Glen Innes Severn Council

Wattle Vale Quarry

Flora and Fauna Impact Assessment

May 2017

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1. Introduction

1.1 Overview

An Environmental Impact Statement (EIS) is being prepared by GHD to assess the significance of the potential environmental impacts associated with the establishment of Wattle Vale Quarry. The EIS has been undertaken in accordance with the *Environmental Planning and Assessment Act*, 1979 (EP&A Act) and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The proposal is being determined under Part 4 of the EP&A Act.

This Biodiversity Assessment has been prepared as a supporting document to the EIS. It assesses the potential for impacts on ecological values, with particular emphasis on threatened ecological communities, populations and species listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and *Fisheries Management Act 1994* (FM Act), and Matters of National Environmental Significance listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Mitigation measures to ameliorate potential impacts of the proposal are included in Section 7 of this report.

The Project involves the establishment of a hard rock quarry with an extraction rate of 300,000 tonnes per year. The total disturbance area of the quarry is approximately 8 hectares which includes an extraction area of approximately 6 hectares.

Project activities will be generally as follows:

- Progressive installation of environmental controls including erosion and sediment control measures.
- Construction of the intersection with the highway and signage.
- Construction of fencing.
- Delineation of the site and stockpiling areas.
- Vegetation clearance, soil stripping and stockpiling.
- Construction of temporary drainage controls.
- Expanded quarry operations.
- Establish site office and weighbridge.
- Close and rehabilitate the quarry.

1.2 Construction

The construction phase of the quarry would be relatively short (i.e. about 1 month). The main activity would be the construction of the access road. Other activities would be:

- Progressive installation of environmental controls including erosion and sediment control measures.
- Vegetation clearance within the proposed extraction area, soil stripping and stockpiling.
- Construction of temporary drainage controls.

A dozer, excavator and haul trucks are the main pieces of equipment likely to be required during construction. Other equipment may include:

- Roller
- Grader
- Water cart
- Compactor
- Light vehicles
- Hand tools

1.3 Operation

The quarry operations would be carried out in stages and in response to demand.

Stripping would occur in stages prior to excavation, generally stripping each area immediately prior to quarrying. Overburden would either be stockpiled for future rehabilitation works, or placed in final location as voids are created. The total area of the quarry would be stripped with excavation continuing to establish a quarry face of about 7 metres.

Excavation would commence on the western side of the disturbed area and continue in an easterly direction.

Once the first bench has been exhausted, a second 7 metre wide bench would be established and the process would be repeated until the final depth of approximately 20 metres below the current ground level (i.e, 1,160 m Australian Height Datum (AHD) is reached.

1.3.1 Drilling and blasting

Overlying weathered material will be removed using bulldozers and excavators. Underlying fresh rock will require blasting.

Blasting will be strictly controlled and conducted by a suitably qualified blasting contractor who will bring explosives onto site as required and fill a series of holes pre-drilled by a separate drilling contractor.

Bulk emulsion explosives such as Ammonium Nitrate Fuel Oil will be used. Following blasting, all blasting equipment and any unused explosives will be removed from site. No explosives would be stored on the Project site. Blasting will be undertaken in 20- 30,000 tonne shots similar to the existing Glen Innes Aggregates site. It is anticipated that up to one blast per month would be required.

1.3.1 Crushing and screening

Contractors would crush and screen the extracted material using mobile plant positioned close to the extraction area. An excavator would feed the excavated rock into a mobile primary crusher. The primary crusher will pass material to a secondary mobile crusher and then to the screening plant to sort the crushed aggregate into different grades depending on market demand. The screening plant will discharge into a stockpile area using a radial stacking conveyor.

1.3.2 Stockpiling

Material would be stockpiled in designated areas close to the respective pits. Material would be stored in various grades for sale or distribution. Ridge gravels may be brought to site from time to time to blend road base products. These components may form up to 10% of the finished product.

1.4 Extraction rate

The Project will extract up to 300,000 tonnes of material per annum. The actual extraction rate per annum will be dictated by demand requirements, however extraction will not exceed 300,000 tonnes in any twelve-month period. The total available resource is estimated to be 2.1 million tonnes.

The maximum extraction rate of 300,000 tonnes per annum has been selected to allow sufficient capacity to service demand during the construction of the proposed wind farms in the area. Once the wind farms have been constructed, it is anticipated the extraction rate would reduce to less than 100,000 tonnes per annum.

The maximum daily extraction and haul rate would be about 3,000 tonnes but this extraction rate would be rare.

The volume of material extracted from the quarry would be recorded using either a weighbridge or a loader with scales.

1.5 Project life and working hours

As the demand for product from the site will vary depending on the progress of certain major projects and fluctuating market conditions, it is not possible to put firm durations on each stage of activity. However, the quarry is expected to commence operation in late 2016 and be in operation for at least 30 years.

Operations would generally be limited to the following times:

- Monday to Friday: 7.00 am to 5.00 pm
- Saturday: 8.00 am to 4.00 pm
- No work on Sundays or Public Holidays

Staff may arrive and leave site before and after these times to ‘start-up’ and ‘shut-down’ the quarry but excavation, crushing or loading would not occur outside the times specified above. Blasting would only occur on weekdays between the hours of 10 am and 3 pm.

1.6 Workforce

The required workforce for the Project will vary depending on the needs for specific activities (contracted crushing and screening, haulage etc.), however it is anticipated to be up to a maximum of eight staff at any time.

1.7 Operational plant and equipment

Equipment at the quarry will depend on levels of activity which will vary from time to time. A description of the plant and equipment to be used is provided in Table 1-1. The frequency of use is relevant to the periods when the quarry is operating.

As an example, when the quarry is operating, the crusher will be operating 100% of the time but when there is no demand for material, the crusher would not be operating.

Table 1-1 Proposed quarry plant and equipment

Type	Approximate Number	Typical Frequency of use during operation	Description
Dozer	1	10%	Clearing and grubbing of vegetation and stripping of topsoil. Rehabilitation
Excavators	2	100%	Excavating material and stockpiling Clearing and grubbing of vegetation and stripping of topsoil
Screen	1	100%	Only for aggregate/gravel production and overburden screening
Front-end Loader	1	100%	Loading material onto the haul trucks and stockpiling material within the pit floor
Jaw, cone and impact crusher	1	100%	Crushing rock
Haul Trucks	Up to 100/day	100%	Delivery of materials to customers and stockpiling in pit if needed and carting unsuitable to rehabilitation areas.
Water Cart	1	10%	To water haul roads and stockpiles
Water Pump	3	10%	To dewater excavation/basin and to fill watercart from standpipe To water stockpiles and put moisture in products
Hand tools	5	5%	General activities maintaining plant
Light vehicles	Up to 12	20%	Transporting staff to, from and around site

1.8 Access and traffic

The source, destination and route of light and heavy vehicles accessing the quarry is not possible to predict however it is assumed they would travel via various routes to projects and customers around the area via the Gwydir Highway. Alternate routes may be used to supply aggregate to specific projects, such as the Glen Innes Wind Farm project directly south of the Project site.

The access road from the Gwydir Highway along the public road reserve has been approved as part of the Glen Innes Wind Farm and is not part of this Project. However, the intersections (one in and one out) with the Gwydir Highway will need to be upgraded. It is proposed to upgrade the accesses shared to incorporate CHR(s) and AUL(s) treatments

1.8.1 Construction traffic generation

During the construction phase, the traffic generated is expected to be limited to a few heavy vehicle movements at the start and end of the construction. A few light vehicles would also access the site daily during the construction works.

1.8.2 Operation traffic generation

Workforce Traffic

During operation, it is likely that there would be a maximum of twelve workers or plant operators on the site at any one time. This would yield a daily workforce traffic generation in the order of 24 vehicle trips per day (vtpd). It is assumed the majority of the workforce would arrive between 6:30 am and 7:30 am and depart generally between 3:00 pm and 6:30 pm.

Heavy Vehicle Traffic

Truck and dog trailer combinations have a capacity of about 32 tonnes. At maximum daily production (i.e. 3,000 tonnes), the quarry is expected to generate about 100 truck and dog loads or 200 truck movements per day. The truck movements would start at 7 am and continue evenly throughout the day, until 5 pm.

During the construction of the Glen Innes Wind Farm, not all truck movements will enter the Gwydir Highway, as the Glen Innes Wind Farm is accessed directly from Wattle Vale to the south on roads to be constructed as part of that project.

This rate of maximum truck movements is expected to be infrequent and for short durations. The average number of truck movements is expected to be a lot less and there will be times when no trucks would be operating.

1.9 Site facilities

1.9.1 Site drainage

Surface flows from the quarry (rainfall or groundwater ingress) would drain to sedimentation ponds (either freely or by pumping depending on the stage of quarrying). Following an appropriate settling time for suspended sediments, water from these dams would discharge to a series of drainage lines that lead to Wellingrove Creek and the Severn River.

Surface runoff from uphill will be prevented from entering the quarry by means of diversion drains along the southern edge.

All sediment and erosion controls will be designed and implemented in accordance with the *NSW Soils and Construction – Managing Urban Stormwater Volume 1* 'the Blue Book' (Landcom, 2004).

1.9.2 Dust suppression

During dry conditions, exposed areas will be sprayed with water from a water cart to suppress dust. Water will be sourced from the sediment basin, which will be oversized to allow for water storage while still allowing sufficient capacity to meet the Blue Book requirements.

1.9.3 Site offices

In the initial stages of the Project operation, the site will be managed from the existing operation in Glen Innes and no infrastructure beyond road, fencing and stockpile hardstands will be required. At some point in the future, an office, weighbridge and public carpark will be constructed adjacent to the access road.

1.9.4 Fuel storage

Mobile plant refuelling will take place on site from a self-bunded portable fuel store with a capacity of up to 10,000 litres. All scheduled plant and equipment maintenance will take place off site.

1.9.5 Lighting

Quarrying will be limited to daylight hours, avoiding the need for lighting.

1.9.6 Utilities

A rainwater tank will be connected to the site office to service the toilets and hand basin but water for domestic uses will be imported to site. Water for dust suppression and vehicle washing will be obtained from the sediment basin.

Toilet facilities will be provided with effluent being treated and disposed onsite via a septic tank.

Power is not required to operate the quarry.

1.9.7 Waste Management

Small amounts of domestic refuse generated on site will be removed for recycling or disposal at a suitably licensed landfill. The extraction is not expected to generate any waste material, as all extracted material will be either sold as a product or retained for reuse during rehabilitation.

1.10 Decommissioning and rehabilitation

1.10.1 Storage of topsoil and overburden

Topsoil would be stripped and stored on site during the site construction phase. Overburden not suitable for aggregate will be stockpiled for use in rehabilitation. Stockpiled overburden would be stabilised in accordance with the Blue Book.

1.10.2 Rehabilitation

Following completion of quarrying, areas that are no longer in use will be landscaped and progressively rehabilitated. Rehabilitation will generally involve:

- Removal of all structures, equipment and other materials from the works area.
- Earthworks and landscaping to reform the land to maximum 3:1 batter slopes with a minimum 0.5% grade to allow free drainage to a small existing farm dam to the west which will act as a sediment basin.
- Revegetation will use native species to match existing conditions.
- Erosion and sedimentation control would remain in place until the site is appropriately reinstated and revegetated.

Access roads will be retained for future uses.

1.11 Scope and limitations

This report: has been prepared by GHD for Glen Innes Severn Council and may only be used and relied on by Glen Innes Severn Council for the purpose agreed between GHD and Glen Innes Severn Council as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Glen Innes Severn Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

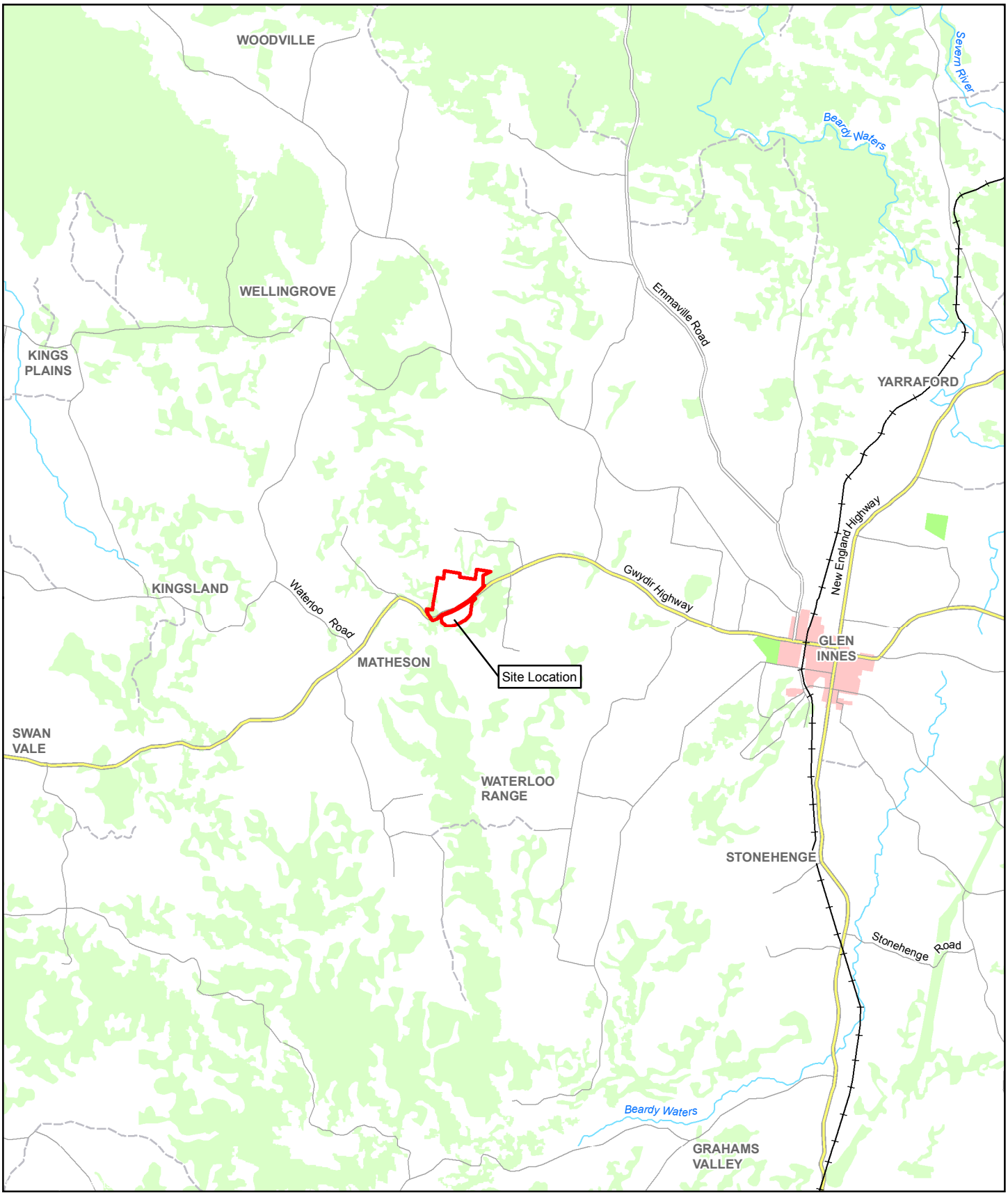
The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Glen Innes Severn Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.



LEGEND

- Principal Road
- Secondary Road
- Minor Road
- Track
- Railway
- Watercourse
- Built Up Area
- Recreation Area
- Forest Or Shrub
- Project boundary

Paper Size A4

0 0.75 1.5 3 4.5 6

Kilometres

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

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GHD

Glen Innes Severn Council
Wattle Vale Quarry
Flora and Fauna Impact Assessment

Job Number 22-18380
Revision A
Date 24 Mar 2017

Site location

Figure 1-1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\18380\GIS\Maps\Deliverables\SouthernQuarryEIS\FloraFauna\2218380_SQFFA001_SiteLocality_A.mxd

Data source: Geoscience Australia: 250k Topographic Data Series 3, 2006. Created by: fmackay

2. Legislative context

2.1 NSW legislation

2.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) forms the legal and policy platform for proposal assessment and approval in NSW and aims to 'encourage the proper management, development and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EP&A Act and EP&A Regulation 2000. The proposal will be assessed under Part 4 of the EP&A Act with Glen Innes Severn Council as the determining authority.

Section 111(4) of the Act states that the determining authority must consider the effect of an activity on:

- 'Critical habitat' (as defined under the TSC Act and FM Act).
- Species, populations or ecological communities, or their habitats (as listed under the TSC Act and FM Act) and whether there is likely to be a 'significant effect' on those species, populations or ecological communities.
- Other protected fauna or protected native plants listed under the National Parks and Wildlife Act 1974.

This study assesses the likelihood of threatened biota listed under the TSC Act occurring in the study area and their potential to be impacted by the proposal. Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act and the FM Act. The '7-part test' is used to assist in the determination of whether a proposal is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. Section 5A of the EP&A Act was addressed as part of the current assessment and 7-part tests were completed for relevant threatened species and ecological communities that are likely to be affected by the proposal. These assessments are included in Appendix C.

2.1.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides legal status for biota of conservation significance in NSW. The Act aims to 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2.

- The listing of 'Key Threatening Processes' (under Schedule 3).
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.
- Requirements or otherwise for the preparation of Species Impact Statement (SIS).

The TSC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the site or have distributions that encompass the study area and hence could occur subject to the habitats present.
- Targeted field surveys for threatened species, populations and ecological communities listed under the Act.
- Identification, assessment and mapping of EECs and threatened species (or their habitat) listed under the Act.
- Assessment of potential impacts on threatened species, populations and ecological communities listed under the Act.

2.1.3 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for:

- The listing of threatened species, populations and ecological communities, with endangered species, populations and communities listed under Schedule 4, 'critically endangered' species and communities listed under Schedule 4A, and vulnerable species and communities listed under Schedule 5.
- The listing of 'Key Threatening Processes' (under Schedule 6).
- Diseases affecting fish and marine vegetation (under Schedule 6B).
- Noxious fish and noxious marine vegetation (under Schedule 6C).
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.
- Requirements or otherwise for the preparation of a SIS.

One of the objectives of the FM Act is to 'conserve key fish habitats ' which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

Given that no works will be undertaken within creeks, no dredging or de-snagging would occur, and there would be no blocking (permanent or temporary) of fish passage or impacts on key fish habitat.

The FM Act has been addressed in the current assessment through undertaking:

- A desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the proposal and hence could occur subject to the habitats present.
- Assessment of aquatic habitats during terrestrial field surveys.
- Assessment of impacts on aquatic habitats.
- Assessment of the potential for impacts on threatened species, populations and ecological communities listed under the Act.
- Identification of suitable impact mitigation and environmental management measures to avoid or mitigate impacts on the aquatic environment.

