact area (Figure 6). The proposal will not require the removal of any plants of *Grevillea parviflora* spp. *parviflora,* and is therefore not likely to lead to a long-term decrease in the size of an important population of this species.

Is the action likely to reduce the area of occupancy of an important population?

The proposal is not likely to reduce the area of occupancy of an important population, as no plants of the species are likely to be removed and the area of habitat impacted is small.

Is the action likely to fragment an existing important population into two or more populations?

The proposal will not result in the removal of any plants of *G. parviflora* spp. *parviflora.* The proposal is not likely to fragment an existing important population into two or more populations.

Is the action likely to adversely affect habitat critical to the survival of a species?

'Habitat critical to the survival of a species or ecological community' is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

To date, the Register of Critical Habitat does not contain any listing for *G. parviflora* ssp. *parviflora* and a recovery plan for the species has not been prepared.

The potential habitat for *G. parviflora* ssp. *parviflora* in the study area is not likely to be critical habitat. The proposal is not likely to adversely affect habitat critical to the survival of this species.

Is the action likely to disrupt the breeding cycle of an important population?

The proposal is not likely to result in the removal of any plants of *G. parviflora* ssp. *parviflora.* The proposal is therefore not likely to disrupt the breeding cycle of an important population of the species.

Is the action likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Grevillea parviflora ssp. *parviflora* was not recorded in the impact area. Potential habitat for *G. parviflora* ssp. *parviflora* in the study area occurs in SSTF. The proposal will remove or modify approximately 0.5 ha of vegetation that is potential habitat for *G. parviflora* ssp. *parviflora.*

There are areas of known and potential habitat for *G. parviflora* ssp. *parviflora* in the local area, with:

- Thirteen previous recordings of the species within a 10 km radius of the study area (Figure 6);
- DECC (NPWS 2002b) mapping approximately 3,942 ha of similar potential habitat (SSTF) within a 10 km radius of the study area;

The proposal will result in the removal or modification of approximately 0.5 ha of potential habitat for *G. parviflora* spp. *parviflora* in the study area. This amounts to 0.01 per cent of the local occurrence of similar habitat (SSTF), which is not considered to be an significant amount.

The potential habitat for *Grevillea parviflora* spp. *parviflora* to be impacted at PA02 occurs on the edge of a continuous piece of bushland within an asset protection zone behind a property with horse yards. Thus fragmentation is not likely in this location.

The construction of the borehole at PA03 will occur in the middle of a patch of SSTF that is potential habitat for *Grevillea parviflora* spp. *parviflora* and considered to be in good condition. This site, while not likely to isolate a patch of SSTF will result in minor fragmentation of this patch of bush.

The proposal is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is the action likely to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

There is potential for the proposal to result in an increase in invasive species in the potential habitat for *Grevillea parviflora* spp. *parviflora*. Amelioration measures, such as implementation of weed management strategies, have been recommended to reduce this threat.

Is the action likely to introduce disease that may cause the species to decline?

The removal or modification of 0.5 ha of potential habitat for *G. parviflora* spp. *parviflora* is not likely to introduce disease that may cause the species to decline. However as a precaution, vehicles should be washed prior to use on site.

Is the action likely to interfere substantially with the recovery of the species?

To date, no recovery plan has been written for *G. parviflora* ssp. *parviflora.* The proposal is not likely to interfere with the recovery of this species.

Conclusion

Based on the above assessment, *G. parviflora* ssp. *parviflora* is unlikely to be significantly impacted by the proposal and as such a referral under the provisions of the EPBC Act is not recommended for this species.

Persoonia bargoensis

An 'important population' is defined by DEH (2006) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

Persoonia bargoensis was not recorded in the study area. The study area is therefore unlikely to support an important population of this species. Potential habitat for this species exists in the study area in Shale Sandstone Transition Forest, which will be impacted by the proposal.

Is the action likely to lead to a long-term decrease in the size of an important population of a species?

Persoonia bargoensis was not recorded in the study area. The study area is unlikely to support an important population of this species. Therefore the proposal is not likely to lead to a long-term decrease in the size of an important population of this species.