2.1.4 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) regulates the clearing of native vegetation on all land in NSW except for land listed in Schedule 1 of the Act. Excluded land under Schedule 1 of the Act includes National Parks and other conservation areas, State forests and reserves, and urban areas.

The NV Act does not apply to the clearing of native vegetation that is, or is part of, designated development within the meaning of the EPA Act and for which development consent has been granted.

2.1.5 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act), provides for the declaration of noxious weeds by the Minister for Primary Industries. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. This report has identified noxious weeds in the study area and appropriate mitigation measures to minimise the potential introduction or spread of weeds as a result of the proposal.

2.2 State planning policies

2.2.1 SEPP 44: Koala Habitat

State Environmental Planning Policy 44 (SEPP 44) aims to encourage the 'proper conservation and management of areas of natural vegetation that provide habitat for Koalas (*Phascolarctos cinereus*) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline'.

Schedule 1 of SEPP No. 44 identifies areas of land that are classified as being 'Core Koala Habitat' or 'Potential Koala Habitat. They are defined as follows:

- Core Koala Habitat is an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.
- Potential Koala Habitat are areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15 per cent of the total number of trees in the upper or lower strata of the tree component.

Under SEPP 44, if core Koala habitat is to be impacted by a proposal, an approved Koala Plan of Management is required prior to approval of the proposed development.

2.3 Commonwealth legislation

2.3.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on MNES undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, undertaking, proposal or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Government Minister for the Environment (the 'Minister').

The EPBC Act identifies MNES as:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (Ramsar wetlands).
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).
- A water resource, in relation to coal seam gas development and large coal mining development.

Potential impacts on any MNES must be subject to assessments of significance pursuant to the EPBC Act Significant Impact Guidelines (DotE, 2013). If a significant impact is considered likely, a referral under the EPBC Act must be submitted to the Minister.

This study assesses the likelihood of MNES occurring in the study area and their potential to be impacted by the proposal. Assessments of significance for relevant MNES are included in Appendix D.

2.4 Local environmental planning instruments

2.4.1 The Glen Innes Severn Local Environmental Plan 2012

The proposal is wholly located within the Glen Innes Severn LGA. The *Glen Innes Severn Local Environmental Plan 2012* (Glen Innes Severn Council LEP 2012) controls development within the LGA.

The proposal is located on land within zone RU1 (Primary Production). The objectives of zone RU1 are:

- *'To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones'.*

Under the provisions of zone RU1, extractive industries are permissible with consent.

3. Existing environment

3.1 Site description

The study area is approximately 8 hectares in area which includes an extraction area of approximately 7.76 hectares and sits on undulating pasture land on the edge of the Waterloo range, a low lying north-south belt of hills to the west of Glen Innes (see Plate 3-1 below). The surrounding area is relatively sparsely populated. The closest residence lies approximately 1,200 m to the east of the study area.

Plate 3-1 Southern portion of the study area

3.1.1 Neighbouring settlements

The nearest population centre to the study area is Glen Innes which is located approximately 13 km to the east. Other residences and settlements in the vicinity of the study area include:

- A small hamlet 1.3 km to the north of the study area on Malboona Road.
- Individual farm properties:
  - 1.7 km west at the entrance to Pitlochry Road
  - 1.5 km east Rose Hill Road
  - 2 km northeast on Malboona Road
  - 2.3 km east of on the Gwydir Highway

The proposed Glen Innes Wind Farm is located to the immediate south of the Project site. The wind farm has a current project approval for the construction and operation of up to 25 wind turbines each with a potential capacity of 3 Megawatts (MW), to produce enough energy to power approximately 47,000 homes (One Wind, 2016). The wind farm is currently moving into the construction phase.

3.1.2 Site history

The study area predominately consists of cleared land that is currently being used as pasture. The study area includes a three-bedroom home and sheds, and is under occupation by the former owners for six months as a condition of the contract of sale.

There are no existing extractive industries on the study area, however there is a small roadside quarry on crown/council road reserve adjacent to the site that has not operated for some years.

3.1.3 Topography and drainage

The study area occurs on land with a gentle slope leading to a ridge with an elevation of approximately 1,190 m Australian Height Datum (AHD).

The proposed extraction pit occurs close to the top of a ridge at around 1,180 m AHD.

An unnamed tributary of Backplain Creek runs through the study area (see Figure 3-1). Backplain Creek is a tributary of the Wellingrove Creek flowing into the Severn River. A number of small farm dams are located throughout the study area.

3.1.4 Ownership

The study area is located on Lot 1 of DP 728579, Lots 133 and 134 of DP 753274, and Lots 249, 174, 253, 101, 175, 87 and 113 of DP 753319. Council has recently acquired this land.

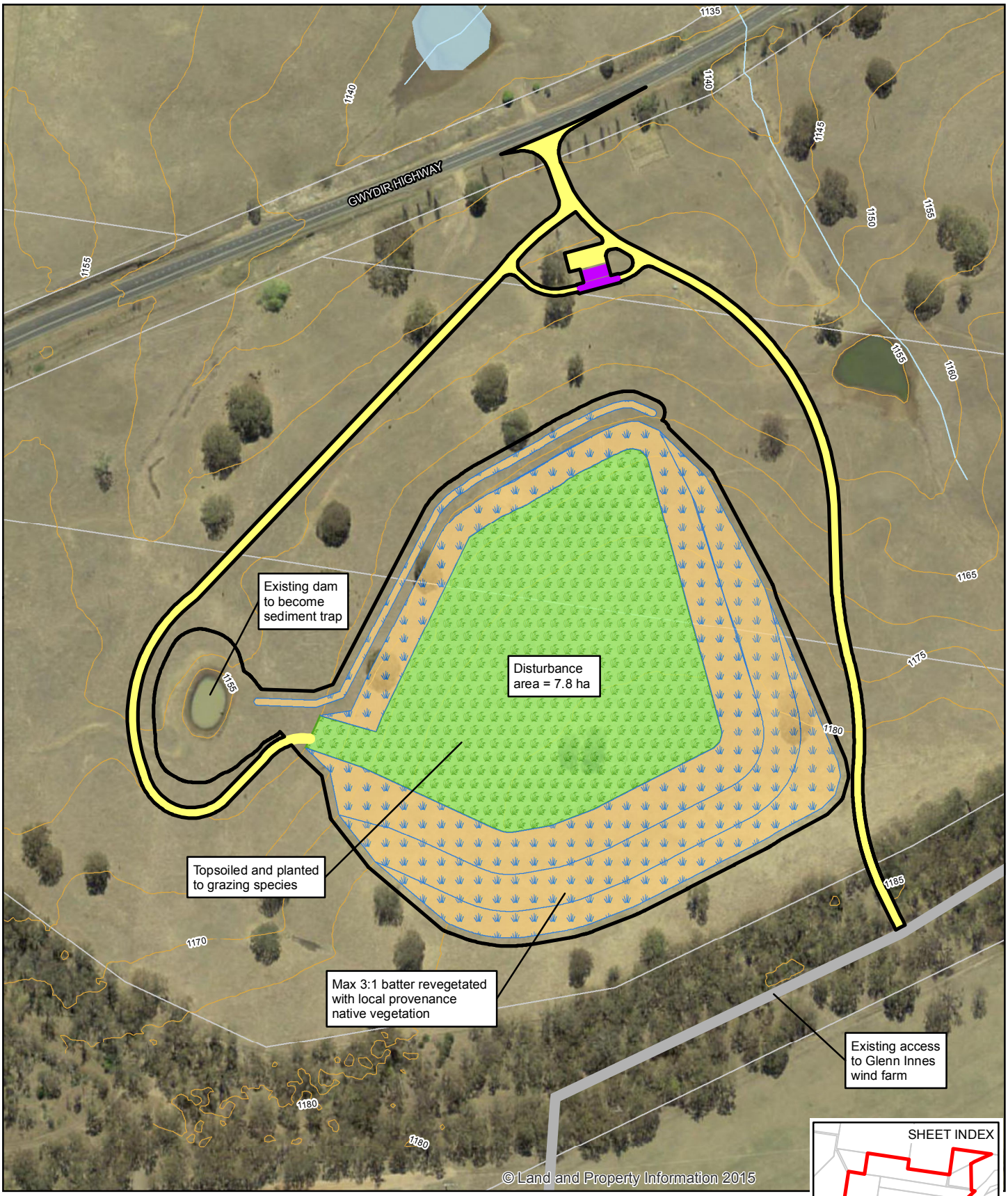
3.1.5 Other proposed or consented activities

Council have entered into preliminary discussions with Glen Innes Wind Farm (One Wind) regarding a shared entrance to the quarry and the wind farm off Gwydir Highway, plus a modification to their approval to incorporate three or four wind turbines on the Wattle Vale property. The shared entrance will be assessed as part of the Project. The modification to the wind turbine locations would be assessed by One Wind as a modification to their approval.

3.2 Regional context

The study area occurs in the Glen Innes Severn Council Local Government Area (LGA) in the New England area of NSW, approximately 13 km west of Glen Innes. The LGA covers an area of approximately 5,487 km^2 with a population of around 9,000 people and lies within the Border Rivers-Gwydir region.

The Glen Innes area is primarily known for its agricultural enterprises with Glen Innes providing an important centre for livestock sales. Key industries in the region include wool, sheep, cattle, agriculture, viticulture, sapphires and tourism. Renewable energy is a growing industry in the region with three wind farms and one solar farm recently approved.



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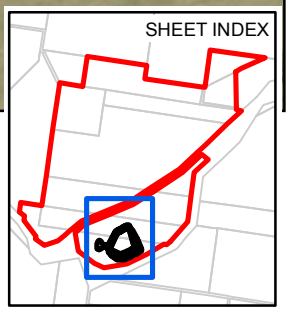

LEGEND

- Study area
- Cadastre
- Watercourse
- Waterbody
- 5m contours
- Existing access
- Site access
- Site office / weigh bridge
- Disturbance area
- Rehabilitation - local provenance native vegetation
- Rehabilitation - topsoiled and planted to grazing species

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

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Glen Innes Severn Council
Wattle Vale Quarry
Flora and Fauna Impact Assessment

Job Number	22-18380
Revision	A
Date	24 Mar 2017

Landscape context and connectivity **Figure 3-1**

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G:\22\18380\GIS\Maps\Deliverables\SouthernQuarryEIS\FloraFauna\2218380_SQFFA002_LandscapeContext_A.mxd

Data source: LPI: DCDB & DTDB, 2012,Aerial Imagery, 2016; GISSC: Aerial Imagery / Quarry Data, 2016. Created by: fmackay, tmorton

4. Methods

4.1 Desktop assessment

4.1.1 Threatened Biota Database Searches

A desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities listed under the TSC Act and FM Act, and MNES listed under the EPBC Act that may be affected by the proposal. Database records pertaining to the study area and locality (i.e. within a 10 km radius of the study area) were reviewed prior to field investigations and included:

- The Commonwealth Department of the Environment (DotE) Protected Matters Search Tool (PMST), for all MNES online database selected for a 10 km radius of the scheme envelope (DotE, 2016a), database queried on 11 August 2016.
- DotE online species profiles and threats database (DotE 2016b).
- Office of Environment and Heritage (OEH) Wildlife Atlas database (licensed) for records of threatened species, populations and threatened ecological communities listed under the TSC Act that have been recorded within the locality (OEH 2016a), data supplied by OEH on 11 August 2016.
- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH 2016b).
- Department of Primary Industries (DPI) online protected species viewer for records of threatened aquatic species in the locality (DPI, 2016a), database queried 11 August 2016.
- The NSW DPI 'Threatened Fish and Marine Vegetation – Find a Species by Geographic Region' online search tool (DPI 2016b).
- Noxious weed declarations for the Glen Innes Severn Council control area (DPI 2016c).

Following collation of database records and species and community profiles, a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the study area. This was further refined following field surveys and assessment of habitat present (see Sections 5.2 and 5.3). The results of this assessment are presented in Appendix A.

4.1.2 Likelihood of occurrence of threatened biota

Following collation of database records and species and community profiles a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the proposal footprint. This was further refined following field surveys, as described below. The likelihood of threatened and migratory biota occurring in the proposal footprint was assessed based on presence of records from the locality since 1980, species distribution and habitat preferences, and the suitability of potential habitat present in the proposal footprint. The results of this assessment are provided in Appendix A. Table 4-1 provides a key to the likelihood of occurrence in the proposal footprint of threatened biota known or likely to occur in the locality.

Table 4-1 Key to likelihood of occurrence for threatened species

Likelihood	Definition
Present	Recorded in the study area during current surveys.
Likely	Species previously recorded within a 10 kilometre radius of the study area and suitable habitat occurs within the study area.
Possible	Species previously recorded within a 10 kilometre radius of the study area and only marginal or limited habitat occurs within the study area. Species with potential habitat within the study area, but no records from the locality in the last 30 years.
Unlikely	Species previously recorded within a 10 kilometre radius of the study area but no suitable habitat recorded. Species not recorded within a 10 kilometre radius of the study area and only marginal or limited habitat occurs within the study area.
Nil	Species not previously recorded within a 10 kilometre radius of the study area and suitable habitat not recorded within the study area, and/or study area outside species known distribution.

4.2 Field Surveys

Field surveys were conducted by two ecologists across two days/ one -night in August 2016 and one day/ one night in March 2017

4.2.1 Flora survey

Vegetation within the study area was surveyed with reference to the BioBanking Assessment Methodology (BBAM) (OEH, 2014) and the DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. Surveys involved mapping of vegetation types occurring in the study area, followed by BioBanking plot-transect surveys and opportunistic threatened flora surveys.

The flora survey involved the following techniques, which are described in detail below:

- Vegetation surveys and mapping
- Plot-transect surveys
- Threatened flora searches

Survey sites were selected using air photo interpretation and field habitat assessment. The locations of quadrat surveys completed during the flora survey are displayed in Figure 4-1.

Vegetation surveys and mapping

Vegetation within the study area was assessed against identification criteria for State and Commonwealth listed TECs (i.e. Critically Endangered Ecological Communities (CEECs) and Endangered Ecological Communities (EECs)). Vegetation and habitats were compared with descriptions provided in OEH (2016b) and DotE (2016b) TEC profiles.

Plot and transect surveys were conducted on site in accordance with the BBAM. The site value was determined by assessing the following ten site condition attributes against benchmark values:

1. Native plant species richness
2. Native overstorey cover
3. Native midstorey cover
4. Native ground cover (grasses)
5. Native ground cover (shrubs)
6. Native ground cover (other)
7. Exotic plant cover (calculated as percentage of total ground and mid-storey cover)

8. Number of trees with hollows
9. Proportion of over-storey species occurring as regeneration
10. Total length of fallen logs

Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement. Cover abundance data was also collected for each species within the 20 metre x 20 metre portion of each plot/transect.

Plots were distributed between vegetation zones (i.e. OEH (2013c) Vegetation Types Database and condition classes identified in the survey) according to the DECC (2008) methodology. A total of eight plots were sampled within the study area as shown on Figure 4-1.

Opportunistic and incidental observations of additional flora species were recorded at all times during field surveys in order to compile a list of the dominant species present within the study area. Casual identification of potential habitat for threatened flora species was also undertaken throughout the course of the flora survey and while incidentally traversing the study area. This included identification of known associated species, identification of particular micro-climate conditions that may favour or enable threatened species to occur, as well as visual observations of threatened species if encountered. All observations of threatened flora or potential habitat for threatened flora species were recorded along with a waypoint captured with a hand-held GPS.

All vascular plants (i.e. not mosses, lichens or fungi) observed were recorded on proforma field data sheets. Each species list was accompanied by a detailed biophysical description, including vegetation structure, soils, geology and geomorphology, habitat and fire and disturbance history. Plant specimens that could not be identified rapidly in the field were collected and subsequently identified using standard botanical texts. Structural vegetation communities were described according to classifications made by Specht (1970). Plant identifications were made according to nomenclature in Harden (1990-93) and Royal Botanic Gardens Trust (2013). Plant specimens which were difficult to identify (either insufficient sample collected or buds/fruiting bodies were not available at the time of the survey) were identified to genus level.

Vegetation Condition Assessment

The vegetation condition assessment was determined in accordance with BBAM (OEH 2014) by assessing ten site condition attributes against benchmark values for the relevant community. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement (DECC, 2009). Cover abundance data was also collected for each species within the 20 metre x 20 metre portion of each plot/transect.

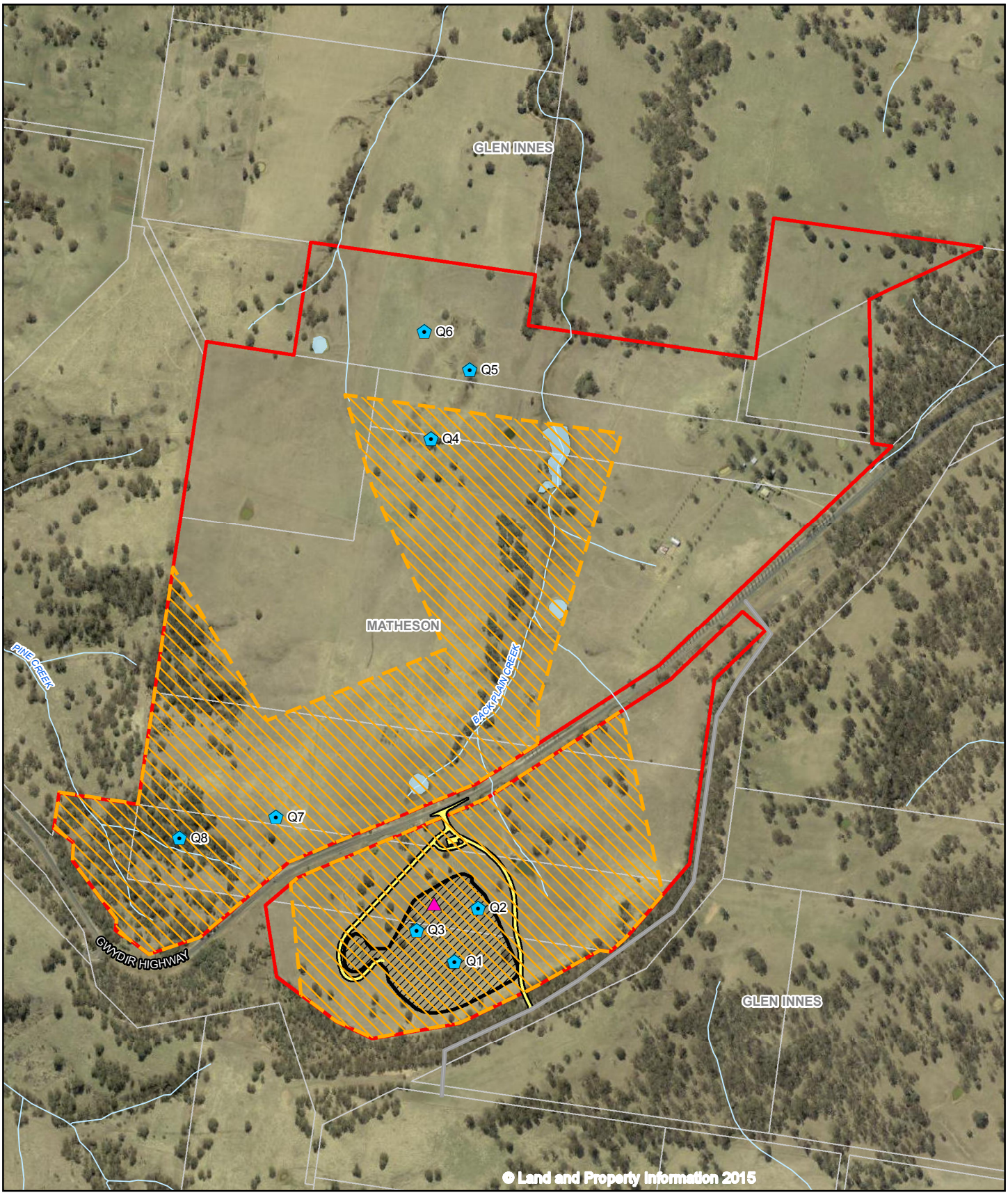
The overall condition of vegetation was also assessed through general observation and comparison against the BioBanking condition benchmark data as well as using parameters such as species diversity, history of disturbance, weed invasion and canopy health.