Is the action likely to reduce the area of occupancy of an important population?

Persoonia bargoensis was not recorded in the study area. The study area is therefore unlikely to support an important population of this species. The proposal is not likely to reduce the area of occupancy of an important population.

Is the action likely to fragment an existing important population into two or more populations?

The study area is not considered to contain an important population of *P. bargoensis.* Therefore the proposal is not likely to result in the fragmentation of an existing important population into two or more populations.

Is the action likely to adversely affect habitat critical to the survival of a species?

'Habitat critical to the survival of a species or ecological community' is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

To date, the Register of Critical Habitat does not contain any listing for *P. bargoensis* and a recovery plan for the species is in preparation, but not yet available to the public.

The potential habitat for *P. bargoensis* in the study area is not likely to be critical habitat, as the species was not recorded in the study area. The area is not likely to be necessary for breeding, dispersal, long-term maintenance of the species, to maintain genetic diversity and long term evolutionary development or for the reintroduction of populations.

Is the action likely to disrupt the breeding cycle of an important population?

The study area is not considered to contain an important population of *P. bargoensis.* The proposal is therefore not likely to disrupt the breeding cycle of an important population of the species.

Is the action likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Persoonia bargoensis was not recorded in the study area. Potential habitat for *P. bargoensis* in the study area occurs in SSTF. The proposal will remove or modify approximately 0.5 ha of vegetation that is potential habitat for *P. bargoensis.*

At least 3,942 ha of similar habitats have been mapped in the locality (within 10 km of the study area) (NPWS 2002b). The area of habitat to be removed as part of the proposal equates to 0.01 per cent of similar vegetation that exists in the locality.

The potential habitat for *Persoonia bargoensis* to be impacted at PA02 occurs on the edge of a continuous piece of bushland within an asset protection zone behind a property with horse yards. Thus fragmentation is not likely in this location.

The construction of the borehole at PA03 will occur in the middle of a patch of SSTF that is potential habitat for *Persoonia bargoensis* and considered to be in good condition. This site, while not likely to isolate a patch of SSTF will result in a minor fragmentation of this patch of bush.

Therefore, the proposal is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is the action likely to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

There is potential for the proposal to result in an increase in invasive species in the potential habitat for *Persoonia bargoensis*. Amelioration measures, such as implementation of weed management strategies, have been recommended to reduce this threat.

Is the action likely to introduce disease that may cause the species to decline?

The removal or modification of 0.5 ha of potential habitat for *P. bargoensis* is not likely to introduce disease that may cause the species to decline. However as a precaution, vehicles should be washed prior to use on site.

Is the action likely to interfere substantially with the recovery of the species?

To date, no recovery plan has been written for *P. bargoensis.* The proposal is not likely to interfere with the recovery of this species.

Conclusion

Based on the above assessment, *P. bargoensis* is unlikely to be significantly impacted by the proposal and as such a referral under the provisions of the EPBC Act is not recommended for these species.

Pomaderris brunnea

An 'important population' is defined by DEH (2006) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

Pomaderris brunnea was not recorded in the study area. The study area is therefore unlikely to support an important population of this species. Potential habitat for this species exists in the study area in Cumberland Plain Woodland, which will be impacted by the proposal.

Is the action likely to lead to a long-term decrease in the size of an important population of a species?

Pomaderris brunnea was not recorded in the study area. The study area is therefore unlikely to support an important population of this species. The proposal is not likely to lead to a long-term decrease in the size of an important population of this species.

Is the action likely to reduce the area of occupancy of an important population?

Pomaderris brunnea was not recorded in the study area. The study area is therefore unlikely to support an important population of this species. The proposal is not likely to reduce the area of occupancy of an important population of the species.

Is the action likely to fragment an existing important population into two or more populations?

The study area is not considered to contain an important population of *P. brunnea*. Therefore, the proposal is not likely to fragment an existing important population into two or more populations.

Is the action likely to adversely affect habitat critical to the survival of a species?

'Habitat critical to the survival of a species or ecological community' is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

To date, the Register of Critical Habitat does not contain any listing for *P. brunnea* and a recovery plan for the species is currently being prepared, but not yet available to the public.