Threatened flora searches

The habitat requirements for threatened flora predicted to occur by the desktop assessment were identified prior to the field survey. Those requirements were then compared with those habitats present within the site during the field survey and an assessment of the likelihood of occurrence was completed based on consideration of known distributions, previous records in the locality and habitat requirements for each species. Searches for threatened plants in areas of suitable habitat were conducted during all traverses across the study area, typically when walking between quadrats or similar.

Targeted threatened flora surveys at appropriate seasonal times were undertaken for all potentially occurring threatened flora species as part of this assessment. The timing of field surveys in August 2016 was not ideal for the detection/identification of some cryptic species (i.e. *Thesium australe* and *Dichanthium setosum*), however, additional surveys were conducted in March 2017 which were considered to be suitable for detection of these species. Areas within the study area which were targeted for threatened flora surveys included areas where a high diversity of native groundcover species were observed. An indicative area of the extent of the flora survey is shown in Figure 4-1.

The habitat assessment conducted for the study area allowed for identification of habitat resources for cryptic species, in order to make an assessment of their likelihood of occurring within the proposal footprint. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values within the study area in order to predict potential impacts of the proposal, with particular emphasis on threatened biota and their habitats. The field survey aimed to identify areas of suitable habitat for cryptic species were possible.



LEGEND

- Study area
- Cadastre
- Watercourse
- Waterbody
- Disturbance area
- Anabat
- Biobank quadrats
- Site access
- Existing access
- Threatened flora survey area

Paper Size A4

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Glen Innes Severn Council
Wattle Vale Quarry
Flora and Fauna Impact Assessment

Job Number 18380
Revision
Date 31 May 2017

Survey effort

Figure 4-1

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G:\22\18380\GIS\Maps\Deliverables\SouthernQuarryEIS\FloraFauna\2218380_SQFFA003_SurveyEffort_B.mxd

Data source: LPI: DCDB & DTDB, 2012,Aerial Imagery, 2016; GISSC: Quarry data, 2016. Created by: fmackay, tmorton

4.2.2 Fauna survey

Fauna habitat assessment

Habitat assessments were conducted to help describe the suite of native fauna likely to occur in the study area. Particular attention was paid to habitat features and resources considered diagnostic of threatened species.

Habitat assessments included searches for and inspection of:

- Vegetation patch size, age, disturbance and structural diversity (important for many threatened birds and mammals).
- Quality of substrate for sheltering frogs and reptiles including rocks, logs, debris, peeling bark, leaf litter and native grassland.
- Presence of winter-flowering eucalypts (important for the Swift Parrot (*Lathamus dicolor*) and Regent Honeyeater (*Anthochaera phrygia*) and feed trees of the Koala (*Phascolarctos cinereus*).
- Koala scats in accordance with the Spot Assessment Technique (SAT) methodology.
- Hollow-bearing trees and logs which provide refuge, nest and den sites for a range of threatened fauna species.
- Stags and other roost sites for raptors and owls.
- Wetlands, moist grassland and other foraging habitat for waterbirds (including migratory birds) and frogs.
- Mammal scats at the base of trees or along tracks and runways.
- Tracks in soft substrate.
- Nest/den sites within logs, tree bases or tree trunks.
- Guano or moth remains at the base of hollow-bearing trees (diagnostic of the presence of tree-roosting bats).
- Scratches on tree trunks (diagnostic of Koalas, gliders or goannas) and worn bark around tree hollows (diagnostic of active use of hollows).
- Owl pellets, whitewash or animal remains beneath trees (diagnostic of owl or raptor roosts).

Locations of important habitat features were captured with a handheld GPS unit.

Feed tree assessments

In order to determine the availability of potential foraging habitat for threatened species with specific feed tree requirements (such as the Koala, Regent Honeyeater and Swift Parrot), an assessment of the relative cover abundance of dominant canopy tree species was undertaken. This assessment was undertaken in conjunction with the BioBanking plot-transects surveys described in section 4.2.1. As part of these plot-transects, the percentage foliage cover is usually estimated for the canopy and midstorey layers every five metres along a 50m transect. For this assessment, the percentage foliage cover of each component canopy species was recorded as well as the overall cover at each point along the transect.

Hollow-bearing tree assessments

Counts of hollow-bearing trees were undertaken within plot-transects in accordance with the BBAM, in order to provide an indication of the density of hollow-bearing trees within each vegetation type. Additional information was collected on the tree species, height, diameter at breast height, evidence of use and number, size and location of hollows for all hollow-bearing trees within the plot-transects. Any hollow-bearing trees encountered during other surveys were also inspected for signs of use, and their location recorded using a handheld GPS unit.

Diurnal bird surveys

Diurnal bird surveys were performed in the early morning within the study area. Area searches of at least 60 minutes' duration were undertaken at a number of locations across all vegetation types to compile a list of native birds present. Species were identified by sight and call. Incidental observations made outside the targeted survey period were also recorded.

Frog searches

Drainage lines within the study area were inspected to see if any frogs were calling from leaf litter or fringing riparian vegetation. Any frogs heard calling were identified by call or by visual inspection where possible.

Microbat surveys

Bat calls were recorded during field surveys using Anabat Express detectors (Titley Scientific). Detectors recorded calls for one night at one location within the study area (Figure 4-1). The single hollow-bearing tree in the southern portion of the study area was identified as a suitable location for placement of the anabat.

Calls were identified using zero-crossing analysis and AnalookW software (version 4.1z, Chris Corben 2015) by visually comparing the time-frequency graph and call characteristics (e.g. characteristic frequency and call shape) with reference calls and/or species call descriptions from available reference material.

The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay et al. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Pennay et al 2011; Churchill 2008; Van Dyck et al. 2013) and records from BioNet (January 2017). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills *et al.* 1996 & Duffy *et al.* 2000) as summarised in Table 4-2. Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls.

Table 4-2 Confidence rating applied to microbat calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
SG - Species Group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species e.g. *Chalinolobus gouldii* /*Ozimops* sp. Nyctophilus sp. The calls of Nyctophilus geoffroyi / gouldi cannot be distinguished during the analysis process and are therefore lumped together. *Nyctophilus* sp/*Myotis Macropus*. The calls of these species can be easily confused during the analysis process and are therefore often lumped together.

Opportunistic observations

Opportunistic and incidental observations of fauna species were recorded at all times during the field survey. Survey effort was concentrated on suitable areas of habitat throughout the course of the survey, for instance burrows and diggings were noted, fallen timber or rocks were scanned and lifted to search for frogs and reptiles, and mature trees were scanned for roosting birds.

4.2.3 Survey effort

Fauna survey effort was determined based on threatened fauna species that were considered to have the potential to occur in the study area. GHD survey effort is provided in Table 4-3 below.

Table 4-3 Survey methods and effort (GHD 2013)

Date	Survey Method	Comment
3-4 August 2016	Habitat assessments	2 persons over 2 days
	BioBanking plot-transects (including feed tree and hollow-bearing tree assessments)	6 plot-transects
	Opportunistic surveys	2 persons over 2 days
	Birds	2 mornings
20-21 March 2017	BioBanking plot-transects	6 plot-transects
	Opportunistic surveys	2 persons over 1 day
	Anabat	1 night
	Birds	1 morning

4.2.4 Survey conditions

Weather observations for the survey period are provided below in Table 4-4.

Table 4-4 Weather details

Date	Survey dates	Minimum temp (Deg Celsius)	Max temp (Deg Celsius)	Max wind gust and direction	Rainfall (mm)
1/08/2016	No	0.0	18.0	NW 31	0.0
2/08/2016	No	3.0	16.0	W 48	0.0
3/08/2016	Yes	6.0	9.0	SSE 48	13.2
4/08/2016	Yes	4.5	12.5	SE 65	18.8
5/08/2016	No	1.5	14.2	SE 54	0.0
6/08/2016	No	0.0	14.0	WNW 24	0.0
18/03/2017	No	14.0	26.0	SE 50	17
19/03/2017	No	14.0	20.0	E 44	68.2
20/03/2017	Yes	16.5	24.5	ESE 41	0.2
21/03/2017	Yes	17.0	23.0	N 30	2.8

*Temperature and rainfall observations are from Glen Innes Ag Research Stn {station 056013}.

4.2.5 Survey limitations

In August 2016, the cold, wet conditions during the survey period were less than ideal for the detection of many flora and fauna species. The survey was undertaken outside the optimal survey period for cryptic threatened flora species such as Austral Toadflax (*Thesium australe*) and Bluegrass (*Dichanthium setosum*) which reduced the chance of the species (if present) being detectable above ground. The conditions also reduced the likelihood of detection of many fauna species such as arboreal mammals, which tend to be inactive during wet nights with low temperatures. Few trees or shrubs were flowering at the time of the field survey. This may further reduce the diversity and abundance of nectarivorous birds present within the study area.

Additional surveys were conducted in March 2017. The timing of these surveys were more conducive to the detection of flora and fauna species within the study area. A large diversity of flora were in flower (i.e. particularly grassland species) and more fauna species were detected including amphibians and microbats.

5. Results

5.1 Database searches

5.1.1 State-listed threatened biota

The database searches identified three EECs, eight threatened flora species, 18 threatened fauna species (13 birds, two frogs, two reptiles and one fish) listed under the TSC Act as potentially occurring in the locality of the study area. Of these, habitat was identified within the study area for two threatened flora species; Austral Toadflax (*Thesium australe*) and Bluegrass (*Dichanthium setosum*), and two threatened fauna species (Regent Honeyeater and Swift Parrot).

One state listed ecological community was identified within the study area; *Mountain Gum – Ribbon Gum Open Forest of Drainage Lines of the Southern New England Tablelands Region.*

5.1.2 Federally listed threatened biota

The database searches identified four TECs, 10 threatened flora species, 19 threatened fauna species and 7 migratory species listed under the EPBC Act as potentially occurring in the locality of the study area. Of these, habitat was identified within the study area for two threatened flora species; Austral Toadflax (*Thesium australe*) and Bluegrass (*Dichanthium setosum*), and two threatened fauna species (Regent Honeyeater and Swift Parrot). None of these species were identified during field surveys These species are further discussed in Section 5.5.

No other MNES (such as World or National Heritage Properties or Wetlands of International Importance) occur within the locality (DotE 2016a).

5.2 Flora and vegetation

5.2.1 Flora species

As described in Section 4.2.1, the survey aimed to identify the dominant flora species present in the study area. A total of 86 species of flora comprising 52 natives and 34 exotic species. The Poaceae family was the most diverse family recorded (21 species), followed by the Asteraceae family (16 species) and Fabaceae (6 species). A flora species inventory is presented in Appendix B.

Flora species are discussed below in relation to the vegetation communities occurring within the study area. Noxious weeds are discussed in Section 5.2.6.

No threatened flora species were recorded within the study area; however habitat for two threatened flora species; Austral Toadflax (*Thesium austral*) and Bluegrass (*Dichanthium setosum*) was identified (see Section 5.5.2).

5.2.2 Vegetation types

Vegetation within the study area was linked to landscape position and topography, with two vegetation types identified:

- Moderate/ good condition - Ribbon Gum/ Mountain Gum Grassy Woodland EEC (71.35 ha).
- Moderate/ good condition - Ribbon Gum/ Mountain Gum Derived native/exotic grassland (141.09 ha)

Vegetation across the study area has been previously disturbed and modified, with much of the study area being cleared leaving few mature remnant trees. There is evidence of heavy grazing by cattle and pasture improvement (i.e. presence of legumes such as *Trifolium* species). Notwithstanding the disturbed nature of vegetation of the site, the mature canopy trees may provide limited foraging habitat resources for native fauna species such as woodland birds.

As a result of historical and ongoing disturbances associated with land clearing, cattle grazing and pasture improvement, the study area is in a state of regeneration. The study area had relatively low floristic diversity, as evidenced by the low number of species recorded overall, however, areas of high native coverage were observed in some grassland areas.

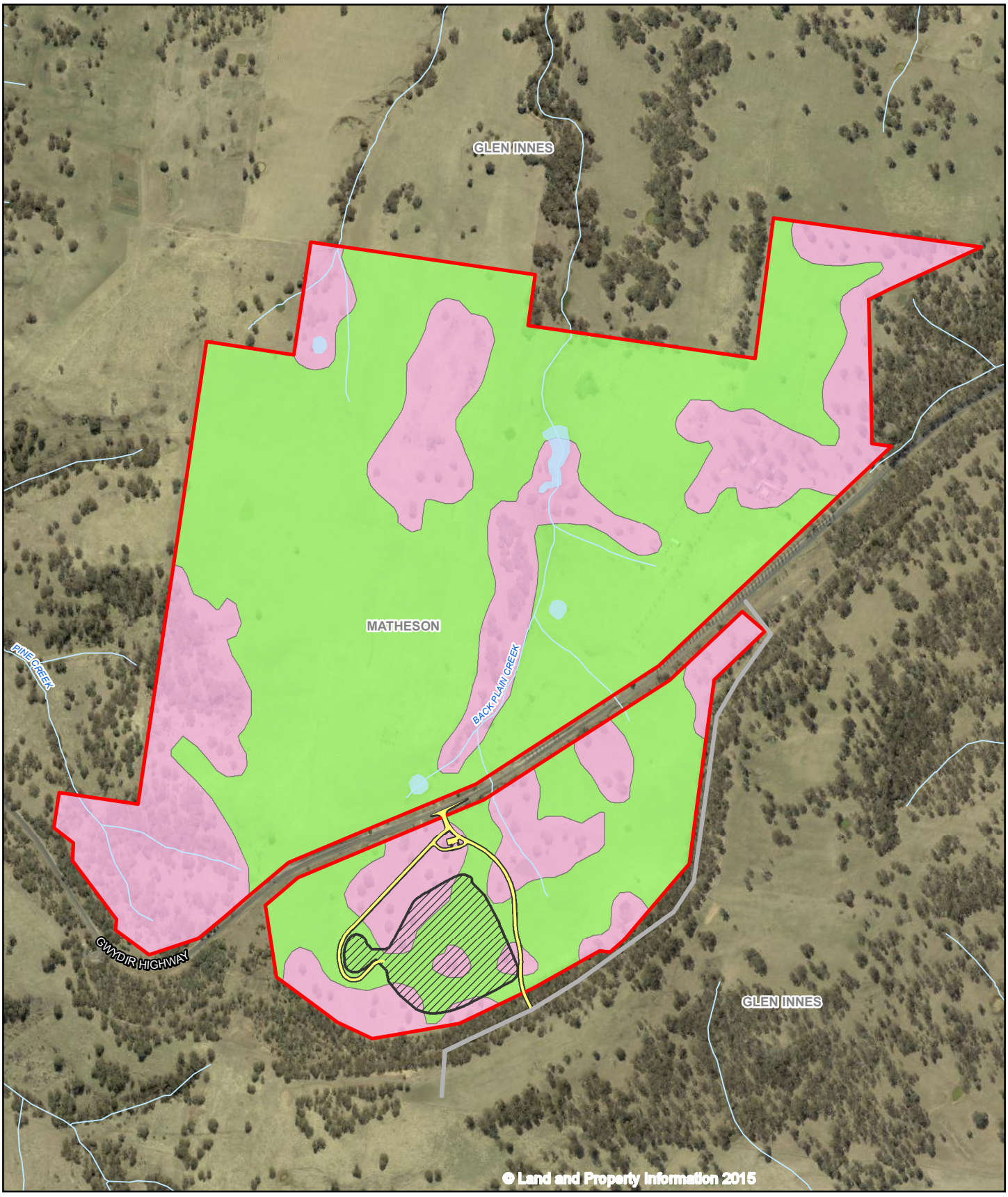
The NSW Vegetation Information System (VIS) was used to allocate Plant Community Types (PCTs) to the vegetation within the study area. The woodland vegetation within the study area was found to have floristic characteristics that were comparable with the following PCTs:

- Mountain Gum - Ribbon Gum open forest of drainage lines of the southern New England Tableland Bioregion (PCT 606)
- Ribbon Gum - Rough-barked Apple - Yellow Box grassy woodland of the New England Tableland Bioregion and NSW North Coast Bioregion (PCT 571)

Justification for PCT allocation includes the following:

- The study area occurs within the New England Tableland Bioregion.
- The vegetation within the study area has an open woodland and grassland structure.
- The soils within the study area are mainly derived from basalt and are therefore high in clay (Tableland Clay Grassy Woodland).
- The dominant canopy tree species within the study area include the following diagnostic species; *Eucalyptus viminalis* (Ribbon Gum) and *Angophora floribunda* (Rough-barked Apple).
- The midstorey is sparse and contains the following diagnostic species; *Bursaria spinosa* (Native Blackthorn), *Acacia filicifolia* (Fern-leaved Wattle) and *Acacia implexa* (Hickory Wattle).
- The groundcover is dense and grassy and contains the following diagnostic species; *Poa sieberiana, Bothriochloa macra* (Red Grass), *Themeda australis* (Kangaroo Grass), *Lomandra longifolia* (Spiny-headed Matt Rush) and *Imperata cylindrica* (Blady Grass).

Table 5-1 details the vegetation of the site and provides a more detailed list of dominant species in all stratums. Figure 5-1 shows the location and extent of vegetation types within the study area. Appendix D provides photographs of mature trees and other habitat features.



LEGEND

- Study area
- Cadastre
- Watercourse
- Waterbody
- Disturbance area
- Moderate/good condition - Ribbon Gum/ Mountain Gum Derived Grassland EEC and exotic grassland
- Moderate/good condition - Ribbon Gum/ Mountain Gum Grassy Woodland EEC
- Site access
- Existing access

Paper Size A4

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Glen Innes Severn Council
Wattle Vale Quarry
Flora and Fauna Impact Assessment

Job Number 18380
Revision
Date 31 May 2017

Vegetation within the study area Figure 5-1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\18380\GIS\Maps\Deliverables\SouthernQuarryEIS\FloraFauna\2218380_SQFFA004_Vegetation_B.mxd

Data source: LPI: DCDB & DTDB, 2012,Aerial Imagery, 2016; GISSC: Quarry data, 2016. Created by: fmackay, tmorton

Table 5-1 Vegetation within the study area

Vegetation Type	Vegetation PCT ID (OEH, 2016d)	Condition	Area within study area (ha)	Conservation Significance (OEH, 2013d)	Description
Ribbon Gum Grassy Woodland EEC	PCT 606 and PCT 571	Moderate/ good	71.35	Listed as an EEC under the TSC Act as *Ribbon gum - mountain gum - snow gum grassy forest/woodland of the New England Tableland Bioregion*	This vegetation type was restricted to small scattered patches throughout the study area. Small areas also occur within the proposed extraction area. Canopy species included Rough-barked Apple (*Angophora floribunda*) and Ribbon Gum (*Eucalyptus viminalis*). Due to previous land clearing activities, the canopy of the community was largely absent and consisted of several isolated mature trees. Midstorey species included Fern-leaf Wattle (*Acacia filicifolia*), Hickory Wattle (*Acacia implexa*) and *Bursaria spinosa* (Blackthorn). These species were mainly restricted to small thickets of regrowth around the bases of mature canopy trees in open areas and within a drainage channel in the western portion of the study area. During the August 2016 surveys, the understorey was largely disturbed due to cattle grazing. Exotic herbs were abundant including Cat's ear (*Hypochaeris radicata*), Dandelion (*Taraxacum officinale*), White Clover (*Trifolium repens*), Yellow Sucking Clover (*Trifolium dubium*) Lamb's Tongues (*Plantago lanceolata*) and Sheep Sorrel (*Acetosella vulgaris*). Noxious species were also observed including Spear Thistle (*Cirsium vulgare*), Saffron Thistle (*Carthamus lanatus*), Blackberry (*Rubus fruticosis*) and African boxthorn. A small number of native grasses and herbs were present in less disturbed areas. Other common native herbs included Kidney Weed (*Dicondra repens*), Native Geranium (*Geranium solanderi*), Two-flowered Knawel (*Scleranthus biflorus*), Stinging Nettle (*Urtica incissa*) and Stinking Pennywort (*Hydrocotyle laxiflora*). During the March 2017 surveys, the understory had responded to the removal of cattle and had significantly regenerated. This survey revealed an abundance of native grasses such as *Poa sieberiana* (Snowgrass), *Bothriochloa macra* (Redgrass) and *Sporobolus creber*

Vegetation Type	Vegetation PCT ID (OEH, 2016d)	Condition	Area within study area (ha)	Conservation Significance (OEH, 2013d)	Description
					(Slender Rat's Tail Grass). Herbs such as *Wahlenbergia communis* (Tufted Bluebell), *Geranium solanderi* (Native Geranium) and *Dichondra repens* (Kidney Weed) were also abundant. Exotic species included *Conyza bonariensis* (Flax-leaf Fleabane), *Cirsium vulgare* (Spear Thistle) and *Rubus fruticosus* (Blackberry).
Derived native/ exotic grassland	N/A	Moderate/ good	141.09	Listed as an EEC under the TSC Act as *Ribbon gum - mountain gum - snow gum grassy forest/woodland of the New England Tableland Bioregion*	During the August 2016 surveys, the grasslands were heavily grazed by cattle. Exotic herbs were abundant including Cat's ear (*Hypochaeris radicata*), Dandelion (*Taraxacum officinale*), White Clover (*Trifolium repens*), Yellow Sucking Clover (*Trifolium dubium*) Lamb's Tongues (*Plantago lanceolata*) and Sheep Sorrel (*Acetosella vulgaris*). Noxious species were also observed including Spear Thistle (*Cirsium vulgare*), Saffron Thistle (*Carthamus lanatus*), Blackberry (*Rubus fruticosis*) and African boxthorn. A small number of native grasses and herbs were present in less disturbed areas. Other common native herbs included Kidney Weed (*Dicondra repens*), Native Geranium (*Geranium solanderi*), Two-flowered Knawel (*Scleranthus biflorus*), Stinging Nettle (*Urtica incissa*) and Stinking Pennywort (*Hydrocotyle laxiflora*). In March 2017, cattle had been removed from the study area and regeneration of the groundcover had occurred. Favourable seasonal conditions for grassland flora also occurred. The main changes in the composition of the grassland was an abundance of native grasses such as *Poa sieberiana* (Snowgrass), *Bothriochloa macra* (Redgrass) and *Sporobolus creber* (Slender Rat's Tail Grass). Herbs such as *Wahlenbergia communis* (tufted Bluebell), *Geranium solanderi* (Native Geranium) and *Dichondra repens* (Kidney Weed) were also abundant. Exotic species included *Conyza bonariensis* (Flax-leaf Fleabane), *Cirsium vulgare* (Spear Thistle) and *Rubus fruticosus* (Blackberry).

5.2.3 Vegetation condition

The vegetation within the study area was assessed via a field assessment in August 2016 (plot/transects 1-6) and again in March 2017 (plot/transects 7 and 8). In August 2016, the study area was in a state of lower condition due to the effects of cattle grazing and seasonal effects (i.e. winter conditions). In March 2017, the study area was re-assessed and was found to have regenerated in the absence of cattle and having warmer weather conditions, which were more conducive to plant diversity (i.e. late summer). A greater cover abundance of native grasses was observed within the study area in March 2017.

In accordance with the BAM (OEH 2014), vegetation condition was examined by comparing ten site attributes against the benchmark values for the most relevant PCT (*Mountain Gum - Ribbon Gum open forest of drainage lines of the southern New England Tableland Bioregion - PCT 606*).

An examination of the site attributes within each plot/transect indicated that the vegetation within the study area had lower values than the benchmark for most attributes with the exception of native ground cover (grasses), which was particularly high in plot 7. Although the woody vegetation within the study area is limited in extent, the condition assessment has determined that the derived grasslands within the study area contain cover abundance of native grasses greater than 50% of the total ground coverage in some areas. These areas are therefore considered to be moderate/good condition native grasslands. Given the difficultly with distinguishing exotic and native grasslands within the study area without further detailed surveys, a conservative approach is employed and all grassland areas within the study area are treated similarly as moderate/good condition derived native/ exotic grasslands.

Table 5-2 Comparison of benchmark values for site condition attributes within plot/transects within the site

Site Condition Attributes	Benchmark (HN606)	Woodland			Derived Native/ Exotic Grassland				
		Plot 1	Plot 4	Plot 8	Plot 2	Plot 3	Plot 5	Plot 6	Plot 7
Native plant species richness	34	11	11	11	15	11	15	11	15
Native over-storey cover	27.5 - 32.5	0.5	5	30	0	0	0	0	0
Native mid-storey cover	44 - 54	0	0	10	0	0	0	0	0
Native ground cover (grasses)	10.7 - 14.7	68	0	15	72	48	26	8	90
Native ground cover (shrubs)	6.1 - 10.1	0	0	0	0	0	0	0	0
Native ground cover (other)	10.7 - 14.7	0	0	5	0	0	4	0	5
Exotic plant cover	0	52	98	35	68	52	86	86	5
Number of trees with hollows	> = 0	0	0	0	0	0	0	0	0
Over storey regeneration	1	1	0	1	1	1	0	0	0
Total length of fallen logs	> = 0	0	5	2	0	0	3	0	0

5.2.4 Threatened flora species

No threatened flora species were recorded in the study area or on adjacent land during the survey. Based on the habitat assessment undertaken, potential habitat for two threatened flora species exists within the study area; Austral Toadflax (*Thesium australe*) and Bluegrass (*Dichanthium setosum*).

5.2.5 Threatened ecological communities

One threatened ecological community was identified within the study area. *Ribbon Gum – Mountain Gum Grassy Forest/Woodland of the New England Tablelands Bioregion* listed as an endangered ecological community under the TSC Act (referred to as Ribbon Gum Woodland EEC).

No vegetation consistent with any threatened ecological communities as listed under the EPBC Act were found to occur within the study area.

5.2.6 Noxious weeds

The study area contains two species declared as a Category 4 noxious weeds in the Glen Innes Severn Council control area. These include African boxthorn (*Lycium ferocissimum*), and Blackberry (*Rubus fruticosus*). The control requirements for these species are as follows:

"*The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed*".

No significant infestations or thickets of these species were observed at the time of the field survey. Rather, scattered plants and seedlings occur throughout the study area, suggesting that the species may be being spread via bird droppings.

5.3 Fauna and habitat

5.3.1 Fauna species

A total of 39 fauna species were detected within the study area consisting of four amphibians, 27 birds and eight mammals, two of which were exotic (Brown Hare and European Fox).

Four amphibian species were detected within the study area; *Litoria latopalmata* (Broad-palmed Frog), *Crinia parinsignifera* (Beeping Froglet), *Uperoleia laevigata* (Smooth Toadlet) and *Limnodynastes tasmaniensis* (Spotted Marsh Frog). All of these species were detected during spotlighting around the dam in the southern portion of the study area.

Twenty-seven bird species were recorded within the study area. The majority of these were common species. The most abundant species were the Australian Magpie, Noisy miner, Rainbow Lorikeet, Yellow-faced Honeyeater and the Pied Currawong.

Nine mammal species were recorded within the study area including five terrestrial species (Brown Hare, Eastern Grey Kangaroo, Red-necked wallaby, Swamp Wallaby and European Fox) and four microbat species; *Chalinobolus gouldii* (Gould's Wattle Bat), *Vespadelus darlingtoni* (Large-eared Forest Bat), *Scotorepens* sp. and *Austronomous australis* (White-striped Free-tailed Bat). All of these microbat species commonly roost in hollow-bearing trees.

The full species list is included in Appendix B. Species observed at the site are discussed in the following section in terms of their habitat use within the study area.

5.3.2 Fauna habitat

Habitat values within the study area were low due to the limited extent of native vegetation present, as a result of extensive historical disturbance. As previously described vegetation within the study area is predominately grassland with scattered mature-age trees

Habitat features identified included the following:

- Myrtaceous trees which would provide potential foraging resources for woodland birds.
- Low density of woody debris (fallen logs) which may provide shelter and foraging habitat for native reptiles and amphibians, and foraging substrate for native insectivorous birds and mammals.
- One dead tree with trunk fissures which may provide potential roost sites for microbats.
- A dam located adjacent to the western boundary of the study area that may provide foraging habitat for native frogs and birds.

These habitat resources are discussed in greater detail below. Habitat features and resources are described in terms of the native fauna they may support with specific reference to species observed during surveys and threatened species potentially present within the study area. The availability of habitat resources for threatened fauna is further discussed in Section 6.4.3.

Feed trees

Myrtaceous species present at the site may provide potential foraging resources, including sap, foliage or nectar for threatened species such as the Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*). Other native nectarivorous birds using these trees may include the Noisy Friarbird (*Philemon corniculatus*), Scarlet Honeyeater (*Myzomela sanguinolenta*) and Lewin's Honeyeater (*Meliphaga lewinii*).

Due to the isolated positon of the trees in the landscape, it is unlikely that they would be utilised by arboreal mammals as a foraging resource.

Woody and other debris

Woody debris such as fallen logs and bark provides foraging and shelter substrate for a range of native birds, mammals, reptiles and frogs. General observations at the site indicated that the limited amount of woody debris present showed no evidence of occupancy by fauna species. This may be due to a lack of other important habitat features such as dense shrubs and other habitat refugia.

Plate 5-1 Woody debris within the study area

Table 5-3 Comparison of benchmark and average recorded values for total length of fallen logs occurring within plot/transects within the site

Vegetation Type	Benchmark value (m)	Average recorded value (m)
PCT 606 Mountain Gum – Ribbon Gum Open Forest of Drainage Lines of the Southern New England Tablelands Region	15	0

Hollow-bearing trees

Around 300 vertebrate species use tree hollows and shedding bark for shelter and roosting sites in Australia, and the shelter provided by these habitat features is essential for the survival of many of these species (Gibbons and Lindenmayer 2002). Only one dead stag was recorded within the study area. This tree had vertical fissures within its main stem which may be suitable habitat for microbats and reptiles. This tree occurs within the extraction area and will therefore require removal for the proposal.

Plate 5-2 Dead stag tree within the study area

Aquatic habitats

Aquatic habitats within the study area consist of a single dam located on the western boundary of the southern proposed extraction area. Due to a lack of emergent vegetation, the dam has limited habitat availability and is likely to be utilised by few amphibian species, insects, small fish and microbats.

5.4 Connectivity

Due to the effects of land clearing activities, the study area has low connectivity with surrounding vegetation. It is therefore likely that only highly mobile species such as woodland birds and terrestrial mammals would utilise the limited habitat available within the study area.

5.5 Conservation significance

5.5.1 Threatened ecological communities

One threatened ecological community was identified within the study area; *Mountain Gum – Ribbon Gum Open Forest of Drainage Lines of the Southern New England Tablelands Region is listed as an endangered ecological community* under the TSC Act.

Justification for identification of this EEC includes the following:

- The study area occurs within the New England Tableland Bioregion.
- The vegetation within the study area has a woodland and derived grassland structure.
- The soils within the study area are mainly derived from basalt and are therefore high in clay (Tableland Clay Grassy Woodland) (Benson and Ashby 2000).
- The dominant canopy tree species within the study area include the following diagnostic species; *Eucalyptus viminalis* (Ribbon Gum) and *Angophora floribunda* (Rough-barked Apple).

- The midstorey is sparse and contains the following diagnostic species; *Bursaria spinosa* (Native Blackthorn), *Acacia filicifolia* (Fern-leaved Wattle) and *Acacia implexa* (Hickory Wattle).
- The groundcover is dense and grassy and contains the following diagnostic species; *Acaena novae-zelandiae*, *Asperula conferta* (Common Woodruff), *Dichondra repens* (Kidney Weed), *Euchiton gymnocephalus* (Creeping Cudweed), *Geranium solanderi* (Native Geranium), *Hydrocotyle laxiflora* (Stinking Pennywort), *Imperata cylindrica* (Blady Grass), *Lomandra longifolia* (Spiny-headed Matt Rush), *Poa sieberiana var. sieberiana, Rumex brownii* (Swamp Dock) and *Themeda australis* (Kangaroo Grass).

The scientific determination for *Mountain Gum – Ribbon Gum Open Forest of Drainage Lines of the Southern New England Tablelands Region* states that '*An unknown area persists as native grassland where the woody component of the community has been eliminated by clearing. Of the area still wooded, much is regrowth after clearing or has had its understorey adversely affected by grazing or weed invasion*. Derived grasslands within the study area are therefore considered to be part of the EEC in this assessment (Figure 5-1).

No vegetation within the study area is consistent with any threatened ecological communities as listed under the EPBC Act.

5.5.2 Threatened flora species

No threatened flora species were identified within the study area during the field surveys. Potential habitat for Austral Toadflax (*Thesium australe*) was identified within the study area. No threatened flora species listed under the FM Act are likely to occur in the study area, or downstream of the study area.

5.5.3 Threatened fauna species

No threatened fauna species were observed during the surveys.

Two threatened fauna species are considered to have potential foraging habitat within the study area; the Regent Honeyeater and the Swift Parrot. Both of these species are typically found in box-ironbark habitats on the inland slopes and plains (Saunders and Heinsohm 2008), but may also forage on nectar-producing eucalypts. Breeding habitat for these species does not occur within the proposal footprint as the Swift Parrot breeds in Tasmania and only occurs on the mainland during the winter non-breeding season. The Regent Honeyeater is only known to breed in two inland areas; Bundarra- Barraba region and the Capertee Valley (Menkhorst et al 1999).

An *Assessment of Significance* for the Regent Honeyeater and the Swift Parrot has been conducted (Appendix C). These assessments found that no significant impacts to these species are likely to occur as a result of the proposal.

Forest owls and raptors

No forest owls or raptors were predicted to occur within the proposal footprint or observed during the survey. While foraging habitat may be present due to the largely cleared nature of the site, no breeding habitat is present due to the lack of hollow bearing trees. Additionally, the proposal footprint would only consist of a small area of a much wider foraging range.

Arboreal mammals

No threatened arboreal mammals were identified within the study area. Due to a lack of canopy vegetation, no suitable habitat for arboreal mammals was present.

Terrestrial mammals

No threatened terrestrial mammals were identified within the study area. Due to a lack of habitat features such as dense low-lying vegetation or suitable hollow logs, no suitable habitat for threatened terrestrial mammals was present.

Bats

Although common microbat species were detected within the study area, no threatened species were recorded. Additionally, the study area contains minimal roosting habitat for bat species. One dead stag was identified within the proposed extraction area. This tree will require removal for the proposal.

Frogs

No threatened frog species were identified within the study area. The adjacent dams were found to have a lack of fringing emergent vegetation such as ferns, sedges or grasses. Therefore, there is no suitable habitat for threatened frog species within the study area.

Reptiles

No threatened reptile species were identified within the study area. Due to a lack of habitat features such as rocks or suitable hollow logs, no suitable habitat for threatened reptiles was present.

5.5.4 Migratory fauna species

Results of the desktop review indicate that 7 migratory bird species listed under the EPBC Act are known or predicted from the locality of the study area (Appendix A). Some of these species can be reliably excluded from occurring within the study area, based on their broad habitat requirements, however a total of 5 species have the potential to utilise habitat within the study area on an occasional or transient basis when conditions are favourable.

Aerial species

The Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail (*Hirundapus caudacutus*) breed in the northern hemisphere and are almost exclusively aerial while in Australia during the non-breeding season. These birds may forage and fly over the study area but would be unlikely to land or to be dependent on the habitats present within the study area.