The potential habitat for *P. brunnea* in the study area is not likely to be critical habitat, as the species was not recorded in the study area and so the area is not likely to be necessary for breeding, dispersal, long-term maintenance of the species, to maintain genetic diversity and long term evolutionary development or for the reintroduction of populations.

Is the action likely to disrupt the breeding cycle of an important population?

The study area is not considered to contain an important population of *P. brunnea*. The proposal is therefore not likely to disrupt the breeding cycle of an important population of the species.

Is the action likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Pomaderris brunnea was not recorded in the study area. Potential habitat for *P. brunnea* in the study area occurs in CPW. The proposal will remove or modify approximately 0.2 ha of vegetation that is potential habitat for *P. brunnea.*

At least 1,959 ha of similar habitats have been mapped in the locality (within 10 km of the study area) (NPWS 2002b). The area of habitat to be removed as part of the proposal equates to 0.01 per cent of similar vegetation that exists in the locality.

The patch of CPW to be disturbed is currently part of a riparian corridor along Mallaty Creek and the 0.2 ha to be impacted occurs along the edge of this corridor. Therefore, while the extent of CPW in the study area will be reduced by 0.2 ha, the removal of this patch would not result in the isolation of any CPW.

Therefore, the proposal is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is the action likely to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

There is potential for the proposal to result in an increase in invasive species in the potential habitat for *Pomaderris brunnea*. Amelioration measures, such as

implementation of weed management strategies, have been recommended to reduce this threat.

Is the action likely to introduce disease that may cause the species to decline?

The removal or modification of 0.2 ha of potential habitat for *P. brunnea* is not likely to introduce disease that may cause the species to decline. However as a precaution, vehicles should be washed prior to use on site.

Is the action likely to interfere substantially with the recovery of the species?

To date, no recovery plan has been written for *P. brunnea.* The proposal is not likely to interfere with the recovery of this species.

Conclusion

Based on the above assessment, *P. brunnea* is unlikely to be significantly impacted by the proposal and as such a referral under the provisions of the EPBC Act is not recommended for these species.

Fauna

Potential habitat occurs within the study area for one Vulnerable animal species listed on the EPBC Act, the Grey-headed Flying-fox. The potential impacts of the proposal on this species are assessed against the Significant Impact Criteria of the EPBC Act below.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox is a canopy-feeding frugivore, blossom-eater and nectarivore of rainforests, open forests, woodlands, Melaleuca swamps and Banksia woodlands. They have a varied diet, encompassing a wide range of fruits and blossoms from both native and non-native trees (Strahan 1995).

The species congregates in large numbers at roosting sites (camps) in habitats that include rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring. Grey-headed Flying-foxes are known to travel up to 50 km from their camps to forage (NPWS 2001a).

Three Grey-headed Flying-fox camps have been recorded within approximately 50 km of the study area. These include a camp in Cabramatta (approximately 50 km from study area), Mt Kembla (approximately 30 km from study area) and Jamberoo (approximately 50 km from study area). The Grey-headed Flying-fox was not recorded during the current survey but has been recorded in the past within the study area (DECC Atlas of NSW Wildlife).

Potential foraging habitat for this species occurs within the woodland and forest habitat where flowering eucalypts provide potential foraging resources. The proposal is likely to directly impact 0.5 ha of potential forest habitat (Shale Sandstone Transition Forest (EEC)) and 0.2 ha of potential woodland habitat (Cumberland Plain Woodland (EEC)). The total extent of similar habitat types within the locality is 5,901 ha, meaning the area proposed to be cleared/modified represents 0.01 per cent of the potential habitat for this species within the locality.

Given the mobility of this species, the lack of camps within the study area (or the locality) and the extent of higher quality potential habitat within the locality (including within the adjacent Dharawal State Conservation Area), it is unlikely that the proposal would have a significant impact on the habitats for this species.