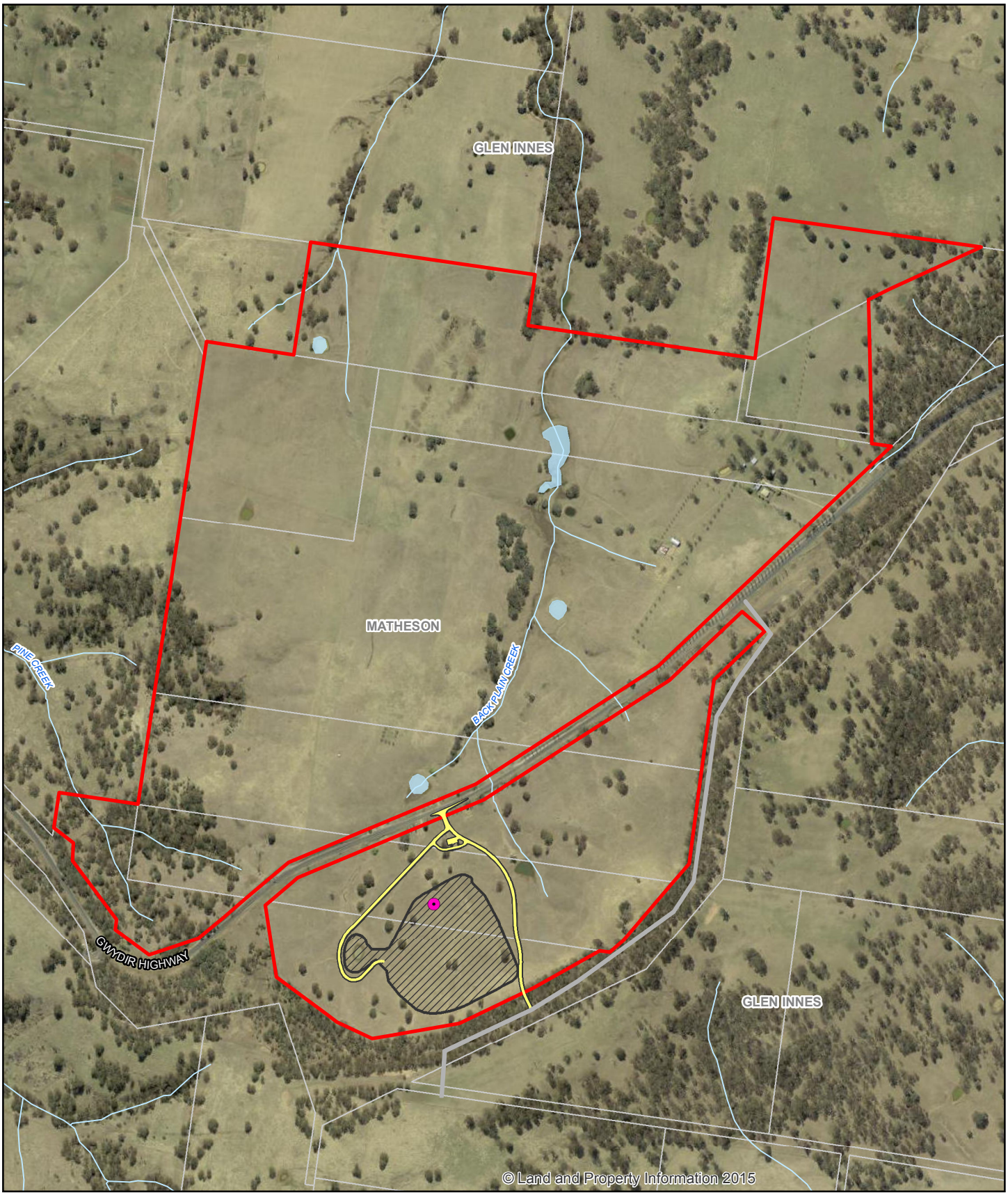
Wetland species

One species of wetland bird; Latham's Snipe (*Gallinago hardwickii*) is predicted to occur within the locality. This species may occur and forage around the edges of dams bordering the study area. This species does not breed in Australia.

Woodland species

Of the 4 migratory woodland species which are modelled to occur within the study area, the Black-faced Monarch (*Monarcha melanopsis*), Satin Flycatcher (*Myiagra cyanoleuca*) and Rufous Fantail (*Rhipidura rufifrons*) tend to prefer moist, densely vegetated habitats, though they may occur in more open habitats while migrating. The Yellow Wagtail (*Motacilla flava*) normally inhabits open country near water, such as wet meadows.

The Yellow Wagtail and Black-faced Monarch, may forage within the drainage lines and dam area just outside the study area.



LEGEND

- Study area
- Cadastre
- Watercourse
- Waterbody
- Existing access
- Site access
- Dead stag (vertical fissures)
- Disturbance area

Paper Size A4

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Glen Innes Severn Council
Wattle Vale Quarry
Flora and Fauna Impact Assessment

Job Number 22-18380
Revision A
Date 24 Mar 2017

Threatened biota and habitat

Figure 5-2

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\18380\GIS\Maps\Deliverables\SouthernQuarryEIS\FloraFauna\2218380_SQFFA005_Th_Biota_Habitat_A.mxd

Data source: LPI: DCDB & DTDB, 2012,Aerial Imagery, 2016; GISSC: Quarry data, 2016. Created by: fmackay, tmorton

6. Potential impacts

6.1 Direct impacts

6.1.1 Vegetation clearing

The proposal would result in the permanent removal of 7.76 hectares of EEC vegetation consisting of 2.29 ha of woodland EEC vegetation and 5.46 hectares of derived native /exotic grassland EEC vegetation. Removal of vegetation within the indicative footprint is shown on Figure 3 and summarised in Table 6-1. This estimate assumes that all clearing and works associated with the proposal would be contained within the indicative footprint as shown, and that access would be limited to the existing access roads where no vegetation clearing will be required.

The proposal will result in the removal of few mature trees (<10 trees); however, due to the extent of vegetation clearing which has already occurred within the locality, the proposal will not affect the connectivity of the EEC in surrounding areas.

A number of mitigation measures are provided in Section 7 to minimise the potential for impacts on retained native vegetation as a result of the proposal.

Table 6-1 Vegetation clearing within the proposal disturbance footprint

Vegetation Community (OEH, 2013)	TSC Act Status	EPBC Act Status	Area of removal in disturbance footprint (ha)	Total area within study area (ha)
Ribbon Gum Mountain Gum Grassy Woodland EEC	EEC	-	2.29	71.35
Derived native/exotic grassland	EEC	-	5.46	141.09
Total Native Vegetation			**7.76**	**212.46**

6.1.2 Loss of flora habitat

The proposal would result in the removal of up to 2.29 hectares of woodland habitat and 5.46 hectares of grassland habitat. Vegetation within the study area exists in a highly modified state, as a result of past land uses and land management practices. The majority of species recorded within the study area are common and widespread, and capable of withstanding repeated and ongoing disturbance such as intense grazing pressure. Extensive areas of comparable vegetation also occur adjacent to the study area and within the wider locality.

The removal of flora habitat as a result of the proposal is unlikely to result in a loss of genetic or floristic diversity to retained vegetation within the study area and surrounding areas.

6.1.3 Loss of fauna habitat

The vegetation that would be removed provides habitat for a limited number of fauna species due to the large distances between isolated mature trees and other remnant vegetation outside of the proposal footprint. Fauna habitat resources that would be removed include the following:

- Myrtaceous species, including suitable feed trees for threatened woodland bird species.
- A low density of fallen logs and woody debris, which would provide limited shelter and foraging habitat for native insects, common reptiles and amphibians.

6.1.4 Injury and mortality

Vegetation clearing

The proposal may cause displacement or in some cases possible mortality of fauna that are present at the time of vegetation clearing and quarry establishment activities. Less mobile terrestrial fauna, such as common species of frogs and reptiles are at most risk of mortality as a result of vegetation clearing.

The majority of native bird species and non-arboreal mammal species occurring within the proposal footprint (i.e. such as those utilising mature trees) are likely to use these habitats as part of a wider network of habitat across the landscape. These species would likely disperse to avoid quarry establishment activities given their more mobile nature, and most individuals directly affected by the proposal are likely to be displaced into surrounding habitat rather than killed.

Mortality of fauna species which are less able to avoid the disturbance may include the following:

- Less mobile individuals, such as nestlings, old or sick individuals.
- Frogs and reptiles which may be sheltering in burrows, woody debris, soil crevices or under bark.

Displaced individuals would be vulnerable to predation since they would be disturbed in daylight hours and would experience energy costs, increased risk of predation and increased competition for resources. This may result in impacts beyond the disturbance area by favouring aggressive or generalist species. Birds breeding in, or in the vicinity of, the proposal footprint may have breeding disrupted for one season.

These direct impacts would affect limited numbers of individuals and so would be unlikely to threaten the survival of any local populations.

Vehicle strike

The proposal would result in an increase of vehicle traffic through the site, thus increasing the risk of vehicle strike for terrestrial fauna. Vehicle movements would be restricted to the access road and quarry site, and would not pass through retained areas of vegetation, reducing the risk of encountering fauna. Works and vehicle movements would be restricted to daylight operating hours, meaning that this risk would affect diurnal species only. Mitigation measures to reduce the risk of vehicle strike, including the enforcement of speed limits are discussed in Section 7.

6.2 Indirect impacts

Potential indirect impacts that may occur as a result of the proposal are discussed below.

6.2.1 Edge effects

Edge effects are described as an ecological impact at two or more interfacing habitat types. Edge effects are inherent or natural in nature (i.e. wherever changes in vegetation or landscape cause sudden changes in vegetation structure) but can have negative impacts if their creation alters ecological processes. They also change habitat conditions (such as degree of humidity and exposure to light or wind) created at or near the boundary between areas. In general, edge effects increase in relation to the dissimilarity between adjoining habitats.

Removal of vegetation causes a number of new environmental conditions to develop along the edges of the cleared environments, in particular in environments that originally contain the upper strata levels (canopy and/ or shrub layer) of vegetation. The removal of vegetation generally promotes the invasion of exotic species and/or disturbance tolerant native plants. With the invasion of these new species it often becomes difficult for the original plant species to recolonise once disturbed.

The proposed quarry area and immediate surroundings are already largely disturbed, with evidence of minor weed infestations throughout the proposal footprint. The proposal would increase edge effects due to potential detrimental impacts resulting from quarry establishment. Impacts may include the introduction or spread of weed species, light and dust to new areas of vegetation, which are currently less affected by these impacts, reducing flora and fauna habitat values in the newly exposed edge areas.

6.2.2 Introduction or spread of weeds

The proposal may cause the dispersal of weed propagules (seeds, stems and flowers) into adjacent areas of native vegetation via plant and machinery, erosion (wind and water) and via worker's shoes and clothing. Some sections of the study area already support infestations of Blackberry (*Rubus fruticosis*), as well as various other exotic species; however, there is a possibility that additional, more invasive or otherwise damaging environmental weeds may be introduced to the retained vegetation, or that existing Blackberry infestations may be further spread into areas that are currently free from infestations. Depending upon the weeds introduced to the site, this could result in a decline in the condition of adjacent native vegetation and associated native fauna habitats.

6.2.3 Introduction of pathogens

The proposal has the potential to introduce or spread pathogens such as *Phytophthora cinnamomi* (Phytophthora). Rainfall is one key factor influencing the distribution of *Phytophthora cinnamomi*; consequently, disease caused by the pathogen is generally restricted to moister regions (Summerell et al.2005). It occurs in gullies, depressions, along drainage lines, and in areas of surface seepage on ridge tops (Laidlaw & Wilson 2003). Mitigation measures as outlined in Section 7 should be implemented as a precaution.

Spread of *Batrachochytrium dendrobatidis* (Chytrid fungus) is also possible, given the presence of drainage lines in the study area and dams immediately outside of the study area, but is unlikely given no works would be undertaken within the drainage lines or near the off-site dams. As previously described, there is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Where present, Phytophthora may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus affects both tadpoles and adult frogs and can wipe out entire populations once introduced into an area. Mitigation measures are

included in Section 7 to minimise the potential for any impacts such as pathogen introduction as a result of the proposal.

6.2.4 Soil and water pollution

The proposal has the potential to result in pollution and contaminated runoff within the proposal footprint and adjoining areas through soil disturbance and quarry establishment activities. Potential sources of soil and water pollution include:

- Soil disturbance during quarry establishment and vegetation clearing activities.
- Inappropriate management of soil and material stockpiles.
- Hydrocarbon leaks or spills from vehicles or equipment used in quarrying or vegetation clearance activities, as well as during works on the access road.
- Increased runoff from hardstand areas.
- Increased sediment transfer and erosion potential in areas cleared of vegetation.

The topography of the study area and nature of the proposal means that there is potential for soil and water pollution as a result of the proposal if appropriate controls are not adopted during quarry establishment and vegetation clearing and soil disturbance activities.

It is anticipated that any water released into the environment as a result of the proposal would be of a similar quality to present conditions. Mitigation measures to reduce the potential for such matters are described in Section 7, and include minimising the disturbance area, the use of erosion and sediment control devices and pollution control methods.

6.2.5 Noise and vibration

There would be noise and vibration impacts during the various stages of quarry operation as a result of vegetation clearing, vehicle movement, operation of plant and blasting for establishment of the quarry itself. Due to the topography of the site and staging of the proposed works, noise and vibration impacts would likely be limited to the areas immediately around the study area.

Raised levels of noise and vibration may deter native fauna from using the area surrounding the source of any noise or vibration. This may potentially interrupt dispersal within the locality if an individual is unwilling to travel through an area where increased levels of noise or vibration is detectable, or may cause some species to abandon an area in search of areas where it is not detectable.

The establishment of the quarry will expose new areas to increased noise and vibration levels, due to quarry establishment activities, resulting in regular blasting activities and the presence of heavy vehicle traffic in and around the quarry. Given the current noise and vibration levels in the vicinity of the proposal, the proposal has the potential to result in additional short-term impacts on native biota.

Mitigation measures to reduce noise and vibration generated by the proposal and to shield sensitive residential receptors have been proposed in the Noise Impact Assessment (GHD, 2016; refer to Chapter 5 of the main EIS document). Measures relevant to reducing impacts on native fauna have been summarised in Section 7.

6.2.6 Artificial lighting

Night time lighting can potentially discourage native species from using habitat where diffuse light penetrates into adjoining areas of vegetation. The foraging and nesting regimes of some nocturnal native mammals and birds can therefore be disrupted by lighting. In addition, the eyesight of nocturnal species (such as owls and possums) is hindered by bright lights, and where they are affected by this, they can become more susceptible to predation.

6.2.7 Alterations to surface water flows

The proposed works would alter the local topography at the site, which would affect the drainage of surface water. It is likely that surface water from beyond the works area would be diverted around the works, which could lead to a concentration and discharge of flows rather than distributed discharges. The impact of this could be increased risk of erosion and sedimentation if not adequately managed.

The proposed operation would expose a larger proportion of rock areas and other impervious areas compared with the existing site, leading to increased runoff volumes during rain events and larger runoff peaks during storm events.

These potential impacts would be managed as described in the Surface and Groundwater Assessment. Mitigation measures would include the installation of a settlement basin to collect and treat excess surface flows from the quarry. This would allow for management of the quality, volume and timing of water discharge to adjoining areas.

6.3 Key threatening processes

A key threatening process (KTP) is defined in the TSC Act as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities.
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 38 KTPs listed under the TSC Act, eight listed under the FM Act and 20 listed under the EPBC Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this proposal are discussed in Table 6-2. Mitigation measures to limit the impacts of these KTPs are discussed in Section 7.

Table 6-2 Key threatening processes

KTP	Status	Comment
Clearing of native vegetation	TSC Act; EPBC Act	Clearing of native vegetation has occurred historically around and throughout the study area. The proposal would result in the clearing of approximately 7.76 hectares of native vegetation from the study area. Mitigation measures are provided in Section 7 to limit the potential for impacts to retained native vegetation elsewhere within the study area.
Removal of dead wood and dead trees	TSC Act	Only one dead stag was identified within the study area which would require removal. The proposal would involve the removal of 7.76 hectares of native vegetation. Mitigation measures are provided in Section 7 to limit the potential for impacts to native biota as a result of removal of dead wood and dead trees.
Invasion of plant communities by perennial exotic grasses	TSC Act	Parts of the study area have been subject to historical disturbance activities, and as a result, there are exotic weed species in some areas of the study area. Weeds have also been introduced in edge areas associated with the existing cleared area. Vehicles and plant could

KTP	Status	Comment
		further spread exotic grass species, as could soil disturbance during quarry activities and vegetation clearing. There is the potential for perennial exotic grasses to invade retained and adjacent native vegetation through disturbance during quarry establishment activities.
Infection of native plants by *Phytophthora cinnamomi*	TSC Act; EPBC Act	Quarry establishment activities have the potential to introduce the root-rot fungus *Phytophthora cinnamomi* to the study area, which could lead to dieback of vegetation. Mitigation measures to reduce the potential for the introduction of Phytophthora are recommended in Section 7 to limit impacts on native vegetation.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	TSC Act; EPBC Act	Quarry establishment activities have the potential to introduce amphibian chytrid to the proposal footprint, which could lead to death of local frogs. This is unlikely, however, given no works would be undertaken within the drainage line or major dams. The implementation of a Flora and Fauna Management Plan with specific measures to reduce the potential for the introduction chytrid fungus is recommended to limit impacts on fauna and their habitats.
Predation by the European Red Fox	TSC Act; EPBC Act	Foxes were observed in the study area. The proposal is unlikely to increase the incidence of this species.
Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)	TSC Act	Rabbits were recorded in the study area. The proposal is unlikely to increase the incidence of this species.

6.4 Impacts on state-listed biota

6.4.1 Threatened ecological communities

The Mountain Gum – Ribbon Gum Open Forest TEC occurring within the proposal footprint is of low, degraded quality. The proposal will result in the clearing 7.76 hectares of this EEC vegetation, while indirect impacts could increase edge effects, sedimentation and increased disturbance of remnant vegetation within the locality as described in Section 6.2.

An assessment of significance in accordance with Section 5A of the EP&A Act has been undertaken for potential indirect impacts on Mountain Gum – Ribbon Gum Open Forest and is presented in Appendix C. The conclusion of this assessment is that the proposal is unlikely to have a significant effect on Mountain Gum – Ribbon Gum Open Forest, as:

- A small area (7.76 ha) of the EEC may be exposed to direct impacts which may result in further modifications to the already modified community within the proposal footprint.
- The relatively large areas of better quality vegetation that exist elsewhere within the locality that would not be impacted by the proposal.
- The modified nature of the vegetation that may be impacted.
- The proposal will not result in the isolation or fragmentation of this vegetation from other areas of vegetation or habitat.

The proposal is unlikely to interfere with the recovery of this community as it occurs elsewhere within the locality.

6.4.2 Threatened flora species

To date, no threatened flora species have been recorded within the study area. Notwithstanding, suitable habitat exists for one threatened flora species listed under the TSC Act, as described in Section 5.2.3. The potential for impacts on these species is summarised in Table 6-3. An assessments of significance in accordance with Section 5A of the EP&A Act has also been undertaken for this species and is presented in Appendix C.

The conclusion of these assessments is that the proposal is unlikely to have a significant effect on threatened flora species for the following reasons:

- No individuals have been recorded in the locality of the proposal footprint.
- Only marginal potential habitat would be removed that is likely to be of poor quality for the species due to habitat degradation.
- The potential habitat to be removed is unlikely to be necessary for the long-term survival of these species within the locality given no known individuals would be impacted.
- Clearing would not fragment habitat such that potential habitat in retained areas of vegetation would be impacted and no barriers to dispersal would be created outside of the proposal footprint.
- Only a small area of habitat would be impacted compared to the large areas that exist elsewhere in the locality, including within the various conservation reserves in the area.

Table 6-3 Potential impacts on threatened flora species listed under the TSC Act

Species name	TSC/ FM Act	EPBC Act	Likelihood of occurrence	Potential impacts
Austral Toadflax (*Thesium australe*)	V	V	Possible. Suitable habitat present.	Loss of up to 7.76 hectares of potential habitat. No impacts to any known individual plants.

6.4.3 Threatened fauna species

The site contains potential habitat for two species of threatened woodland birds (Swift Parrot and the Regent Honeyeater) as described in Section 5.5.3. Assessments of significance in accordance with Section 5A of the EP&A Act have been undertaken for these species and are presented in Appendix C. The conclusion of these assessments is that the proposal is unlikely to have a significant effect on these species for the following reasons:

- The Regent Honeyeater and Swift Parrot would be unlikely to breed within habitats to be removed.
- Vegetation to be removed comprises a negligible proportion of native vegetation present and conserved in surrounding areas and the broader locality.
- Habitat connectivity would be retained for these highly mobile species.

Table 6-4 Threatened fauna species likely to be impacted by the proposal

Common Name	TSC/FM Act	EPBC Act	Likelihood of occurrence	Potential impacts
Woodland Birds				
Regent Honeyeater	CE	E	**Possible**. Outside breeding range. May forage within study area on an opportunistic basis.	Removal of up to 7.76 hectares of potential foraging refuge habitat which does not contain known feed trees. This species does not breed in the locality.
Swift Parrot	E	E	**Possible**. Non-breeding visitor to NSW. May forage in locality on occasion.	Removal of up to 7.76 hectares of potential foraging habitat, which does not contain known feed trees. This species does not breed in the locality.

6.5 Impacts on MNES

6.5.1 Threatened ecological communities

No nationally threatened ecological communities are present in the study area. The proposal would not impact any nationally threatened ecological communities in the locality.

6.5.2 Threatened flora species

No threatened flora species as listed under the EPBC Act have been recorded within the study area; however potential habitat for one threatened flora species listed under the Act exists within the study area. Potential habitat for *Thesium australe* (Austral Toadflax) and *Dichanthium setosum* (Bluegrass) may be impacted by the proposal. This species is also listed under the NSW TSC Act, and the potential for impacts has been discussed in Section 6.4.2.

The factors listed in the EPBC Act significant impact guidelines (DotE 2013c) were considered in conjunction with the assessments of significance included in Appendix C. It was concluded that the proposal would not lead to a significant impact on *Thesium australe* (Austral Toadflax) or *Dichanthium setosum* (Bluegrass).

6.5.3 Threatened fauna species

Potential habitat for a total of two threatened fauna species listed under the Act exists within the study area, and may be impacted by the proposal:

- Regent Honeyeater, listed as an endangered species under the EPBC Act.
- Swift Parrot, listed as an endangered species under the EPBC Act.

These species are also listed under the NSW TSC Act, and potential impacts have been discussed in Section 6.4.3. For the Regent Honeyeater and Swift Parrot, the factors listed in the EPBC Act significant impact guidelines (DotE 2013c) were considered in conjunction with the assessments of significance included in Appendix C. It was concluded that the proposal would not lead to a significant impact on these species.

6.5.4 Migratory species

The Significant Impact Guidelines (DotE 2013c) for migratory species listed under the EPBC Act define important habitat as follows:

'An area of 'important habitat' for a migratory species is:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- Habitat that is of critical importance to the species at particular life-cycle stages, and/or
- Habitat utilised by a migratory species which is at the limit of the species range, and/or
- Habitat within an area where the species is declining'

Seven migratory species were modelled to occur within the study area, however, habitat for only five of these species was identified within aquatic habitat adjacent to the study area (Section 5.5.4). The study area is not considered important habitat for any of these species, according to the Significant Impact Guidelines (DotE 2013c). This is due to the fact that potential habitat in the study area would not support an ecologically significant proportion of the population of these species, is not of critical importance to these species at particular life-cycle stages, is not at the limit of these species ranges, and is not within an area where these species are declining. No assessments of significance have been prepared for these species.

Based on the above considerations the proposal is unlikely to impose “a significant effect” on any of the listed migratory fauna species predicted to occur within the locality.

Table 6-5 Migratory fauna with the potential to occur within the study area

Common Name	TSC/FM Act	EPBC Act	Potential impacts
Aerial species			
Fork-tailed Swift		C,J,K	Unlikely to be impacted: aerial habitat largely unaffected. Quarrying activities may reduce foraging activity directly above and adjacent the study area. The proposal would affect a negligible proportion of habitat available to these highly mobile species.
White-throated Needletail		C,J,K	
Wetland species			
Latham's Snipe		C,J,K	Minimal potential for impacts: no direct impacts on dams with potential habitat value for these species.
Woodland species			
Black-faced Monarch		M	Removal of 7.76 hectares of potential foraging habitat.
Yellow Wagtail		M	

6.5.5 Additional MNES

There are no additional MNES (such as Ramsar Wetlands, World or National Heritage Areas or Commonwealth Marine Areas) that are predicted to occur within the locality of the study area that are relevant to or are likely to be impacted by the proposal.

7. Mitigation

The mitigation of adverse effects arising from the proposal has been presented according to the hierarchy of avoidance, mitigation and offsetting of impacts.

The proposal would result in direct impacts on native biota and their habitats within the proposed quarry establishment area. There is also the potential for impacts on habitats outside the disturbance area through indirect impacts such as noise, sedimentation, runoff or edge effects. Specific mitigation measures are recommended to minimise such impacts on the natural environment.

The proposal would result in some unavoidable residual adverse impacts imposed upon some elements of the natural environment, including removal of EEC vegetation and imposition of edge effects on adjoining areas of retained native vegetation. These residual impacts are not expected to impose a significant negative effect on any local populations of native biota, including threatened species, TECs and their habitats, which occur in the study area or in adjoining habitats.

The following sections detail the avoidance of impacts and mitigation measures recommended for the proposal.

7.1 Avoidance of impacts

The proposal is the establishment of a quarry. The majority of the proposed quarry establishment area has avoided areas of ecological significance and falls within land that has been cleared in association with historical land uses, including logging and agriculture (grazing and pasture improvement). As a result, impacts on native flora and fauna are somewhat less than would be associated with a less disturbed site.

7.2 Mitigation of impacts

The proposal will impact native vegetation communities and habitat for threatened flora and fauna. In order to minimise the potential impacts of the proposal on biodiversity, the mitigation measures detailed below are recommended.

7.2.1 Detailed Design Phase

During the detailed design process, the impact of the proposal on areas with higher biodiversity values should be minimised wherever possible by:

- Minimising the area of native vegetation to be cleared wherever possible.
- Avoidance of identified hollow-bearing trees wherever possible.
- Minimising disturbance to adjacent retained vegetation, aquatic and riparian areas.

These measures aim to guide the vegetation clearing process by encouraging the contractor to avoid unnecessary clearing of vegetation, and limiting vegetation clearing to that which is required for the proposal only. Any establishment of laydown areas, site compounds or similar should be located within existing cleared areas or within the proposal footprint (as per Figure 1-1), so as to avoid any additional impacts outside the proposal footprint.

7.2.2 Environment Management Plan

An Environment Management Plan (EMP) will be prepared for the proposal which will include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures including the environmental impact mitigation measures outlined below. While some of these mitigation measures are relevant to other assessments completed as part of this EMP (e.g. Surface and Groundwater Assessment), they are included here as they are relevant to maintaining existing levels of habitat and biodiversity values associated with the study area and adjacent areas.

Worker induction

Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the study area and measures to be implemented to protect biodiversity.

Water quality management

A Water Management Plan would be incorporated into the EMP and designed to minimise the impact of altered groundwater and surface water flows at the site. This would include measures to ensure the impact of water releases from the settlement ponds would have minimal impact on adjacent areas of EEC vegetation and aquatic habitats. Mitigation measures would include, but not be limited to:

- Monitoring of all water to be pumped into the environment prior to pumping, targeting turbidity levels.
- Use of results of monitoring to determine the need to treat water to be discharged (e.g. flocculation).
- Appropriate management of surface flows from the quarry area, including sufficient settlement time within overflow ponds to allow sediment load to be deposited.
- Treatment (if necessary) of excess surface water in accordance with relevant licensing standards to ensure water quality in adjacent aquatic habitats is not impacted.
- Staged release of excess water where necessary to reduce erosion potential of additional surface flows into adjacent vegetation and aquatic areas.
- Ongoing contamination, sediment and erosion control measures as per the EMP.
- Use of an oil sock to remove any hydrocarbons in water to be pumped into the environment.
- Ongoing monitoring of surface and groundwater quality and development of contingency measures to address any decrease in quality due to quarrying activities.

Erosion control

A Sediment and Erosion Control Plan will be incorporated in the EMP and should contain detailed mitigation measures to reduce soil erosion and pollutant run-off during all quarry establishment works as well as during all works on the access road. These should include:

- Installation of erosion and sediment control measures prior to any works.
- Regular inspection of erosion and sediment control measures, particularly following rainfall events, to ensure their ongoing functionality.
- Stockpile management measures which minimise the potential for erosion and surface water runoff.

- Construction and maintenance of silt fences to capture and isolate any surface water runoff.
- Immediate removal offsite of excavated materials.

Dust

Specific measures will be incorporated into the EMP to minimise the generation of dust and associated impacts on adjacent natural environments. These should include:

- Setting maximum speed limits for all traffic within the proposal area to limit dust generation.
- Use of a water tanker or similar to spray unpaved roads during all quarry establishment and operational phases where required.
- Application of dust suppressants or covers on soil stockpiles.
- Stockpile management to limit the potential for dust generation.

Chemical spills

Specific measures will be incorporated into the EMP to minimise the potential for chemical spills and associated impacts on adjacent natural environments. These should include:

- All chemicals must be kept in clearly marked bunded areas.
- Regularly inspect vehicles and mechanical plant for leakage of fuel or oil.
- No re-fuelling of vehicles, washing of vehicles or maintenance of vehicles and plant to be undertaken within 20 m of creeks.

7.2.3 Flora and fauna management plan

A Flora and Fauna Management Plan (FFMP) should be prepared as a sub-plan to the EMP for the proposal. The FFMP would identify environmental management measures to protect the natural environment (e.g. weed and pathogen controls) and detailed site-specific and species-specific mitigation measures and management protocols to be implemented before, during and after all quarry establishment works and quarry activities to further avoid or reduce impacts on threatened biodiversity.

The FFMP would include but not be restricted to key protocols for the protection of threatened flora, fauna and their habitats as outlined below. As noted above, these specific protocols will be important to address remaining uncertainties with respect to potential impacts.

Pre-quarry establishment

Minimising vegetation clearance and habitat loss

Disturbance and removal of some areas of EEC vegetation and habitat will be unavoidable during the establishment of the quarry. To reduce the potential for adverse impacts on ecologically sensitive areas the following measures would be implemented:

- Locating any site offices and stockpiles in already cleared and disturbed areas to avoid further removal of native vegetation and/or hollow-bearing trees.
- Delineation and protection of any exclusion zones around native vegetation to be retained.

Pre-clearance surveys

Pre-clearing surveys of fauna and flora habitat would be carried out by a qualified ecologist. Pre-clearing surveys would largely focus on:

- Inspections of mature trees and stags for resident fauna, including inspections of nests and under exfoliating bark.
- Active searches for reptiles, including checking of exfoliating rock, rock crevices, and woody debris within the quarry footprint.
- Pre-clearing surveys for Austral Toadflax (*Thesium australe*) and *Dichanthium setosum* (Bluegrass) in areas of potentially suitable habitat.

Phytophthora management

Phytophthora may occur in the proposed development area given annual rainfall for the area is greater than 600 mm (McDougall and Summerell, 2003).

Hygiene measures in accordance with national best practice guidelines for Phytophthora (DEH 2006) to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the proposal should be incorporated into the FFMP and include decontamination of personnel and plant equipment prior to entering the proposal site and when traversing between areas of vegetation within the proposal site.

These measures relate to the vegetation clearing and access road construction/upgrade stages of the proposal only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area. It is envisaged that once the quarry is operational, and machinery movement is restricted to established roads and tracks, that these measures would not be required.

Chytrid fungus management

Vegetation clearing and quarrying activities have the potential to introduce amphibian chytrid fungus to the study area, which could lead to death of local frogs. This potential is limited, however, as there would be no works in aquatic areas. Hygiene measures to prevent the introduction or spread of the pathogen during the vegetation clearing should be incorporated into the FFMP and include decontamination of plant equipment working within 40m of waterways and dams.

These measures relate to the vegetation clearing and access road construction stages of the proposal only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area. It is envisaged that once the quarry is operational, and machinery movement is restricted to established roads and tracks, that these measures would not be required.

During quarry establishment

Management of weeds and edge effects

A weed management plan would be included within the FFMP, and would include a description of the following:

- Type and location of weeds of concern (including noxious weeds) within the proposal disturbance footprint.
- Sensitive receivers (such as native vegetation and waterways) within or adjacent to the proposal disturbance footprint.

- Measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing.
- Proposed weed control methods and targeted areas.
- Weed disposal protocols.

The weed management plan would include measures designed to mitigate edge effects that reduce impacts outside the footprint of the proposal (namely within surrounding retained vegetation). The aim of these measures would be to control the possible impacts at their source within existing weed infested areas and soften the edge between the earthworks and the retained native vegetation. Measures that would be adopted include:

- Avoid stockpiling of materials adjacent to native vegetation wherever possible.
- Avoid stockpiling of fill in areas of remnant vegetation but instead in adjacent already cleared areas.
- Implementing soil erosion and sediment control measures.
- During quarry establishment areas of vegetation to be retained should be demarcated to restrict access by site staff and machinery to remnant vegetation.
- During quarry establishment undertake maintenance of silt fences and other mitigation measures to isolate runoff; and immediately rehabilitate disturbed vegetation to limit the potential for colonisation by weeds.

Managing vehicle movements

The proposal would increase the risk of injury or mortality of native fauna due to vehicle strike by increasing the rate of vehicle visitation to the site. This risk would be reduced by:

- Restricting vehicle movements to operational (daylight) hours.
- Implementing and enforcing appropriate speed limits for vehicles traversing the site.

7.2.4 Remediation

Following completion of extraction works in the future, the quarry would be rehabilitated in an ecologically appropriate manner using local and endemic species characteristic of the vegetation types in the area.

8. Conclusion

8.1 Overview

The proposal involves the establishment of a quarry in a property that has been previously cleared for cattle grazing. The proposal will require the removal of up to 7.76 hectares of EEC vegetation. There are minor infestations of Blackberry (*Rubus fruticosus*) across parts of the study area. Where possible, the proposal has been situated so as to avoid native vegetation and other sensitive ecological receptors such as riparian areas around ephemeral drainage lines within the study area.

Areas north of the study area are predominately cleared agricultural grazing land and rural residential properties which support small stands of native vegetation. As such, they represent a significant movement barrier for many native fauna species apart from highly mobile, disturbance tolerant species such as birds, bats and macropods.

8.2 Impacts on State-listed Biota

No threatened flora species were identified within the study area; however, potential habitat for two threatened flora species listed under the TSC Act will be impacted by the proposal. A total of 7.76 hectares of EEC vegetation which constitutes potential habitat for Austral Toadflax (*Thesium australe*) and *Dichanthium setosum* (Bluegrass) would be impacted by the proposal. An assessment of significance for this removal determined that the proposal is unlikely to result in a significant impact to these species.

One threatened ecological community listed under the TSC Act was identified within the study area; Mountain Gum – Ribbon Gum Open Forest of Drainage Lines of the Southern New England Tablelands Region. An assessment of significance has been completed for direct impacts to 7.76 hectares of the community which determined that the proposal is unlikely to result in a significant impact within the locality.

No threatened fauna species were identified within or directly adjacent to the study area during field surveys. Habitat was identified for the Regent Honeyeater and the Swift Parrot. Assessments of significance were conducted for these species which determined that the proposal is unlikely to result in a significant impact to these species within the locality.

No threatened biota listed under the FM Act are likely to occur in the study area, or downstream of the study area. No assessments of significance were considered warranted for any threatened species, populations or communities listed under the FM Act.

The proposal is not likely to have a significant effect on threatened species, populations or ecological communities listed under the TSC Act or FM Act, pursuant to s.5A of the EP&A Act. As such, a SIS is not required.

8.3 EPBC Act MNES

The proposal contains potential habitat for two threatened fauna species and five migratory bird species listed under the EPBC Act. There are no other MNES within the locality which would be affected by the proposal. It is considered unlikely that the proposal would result in a significant impact on any MNES (see below).

Threatened species

Assessments to determine the likely significance of impacts pursuant to the EPBC Act significant impact guidelines (DotE 2013c) have been prepared for any flora and fauna species listed under the EPBC Act, as all species are also listed under the TSC Act and have been considered as part of the assessments of significance completed as per the EP&A Act in conjunction with the considerations outlined in the DotE (2013c) guidelines. On the basis of the assessments undertaken, the proposal is unlikely to impose a significant impact on any MNES and is therefore unlikely to be a controlled action.

Migratory birds

Habitat was identified within the study area for five migratory species listed under the EPBC Act. These species have the potential to occur within the study area on an occasional or transient basis. The study area is not considered important habitat for any of these migratory species, according to the significant impact criteria for migratory species (DotE 2013c), and the proposal is therefore unlikely to impose “a significant effect” on any of the listed migratory fauna species predicted to occur within the locality.

8.4 Avoidance and mitigation of impacts

The proposal has been positioned during the detailed design phase in order to avoid sensitive ecological receptors such as threatened ecological communities and high value aquatic habitats.