Populations of the Grey-headed Flying-fox that may occur within the study area are not considered important populations because:

- they are unlikely to be key source populations either for breeding or dispersal, seeing as no camps have been recorded in the study area and the nearest camp is approximately 30 km away;
- they are unlikely to be necessary for maintaining genetic diversity, as there is no evidence that the study area contains an isolated genetic variant of this species or that the proposal would impact on the overall genetic diversity of the species; and,
- the study area is not at or near the limit of the species range which extends along the coast from Bundaberg in Queensland, south to western Victoria.

Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of an important population of a species?

The study area is not considered to contain an important population of the Grey-headed Flying-fox. Furthermore, as the study area contains no camps and given the range and mobility of this species it is unlikely to be wholly dependent upon resources within the study area. Therefore the proposal is unlikely to lead to a long-term decrease in the size of an important population.

Is there a real chance or a possibility that the action will reduce the area of occupancy of an important population?

The study area is not considered to contain an important population of the Grey-headed Flying-fox. Furthermore, the proposal is unlikely to impact potential roost sites (camps), although foraging habitat (flowering eucalypts) for this species may be affected. Therefore, it is unlikely that the proposal would reduce the area of occupancy of an important population of this species.

Is there a real chance or a possibility that the action will fragment an existing important population into two or more populations?

The study area is not considered to contain an important population of the Grey-headed Flying-fox. The study area is already fragmented by existing agricultural practices and roads. The proposal is unlikely to fragment an existing important population into two or more populations.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?

The Commonwealth Environment Minister may identify and list habitat critical to the survival of a listed threatened species or ecological community. Details of this identified habitat will be recorded in a Register of Critical Habitat. To date no areas of critical habitat have been listed for Grey-headed Flying Fox.

Is there a real chance or a possibility that the action will disrupt the breeding cycle of an important population?

The study area is not considered to contain an important population of the Grey-headed Flying-fox. Therefore the proposed action is unlikely to disrupt the breeding cycle of an important population. Furthermore, the proposal is unlikely to impact potential roost sites (camps) where breeding occurs (Strahan 1995).

Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposal is likely to directly impact approximately 0.7 ha of potential foraging habitat which represents 0.01 per cent of the distribution of similar potential habitat within the locality (5,901 ha). The potential habitat within the study area exists in small stands, fragmented by agricultural uses, roads and electricity easements. Given the range of this species, extent of potential habitat within the locality, the moderate to low quality of the potential habitat and lack of breeding camps within the study area, it is unlikely that the proposal would decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is there a real chance or a possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

Potential habitat within the study area has been previously disturbed and is subject to ongoing disturbance, due to adjacent agricultural practices and roads, including weed invasion. It is possible that the proposal will exacerbate the existing weed invasion in the impacted patches of vegetation, with increased edge effects. However with suitable mitigation measures as outlined in Section 5.2 any impacts on the potential habitat will be minimised.

Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?

Diseases have not been identified as a threat to populations of the Grey-headed Flying-fox (NPWS 2001a).

Clearing vegetation and the associated construction works have the potential to introduce or increase incidence of external diseases into vegetation or fauna populations. However, as the potential habitat for the Grey-headed Flying Fox in the study area is already degraded and fragmented by existing roads and agricultural uses, it is unlikely that the proposal would introduce new diseases into the area which could result in the species' decline.

Is there a real chance or a possibility that the action will interfere substantially with the recovery of the species?

The Australian Government Minister for the Department of Environment and Water Resources may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species) and threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

To date, there is no recovery plan for the Grey-headed Flying-fox. However, the DECC has compiled a list of priority actions to aid in the recovery of the species. The action relevant to the proposal is:

- Identify and protect key foraging areas.

The proposal would result in the clearing of 0.7 ha of potential foraging habitat for the Grey-headed Flying-fox. Although clearing of habitat is identified as a threat to the recovery of the Grey-headed Flying-fox, the proposed area to be cleared is estimated to be a small percentage (0.01 per cent) of the broader distribution of potential habitat in the locality (5,901 ha). In addition, potential habitat within the study area is considered to be of moderate to poor quality and contains no recorded camps/roosting sites. For these reasons it is unlikely that the proposal would interfere with the recovery of the Grey-headed Flying-fox.

Conclusion

Based on the above assessment, the Grey-headed Flying-fox is **unlikely** to be significantly impacted by the proposal, and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

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