Recommended mitigation measures are included in this report in order to minimise the impact of the proposal on native flora, fauna and ecological processes within the study area and adjacent land. These measures would be incorporated into an Environmental Management Plan for the proposal, and would include:

- Pre-clearing surveys and clearing protocols to minimise risk of damage to resident fauna, minimise clearing of native vegetation and prevent encroachment into retained adjoining habitats.
- Standard environmental management measures to minimise the risk of indirect impacts on adjoining habitats through contaminated runoff, sedimentation, erosion, noise and vibration.

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Appendices

Appendix A – Likelihood of occurrence of threatened biota

Notes:

- All information in biota descriptions is derived from threatened biota profiles (OEH 2016b and/or DoE 2016b) unless otherwise stated.
- Marine and littoral threatened species (particularly turtles, dugongs etc.) which are restricted to coastal environments were excluded from the threatened biota table as they were considered irrelevant to the current proposal, given the extent of potential impacts and the location of the proposal site.
- Wildlife Atlas records: only records from 1980 or later were considered. The date of the last record is included for any species which have not been recorded within the last 20 years.
- DPI online records viewer (DPI 2016a) revealed no records of threatened fish species within the locality.

Threatened biota known or predicted from the locality, habitat association and suitable habitat present at the study area

Threatened Ecological Communities

Scientific Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Natural grasslands on basalt and fine textured alluvial plains of northern New South Wales and southern Queensland	-	CEEC	Occurs mainly in the Darling Downs of southern Queensland and the Liverpool Plains and Moree Plains of northern NSW The distribution of the ecological community is strongly reliant on soil type as it is associated with fine textured, often cracking clays derived from either basalt or quaternary alluvium.	**Predicted** to occur within 10 km (DotE 2016a)	Does not occur within the study area
New England Peppermint (Eucalyptus nova-angelica) Grassy Woodlands	CEEC	CEEC	Occurs Basalts and Sediments in the New England Tableland Bioregion - Northern Rivers is known to be associated with valley flats on poorly drained soils, often basalt	**Predicted** to occur within 10 km (DotE 2016a)	Does not occur within the study area
Upland Wetlands of the New England tablelands and the Monaro Plateau	EEC	EEC	The Upland Wetlands of the New England Tablelands and the Monaro Plateau are wetlands that are not connected to rivers or streams. Instead, they occur in depressions in the landscape. The persistence of the wetlands throughout the year depends on the depth of the depression in which they occur, the depth of water in the wetland, the catchment area supplying the wetland with water, rainfall patterns, and past and current disturbances.	**Predicted** to occur within 10 km (DotE 2016a)	Does not occur within the study area
White Box – Yellow Box – Blakey's Red Gum Grassy Woodland and Derived Native Grassland	EEC	CEEC	Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. The community is characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. Commonly co-occurring eucalypts include Apple Box (*E. bridgesiana*), Red Box (*E. polyanthemos*), Candlebark (*E. rubida*), Snow Gum (*E. pauciflora*), Argyle Apple (*E. cinerea*), Brittle Gum (*E. mannifera*), Red Stringybark (*E. macrorhyncha*), Grey Box (*E. microcarpa*), Cabbage Gum (*E. amplifolia*) and others.	**Predicted** to occur within 10 km (DotE 2016a)	Does not occur within the study area

Threatened Flora

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Boronia granitica	Granite Boronia	V	E	Grows on granitic soils amongst rock outcrops, often in rock crevices, and in forests and woodlands on granite scree and shallow soils. Important site characteristics include low precipitation and high levels of solar radiation. Granite Boronia occurs in scattered localities on the New England Tablelands and North West Slopes north from the Armidale area to the Stanthorpe district in southern Queensland. In NSW, the species is restricted to the New England Tablelands between Armidale and Torrington.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Callistemon pungens		-	V	Habitats range from riparian areas dominated by *Casuarina cunninghamiana subsp. cunninghamiana* to woodland and rocky shrubland. Often found in rocky watercourses, usually with sandy granite (occasionally basalt) creek beds from near Inverell to the eastern escarpment at New England NP.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Dichanthium setosum	Bluegrass	V	V	Associated with heavy basaltic black soils and red-brown loams with clay subsoil and often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. Locally common or found as scattered clumps in broader populations. The extensive distribution and wide environmental tolerances make predictions about suitable habitat difficult. Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas.	**Predicted** to occur within 10 km (DotE 2016a)	**Possible**. Marginal habitat present. Records occur close to the study area (5km west).

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Diuris pedunculata	Small Snake Orchid	E	E	The Small Snake Orchid grows on grassy slopes or flats and often on peaty soils in moist areas. This can extend to shale and trap soils, on fine granite, and among boulders. It is known to prefers moist areas, and has been found growing in open areas of dry sclerophyll forests with grassy understories, in riparian forests (including gallery rainforests), swamp forests, in sub-alpine grasslands and herbfields. The altitude range known for the species is 50–900 m. Confined to north east NSW. It was originally found scattered from Tenterfield south to the Hawkesbury River, but is now mainly found on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Eucalyptus mckieana	Mckie's Stringybark	V	V	*Eucalyptus mckieana* is found in grassy open forest or woodland on poor sandy loams, most commonly on gently sloping or flat sites. McKie's Stringybark is locally abundant, forming in places a moderately dense forest in association with other local trees. Confined to the drier western side of the New England Tablelands of NSW, from Torrington to Bendemeer. Most populations occur on private property, but it does occur in Kings Plain National Park, Torrington State Conservation Area and Severn River Nature Reserve.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Eucalyptus nicholii	Narrow-leaved Peppermint	V	V	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges and found primarily on infertile soils derived from granite or metasedimentary rock. Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire. It tends to grow on lower slopes in the landscape. This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Pelargonium sp. Striatellum (G.W.Carr 10345)	Omeo Stork's bill	E	E	Known from only 4 locations in NSW, with three on lake-beds it occurs at altitudes between 680 to 1030 m. It is known to occur in the local government areas of Goulburn-Mulwaree, Cooma-Monaro, and Snowy River, but may occur in other areas with suitable habitat; these may include Bombala, Eurobodalla, Palerang, Tumbarumba, Tumut, Upper Lachlan, and Yass Valley local government areas. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It sometimes colonises exposed lake beds during dry periods. The extent of habitat at any one site and the persistence of the species is likely be closely related to the combined effects of: - frequency of inundation and the topography of lake bed and shoreline, which maintains a more or less extensive disturbed interzone between grass-dominated communities and sedge-dominated aquatic vegetation; and - past and current grazing regimes and other forms of disturbance. Nowhere at the proposal site where the plant would be exposed to period of inundation necessary for growth.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Prasophyllum petilum	Tarengo leek Orchid	E	E	Natural populations are known from a total of five sites in NSW where it is known to grow in open sites within Natural Temperate Grassland as well as in grassy woodland in fertile soils. Apparently highly susceptible to grazing, it is only retained at little-grazed travelling stock reserves in relatively moist areas.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Prasophyllum sp. Wybong (C.Phelps ORG 5269)	Leek Orchid	-	CE	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. It is known to occur in open eucalypt woodland and grassland.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Thesium australe	Austral Toadflax	V	V	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass (*Themeda australis*).	**Predicted** to occur within 10 km (DotE 2016a)	**Possible**. Marginal habitat present. Records occur close to the site (north and south within 0.5km)

Threatened fauna

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Birds						
Anthochaera phrygia	Regent Honeyeater	CE	E	In NSW confined to two known breeding areas: The Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	**Predicted** to occur within 10 km (DotE 2016a)	**Possible**. Marginal habitat present.
Erythrotriorchis radiatus	Red Goshawk	CE	V	Typically occurs in coastal and subcoastal areas, with 90% of recent records in NSW confined to the Northern Rivers and Northern Tablelands regions, north of the Clarence River. Formerly occurred south to Port Stephens. Prefer woodlands and forests with a mosaic of vegetation types that are open enough for fast manoeuvring flight, avoiding very open or very dense habitats. In NSW inhabits mixed subtropical rainforest, Melaleuca swamp forest and open eucalypt forest along coastal rivers. Nests built within 1km of a permanent freshwater body in a large, tall tree(>20m) within a remnant stand. Home ranges large (120-200km2).	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Geophaps scripta scripta	Squatter Pigeon	E	V	The Squatter Pigeon habitat is generally defined as open-forests to sparse, open-woodlands and scrub that are mostly dominated in the overstorey by Eucalyptus, Corymbia, Acacia or Callitris species in remnant, regrowth or partly modified	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
				vegetation communities, and within 3 km of water bodies or courses. It is known to access suitable waterbodies such as permanent or seasonal rivers, creeks, lakes, ponds and waterholes, and artificial dams to drink on a daily basis. The majority of it's know distribution is within QLD, but it is also noted within Border Rivers-Gwydir region in NSW.		
Grantiella picta	Painted Honeyeater	V	Not listed	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the *Amyema* genus. Nests in outer tree canopy.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Lathamus discolor	Swift Parrot	E	E	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. *Eucalyptus robusta, Corymbia maculata* and *C. gummifera* dominated coastal forests are also important habitat.	**Predicted** to occur within 10 km (DotE 2016a)	**Possible**. Marginal habitat present.
Poephila cincta cincta	Southern Black-throated Finch	E	E	Occurs mainly in grassy, open woodlands and forests, typically dominated by Eucalyptus, Corymbia and Melaleuca, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water. Requires access to seeding grasses and water, therefore needs a mosaic of different habitats.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Rostratula benghalensis	Painted Snipe (was Australian Painted Snipe)	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den subject sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Nyctophilus corbeni	Corben's Long-eared Bat	V	E	Corben's Long-eared Bat inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities. Yet it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Preferring areas with a well-formed shrub layer and old, hollow bearing trees. Roosts in tree hollows, crevices, and under loose bark.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Petaurus volans	Greater Glider	-	V	The greater glider is restricted to eastern Australia and favours forests with a diversity of eucalypt species due to seasonal variation in its preferred tree species. It lives in a variety of eucalypt-dominated habitats, ranging from low open forests on the coast to tall forests in the ranges and low woodland westwards of the Dividing Range. It is considered to be particularly sensitive to forest clearance and to intensive logging.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Petrogale pencillata	Brush-tailed Rock-wallaby	E	V	Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Phascolarctos cinereus	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	**1 record** within 10 km (OEH 2016a) **Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Frogs						
Litoria booroolongensis	Booroolong Frog	CE	E	Lives along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins and shelter under rocks or amongst vegetation near the ground on the stream edge. The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from much of the	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
				Northern Tablelands, however several populations have recently been recorded in the Namoi catchment.		
Litoria castanea	Yellow-spotted Tree Frog	E	E	Require large permanent ponds or slow flowing 'chain-of-ponds' streams with abundant emergent vegetation such as bulrushes and aquatic vegetation. Shelter during autumn and winter under fallen timber, rocks, other debris or thick vegetation. The northern population of the Yellow-spotted Bell Frog is known from a relatively restricted distribution centred around the town of Guyra on the New England Tableland, New South Wales, at altitudes between 1000 and 1500 m.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Reptiles						
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	V	The Border Thick-tailed Gecko is most commonly found in undisturbed habitat remnants on rocky outcrops and stony hills (especially granite) within eucalypt and cypress-pine open forest or woodland between 500-1100 m elevation. Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. Occupied sites often have a dense tree canopy that helps create a sparse understorey. It occurs in the New England Tableland, Nandewar and Brigalow Belt South Bioregions in northern New South Wales.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Wollumbinia belli	Bell's Turtle	V	V	Bell's Turtle normally occupies shallow to deep pools in upper reaches or small tributaries of major rivers in granite country. Most of which are commonly less than 3 m deep with rocky or sandy bottoms and patches of vegetation. Typically uses narrow stretches of rivers 30 - 40 m wide and has been found in areas where surrounding habitat has been converted to grazing land. In NSW, currently found in four disjunct populations in the upper reaches of the Namoi, Gwydir and Border Rivers systems, on the escarpment of the North West Slopes.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Fish						
Maccullochella peelii	Murray Cod	-	V	The Murray Cod occurs naturally in the waterways of the Murray–Darling Basin in a wide range of warm water habitats	**Predicted** to occur within	**Unlikely.**

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
				that range from clear, rocky streams to slow flowing turbid rivers and billabongs. The upper reaches of the Murray and Murrumbidgee Rivers are considered too cold to contain suitable habitat They are frequently found in the main channels of rivers and larger tributaries. Preferred microhabitat consists of complex structural features in streams such as large rocks, snags (pieces of large submerged woody debris), overhanging stream banks and vegetation, tree stumps, logs, branches and other woody structures. Such structures reduce or influence stream flows and provide Murray Cod with shelter from fast-flowing water.	10 km (DotE 2016a)	Preferred habitats not present.

Migratory species

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Apus pacificus	Fork-tailed Swift	Not listed	C,J,K	Recorded in all regions of NSW. Non- breeding, and almost exclusively aerial while in Australia. Occurs over urban and rural areas as well as areas of native vegetation.	**Predicted** to occur within 10 km (DotE 2016a)	**Possible.** Non-breeding visitor. Potential aerial foraging habitat present.
Gallinago hardwickii	Latham's Snipe	Not listed	C,J,K	Occurs along the coast and west of the Great Dividing Range. Non breeding visitor to Australia. Inhabit permanent and ephemeral wetlands up to 2000 m asl. Typically, in open, freshwater wetlands with low, dense vegetation (incl. swamps, flooded grasslands and heathlands). Can also occur in saline/brackish habitats and in modified or artificial habitats close to human activity.	**Predicted** to occur within 10 km (DotE 2016a)	**Possible.** Non-breeding visitor. May forage within dams within the study area.
Hirundapus caudacutus	White-throated Needletail	Not listed	C,J,K	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occur above most habitat types, but are more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.	**Predicted** to occur within 10 km (DotE 2016a)	**Possible.** Non-breeding visitor. Potentially suitable aerial foraging habitat present.
Monarcha melanopsis	Black-faced Monarch	Not listed	M	Summer breeding migrant to south-east. Occurs along the coast of NSW. Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating (Birds Australia 2005).	**Predicted** to occur within 10 km (DotE 2016a)	**Possible.** Potential habitat along drainage lines.
Motacilla flava	Yellow Wagtail	Not listed	M	This species breeds in much of temperate Europe and Asia. It is resident in the milder parts of its range, such as western Europe, but northern and eastern populations migrate to Africa and south Asia. Inhabits open country near water, such as wet meadows.	**Predicted** to occur within 10 km (DotE 2016a)	**Possible.** Non-breeding visitor. May forage within dams within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Myiagra cyanoleuca	Satin Flycatcher	Not listed	M	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests.	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.
Rhipidura rufifrons	Rufous Fantail	Not listed	M	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas (Birds Australia 2008).	**Predicted** to occur within 10 km (DotE 2016a)	**Unlikely.** Preferred habitats not present.

Appendix B – Survey results

Flora species recorded

Family	Scientific Name	Common Name	Exotic	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Random Meander
				Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Occurrence
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort				2	500					2	500			10	1000	10	1000	
Asteraceae	*Aster subulatus*	Wild Aster	*	1	5					1	5									
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	*															1	20	X
Asteraceae	*Brachyscome sp.*															5	1000			
Asteraceae	*Carthamus lanatus*	Saffron Thistle	*																	X
Asteraceae	*Cirsium vulgare*	Spear Thistle	*															2	20	X
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	*			1	20					1	20					5	100	
Asteraceae	*Conyza sumatrensis*	Tall Fleabane	*													15	200			X
Asteraceae	*Cotula australis*	Common Cotula				1	50					1	50							
Asteraceae	*Cymbonotus lawsonianus*	Bear's Ear		1	50					1	50									
Asteraceae	*Euchiton gymnocephalus*	Creepng Cuddweed																		
Asteraceae	*Euchiton involucratus*	Star Cudweed		1	50	1	20			1	50	1	20							
Asteraceae	*Gamovchaeta americana*	cudweed	*													5	1000			X
Asteraceae	*Hypochaeris radicata*	Catsear	*	3	100	3	1000	4	1000	3	100	3	1000	4	1000	5	1000	2	500	X
Asteraceae	*Sencio hispidulus*	Hill Fireweed																		
Asteraceae	*Taraxacum officinale*	Dandelion	*	2	50					2	50					1	20			
Asteraceae	*Vernonia plebeia*	Trailing Speedwell						2	500					2	500					
Asteraceae	*Vittadinia cuneata*	A Fuzzweed		1	20			2	50	1	20			2	50					
Blechnaceae	*Blechnum* sp.																			X
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell														2	500	2	500	X
Caryophyllaceae	*Cerastium sp.*		*			1	20					1	20							
Caryophyllaceae	*Paronychia brasiliana*	Chilean Whitlow Wort	*			1	10					1	10							
Caryophyllaceae	*Scleranthus biflorus*	Two-flowered Knawel		1	200	2	500			1	200	2	500							
Caryophyllaceae	*Scleranthus sp.*							2	100					2	100					
Clusiaceae	*Hypericum perforatum*	St. Johns Wort	*																	X
Convolvulaceae	*Dichondra repens*	Kidney Weed		3	1000			3	1000	3	1000			3	1000			10	1000	X
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge																		X
Cyperaceae	*Isolepis inundata*																			
Fabaceae (Faboideae)	*Acacia implexa*	Hickory Wattle																10	4	X

Family	Scientific Name	Common Name	Exotic	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Random Meander
				Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Occurrence
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine														5	1000	10	1000	X
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine														5	1000			X
Fabaceae (Faboideae)	*Trifolium arvense*	Haresfoot Clover	*			1	50					1	50							
Fabaceae (Faboideae)	*Trifolium dubium*	Yellow Suckling Clover	*	3	1000	2	1000	2	11	3	1000	2	1000	2	11					X
Fabaceae (Faboideae)	*Trifolium repens*	White Clover	*	3	5000	3	1000	3	1000	3	5000	3	1000	3	1000	20	1000	2	500	X
Gentianaceae	*Centaurium erythraea*	Common Centaury	*					2	100					2	100					
Geraniaceae	*Geranium homeanum*					2	100	2	50			2	100	2	50					X
Geraniaceae	*Geranium solanderi*	Native Geranium		2	100	2	100	3	500	2	100	2	100	3	500	5	500			
Haloragaceae	*Haloragis heterophylla*	Variable Raspwort				1	5					1	5							
Juncaceae	*Juncus australis*																			x
Lamiaceae	*Marrubium vulgare*	White Horehound	*																	X
Loganiaceae	*Mitrasacme sp.*					1	20					1	20							
Loranthaceae	*Muellerina eucalyptoides*																			X
Myrtaceae	*Angophora floribunda*	Rough-barked Apple																10	1	X
Myrtaceae	*Eucalyptus camaldulensis*	River Red Gum																		X
Myrtaceae	*Eucalyptus viminalis*	Ribbon Gum		3	22			2	1	3	22			2	1			50	20	X
Oxalidaceae	*Oxalis perennans*															1	100	2	500	
Pinaceae	*Pinus radiata*	Radiata Pine	*																	X
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn																5	3	X
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	*	2	500	2	50	4	11	2	500	2	50	4	11	30	1000			X
Plantaginaceae	*Veronica peregrina*	Wandering Speedwell	*					1	20					1	20					
Poaceae	*Anthoxanthum odoratum*	Wseet Vernal Grass																		X
Poaceae	*Bothriochloa macra*	Red Grass														1	100			X
Poaceae	*Bromus secalinus*	Rye Brome	*																	X
Poaceae	*Cenchrus purpurascens*	Swamp Foxtail																		X
Poaceae	*Chloris gayana*	Rhodes Grass	*																	X
Poaceae	*Chloris truncata*	Windmill Grass																		X
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass				1	50	2	5			1	50	2	5					X
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass														5	1000			
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass																		X

Family	Scientific Name	Common Name	Exotic	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Random Meander
				Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Cover	Abund	Occurrence
Poaceae	*Imperata cylindrica*	Blady Grass																		X
Poaceae	*Megathyrsus maximus*	Guinea Grass	*																	X
Poaceae	*Panicum effusum*	Hairy Panic														20	500			
Poaceae	*Panicum simile*	Two-colour Panic				1	50					1	50							X
Poaceae	*Paspalum dilatatum*	Paspalum	*													1	50			X
Poaceae	*Paspalum longifolium*																			X
Poaceae	*Phalaris aquatica*	Phalaris	*																	X
Poaceae	*Poa labillardierei var. labillardierei*	Tussock		3	200	5	1000	3	600	3	200	5	1000	3	600					
Poaceae	*Poa sieberianavar. sieberiana*	Snowgrass		4	200	4	500	2	200	4	200	4	500	2	200	80	1000	80	100	X
Poaceae	*Sporobolus africanus*	Parramatta Grass	*																	X
Poaceae	*Sporobolus creber*															1	50			
Poaceae	*Themeda australis*	Kangaroo Grass				1	10					1	10							X
Polygonaceae	*Acetosella vulgaris*	Sheep Sorrel	*	1	100					1	100									X
Polygonaceae	*Rumex brownii*	Swamp Dock																		
Polygonaceae	*Rumex crispus*	Curled Dock	*																	
Ranunculaceae	*Clematis aristata*	Old Man's Beard																		X
Rosaceae	*Acaena novae-zelandiae*	Bidgee-widgee		1	100	1	2			1	100	1	2			1	500	2	500	X
Rosaceae	*Rosa rubiginosa*	Sweet Briar	*																	X
Rosaceae	*Rubus fruticosus sp. agg.*	Blackberry complex	*	1	5	1	1	1	5	1	5	1	1	1	5	1	1	2	1	X
Rubiaceae	*Asperula conferta*	Common Woodruff		1	500			2	200	1	500			2	200					
Rubiaceae	*Galium propinquum*	Maori Bedstraw				2	500					2	500			2	200			
Rubiaceae	*Richardia humistrata*		*																	X
Salicaceae	*Salix babylonica*	Weeping Willow	*																	
Solanaceae	*Solanum nigrum*	Black-berry Nightshade	*																	X
Thymelaeaceae	*Pimelea sp.*															1	20			
Urticaceae	*Urtica incisa*	Stinging Nettle																		X
Verbenaceae	*Verbena rigida var. rigida*	Veined Verbena	*					1	10					1	10					X

Cover refers to the percentage of coverage within the plot. Abundance refers to the relative number of individuals or shoots of a species within the plot

Fauna species recorded

Family	Scientific Name	Common Name	TSC Status	EPBC Status
Amphibians				
Hylidae	*Litoria latopalmata*	Broad-palmed Frog	P	-
Myobatrachidae	*Crinia parinsignifera*	Beeping Froglet	P	-
Myobatrachidae	*Uperoleia laevigata*	Smooth Toadlet	P	-
Myobatrachidae	*Limnodynastes tasmaniensis*	Spotted Marsh Frog	P	-
Birds				
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra	P	-
Apodidae	*Apus pacificus*	Fork-tailed Swift	P	-
Artamidae	*Cracticus tibicen*	Australian Magpie	P	-
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	P	-
Artamidae	*Strepera graculina*	Pied Currawong	P	-
Cacatuidae	*Eolophus roseicapillus*	Galah	P	-
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	P	-
Climacteridae	*Cormobates leucophaea*	White-throated Treecreeper	P	-
Corvidae	*Corvus sp.*		P	-
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo	P	-
Estrildidae	*Neochmia temporalis*	Red-browed Finch	P	-
Falconidae	*Falco cenchroides*	Nankeen Kestrel	P	-
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra	P	-
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	P	-
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	P	-
Meliphagidae	*Manorina melanocephala*	Noisy Miner	P	-
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	P	-
Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater	P	-
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird	P	-
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	P	-
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	P	-
Psittacidae	*Platycercus elegans*	Crimson Rosella	P	-
Psittacidae	*Platycercus eximius*	Eastern Rosella	P	-

Family	Scientific Name	Common Name	TSC Status	EPBC Status
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	P	-
Psittacidae	*Aprosmictus erythropterus*	Red-winged Parrot	P	-
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail	P	-
Timaliidae	*Zosterops lateralis*	Silvereye	P	-
Mammals				
Leporidae	**Lepus capensis*	Brown Hare	-	-
Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo	P	-
Macropodidae	*Macropus rufogriseus*	Red-necked Wallaby		
Macropodidae	*Wallabia bicolor*	Swamp Wallaby	P	-
Vespertilionidae	*Chalinobolus gouldii*	Gould's Wattle Bat	P	-
Vespertilionidae	*Vespadelus darlingtoni*	Large-eared Forest Bat	P	-
Vespertilionidae	*Austronomous australis*	White-striped Free-tailed Bat	P	-
Vespertilionidae	*Scotorepens* sp.		P	-
Canidae	**Vulpes vulpes*	Fox	-	-

Appendix C – Assessments of significance for State-listed threatened biota

Assessments of significance have been prepared in accordance with the threatened species assessment guidelines (DEC & DPI 2005) for threatened species and communities recorded or likely to occur in the study area that have the potential to be impacted by the proposal. Where possible, assessments have been grouped for species with similar habitat requirements. Assessments are provided for the following:

- Threatened flora species
  - Austral Toadflax (*Thesium australe*)
  - Bluegrass (*Dichanthium setosum*)
- Threatened ecological communities
  - Ribbon Gum - Mountain Gum – Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion
- Threatened fauna species
- Woodland birds: Regent Honeyeater (*Anthochaera phrygia)*, Swift Parrot (*Lathamus discolour)*

1. Threatened Ecological Communities

Ribbon Gum – Mountain Gum Grassy Forest/Woodland of the New England Tablelands Bioregion

Ribbon Gum - Mountain Gum - Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion is the name given to the ecological community characterised by the assemblage of species listed in paragraph 2 that typically occurs at elevations of 700 - 1500 m, and is mainly confined to the high undulating basalt plateau with deep, chocolate or krasnozem loam soils (Benson and Ashby 2000). The structure of the community is typically open forest 20 - 30 m tall, although it may assume the structure of woodland, sometimes less than 12 m tall, in exposed sites or where subject to past clearing or thinning. The understorey contains a sparse stratum of shrubs and a continuous groundcover composed mostly of grasses and herbs.

The community is listed as an endangered ecological community under the TSC Act.

A total of 71.35 hectares of Ribbon Gum - Mountain Gum - Snow Gum Grassy Woodland and 141.09 ha of derived native/exotic grassland were identified within the study area (Figure 4). Due to land clearing activities and long term cattle grazing within the study area, the vegetation is considered to be in a state of regeneration. Given the modified nature of this community within the study area, any such impacts are unlikely to significantly influence the persistence of this community within the study area or surrounding lands.

The following Assessment of Significance has been prepared to assess the impacts of removal of 7.76 hectares of Ribbon Gum – Mountain Gum Grassy Woodland EEC within the disturbance footprint (2.29 ha of woodland EEC and 5.46 hectares of derived grassland EEC).

Section 5A Assessment
Ribbon Gum – Mountain Gum – Snow Gum Grassy Forest/Woodland of the New England Tablelands Bioregion
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Not applicable to this threatened ecological community.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Not applicable to this threatened ecological community.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
A total of 212.44 hectares of vegetation consistent with a woodland and derived native grassland form of the community are present within the study area. As it occurs within the study area, this vegetation type is modified and lacks the natural diversity typically present within this vegetation type. There is also a significant prevalence of other exotic species in the groundcover of this community. The vegetation that may be directly impacted represents a very small portion of the native vegetation mapped within the locality. Approximately 204.68 hectares of the vegetation type will be retained within the study area. Therefore, the vegetation is unlikely to be placed at risk of extinction within the locality.

Section 5A Assessment
Ribbon Gum – Mountain Gum – Snow Gum Grassy Forest/Woodland of the New England Tablelands Bioregion
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Within the study area, this ecological community has been degraded through historic and ongoing disturbances. The vegetation has been modified through past land clearing, cattle grazing and pasture improvement. Within the study area, this community occurs as a modified vegetation type, with lower than usual floristic diversity. Additionally, some areas support exotic species which can reduce potential for recruitment of native flora species. In this context, direct impacts to 7.76 ha of this historically modified community would be unlikely to further alter the composition of the community such that the local occurrence of this community would be placed at risk of extinction.
d) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed
The proposal has the potential to directly impact on up to 7.76 hectares of the community within the study area. The area that may be impacted is already modified from historical activities and supports numerous exotic understorey species. The vegetation represents a very small portion of the native vegetation mapped within the locality. Given the small area of modified and degraded vegetation within the study area that may be impacted, any indirect impacts to a small area of this community are unlikely to impact the long-term survival of the community within the locality.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Vegetation in the study area appears to have been modified by historical land uses, including land clearing, cattle grazing and pasture improvement. The proposal will result in the removal of some mature trees; however, this will not affect the connectivity of the EEC in surrounding areas. Indirect impacts resulting from altered hydrology have the potential to influence the floristic assemblage of the mid- and understorey of this community within the study area as result of changes to hydrology, however given the already degraded and modified nature of this vegetation within the study area, any such impacts are unlikely to be significant. Similarly, any potential influence of increased or new edge effects is unlikely to substantially modify the local occurrence of this community and will not result in any additional fragmentation or isolation. The proposal is unlikely to increase fragmentation within the locality, or result in the isolation of habitat for this community from other areas of habitat.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality
Within the site, this vegetation type is already modified, and supports a large diversity of exotic species. Any changes to the floristic assemblage are unlikely to result in any further negative impacts to the community within the study area or surrounds. The vegetation that may be indirectly impacted represents a very small portion of the native vegetation mapped within the locality. The small area of modified vegetation within the study area that may be impacted is not considered to be important to the long-term survival of the community in the locality.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Section 5A Assessment
Ribbon Gum – Mountain Gum – Snow Gum Grassy Forest/Woodland of the New England Tablelands Bioregion
There is no critical habitat listed for this threatened ecological community.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
No recovery plan has been developed for this community. In lieu of a formal recovery plan, OEH, (2016) lists the following activities to assist this community: • Ensure remnants remain connected or linked to each other; in cases where remnants have lost connective links, re-establish them by revegetating sites to act as stepping stones for fauna, and flora (pollen and seed dispersal). • Manage stock to reduce grazing pressure in high quality remnants and develop more sustainable fire regimes. • Mark remnants onto maps (of the farm, shire, region, etc) and use to plan activities (e.g. remnant protection, rehabilitation or road, rail and infrastructure maintenance work). On-site markers can alert maintenance staff to the presence of a threatened species. Mitigation measures are provided to limit the potential for negative influences associated with edge effects such as weed management and erosion and sediment control. As such, potential indirect impacts to this community are unlikely to interfere with the recovery of this community.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The proposal has the potential to introduce or increase the operation of the following KTPs within this community through soil disturbance and increased visitation to the area: • Invasion of native plant communities by exotic perennial grasses. • Infection of native plants by *Phytophthora cinnamomi*. • Infection of native frogs by amphibian chytrid causing the disease chytridiomycosis. A number of mitigation measures are provided in order to reduce the potential for the proposal to influence these KTPs (refer to Section 7).
Conclusion of Assessment of Significance
The proposal is highly unlikely to result in a significant impact on the EEC, pursuant to s.5A of the EP&A Act given: • Only a small area (7.76 ha) of the EEC may be exposed to direct impacts which may result in further modifications to the already modified community within the study area. • The relatively large areas of better quality vegetation that exist elsewhere within the locality that would not be impacted by the proposal. • The modified nature of the vegetation that may be impacted. • The proposal will not result in the isolation or fragmentation of this vegetation from other areas of vegetation or habitat. • The proposal is unlikely to interfere with the recovery of this community as it occurs elsewhere within the locality.

2. Threatened flora species

Austral Toadflax (*Thesium australe*)

Thesium australe is a small, straggling herb to 40 cm tall. Leaves are pale green to yellow-green, somewhat succulent, 1 - 4 cm long and 0.5 - 1.5 mm wide. Flowers are minute and white, emerging where the leaves meet the stems and appearing in spring. The species occurs in small populations scattered across eastern NSW, from the Northern to Southern Tablelands. There are no records of the species in the locality of the proposal; however, it is predicted to occur within the locality.

The species was not recorded during the field survey; however, potential habitat exists for this species in the 7.76 hectares of vegetation that may be impacted by the proposal. The removal of this potential habitat is the focus of this assessment.

Section 5A Assessment
Austral Toadflax (*Thesium australe*)
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
Thesium australe flowers and fruits throughout the year on the coast, and in summer at higher altitudes. In subalpine and tableland climates, the species dies back to rootstock during winter and resprouts in spring. This is not the case in coastal areas where the species persists all year round and may live for longer than two years. The species appears to cope well with but does not require frequent disturbance. It is observed to germinate well after fire; however, fire is not essential for germination. The existence of buds near the soil surface allows the species to resprout after disturbance. The proposal would result in removal of 7.76 hectares of potential marginal habitat from within the study area (see Table 17, Section 6.4.2). Approximately 204.68 hectares of similar habitat will be retained within the study area. The vegetation to be impacted is in a range of conditions, with some areas of extensive weed infestation as well as areas of dense Blady Grass and evidence of historical and ongoing disturbances associated with land clearing, cattle grazing and pasture improvement. The removal of up to 7.76 hectares of potential habitat may result in the loss of individuals that occur within the area to be impacted, however will not result in any changes to abiotic conditions such as fire regimes that may influence the dispersal or germination of this species elsewhere in the locality. The vegetation to be impacted by the proposal is likely to provide marginal habitat at best for the species, given that the habitat is degraded from cattle grazing. The 7.76 hectares of potential marginal habitat to be impacted by the proposal represents a small area of comparable habitat within the locality. Given that only marginal potential habitat would be removed as a result of the proposal, it is unlikely that the proposal would result in impacts such that a viable local population is placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
Not applicable to these threatened species.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

Section 5A Assessment
Austral Toadflax (*Thesium australe*)
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
Not applicable to these threatened species.
d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
The proposal would remove up to 7.76 hectares of potential marginal habitat for the species from within the study area. Potential habitat to be impacted is of low value to these species, given the presence of a dense cover of exotic species. The species was not located within the habitat to be impacted during the field survey. The vegetation that may be indirectly impacted represents a very small portion of the native vegetation mapped within the locality.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
Fragmentation from past clearing activities is already evident within the study area, although there are still large tracts of native vegetation within the surrounding lands. The proposal would result in the loss of up to 7.76 hectares of marginal habitat for this species. The proposal would result in a minor increase to the level of fragmentation within the study area, compared to the existing conditions. The proposal would not result in any impacts to vegetation outside of the study area and would not impose any barriers to dispersal for these species in retained vegetation.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality
The marginal potential habitat for the species that would be impacted by the proposal does not contain any known individuals of the species. The vegetation to be impacted is unlikely to be important habitat for the species given that it is heavily degraded by cattle grazing. The area to be impacted represents only a small area of potential marginal habitat in relation to that in the surrounding locality. The potential habitat that would be removed is not considered important to the long-term survival of the species in the locality.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)
No critical habitat has been listed for these species.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
No recovery plan has been developed for these species. In lieu of a formal recovery plan, OEH, (2013) lists the following activities to assist the species recovery: *Thesium australe*:

Section 5A Assessment
Austral Toadflax (*Thesium australe*)
• Protect known populations from changes to land use. • Do not undertake road works, pasture modification or other changes in land use that may affect populations. • Do not increase grazing pressures on sites where populations persist - reduce grazing pressures where possible. • Undertake weed control in and adjacent to populations, taking care to spray or dig out only target weeds. • Mark sites and potential habitat onto maps (of the farm, shire, region, etc) used for planning (e.g. road works, residential and infrastructure developments, remnant protection, rehabilitation). • Search for new populations in potential habitat. The proposal would remove up to 7.76 hectares of potential habitat for the species but there would not be any impact on known individuals or populations. Vegetation to be impacted is in a state of regeneration due to previous land clearing, cattle grazing and pasture improvement, which is likely to reduce the value of potential habitat for these species substantially. As such, the removal of a small area of marginal potential habitat for these species as a result of the proposal is unlikely to interfere with the recovery of these species.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The proposal would contribute to the operation of three KTPs relevant to the species: • Clearing of vegetation – the proposal would remove up to 7.76 hectares of vegetation that represents marginal habitat for the species. • Invasion of exotic perennial grasses – clearing and disturbance within the study area could increase the incidence of these species in adjacent retained patches of vegetation. Mitigation measures to minimise the potential for spread and or/introduction of any additional species are recommended in Section 7.
Conclusion of Assessment of Significance
Removal of up to 7.76 hectares of marginal habitat is unlikely to result in a significant impact on *Thesium australe*, pursuant to section 5A of the EP&A Act, given that: • No individuals have been recorded in the locality of the study area. • Only marginal potential habitat would be removed that is likely to be of poor quality for the species due to habitat degradation. • The potential habitat to be removed is unlikely to be necessary for the long-term survival of these species within the locality given no known individuals would be impacted. • Clearing would not fragment habitat such that potential habitat in retained areas of vegetation would be impacted and no barriers to dispersal would be created outside of the proposal footprint. • Only a small area of habitat would be impacted compared to the large areas that exist elsewhere in the locality, including within the various conservation reserves in the area.

Bluegrass (*Dichanthium setosum*)

Bluegrass is usually found in association with heavy basaltic black soils and red-brown loams with clay subsoil. It is also often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture and is often collected from disturbed open grassy

woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat. Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Medicago minima, Leptorhynchos squamatus, Lomandra aff. longifolia, Ajuga australis, Calotis hispidula and Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia* and *Psoralea species.*

The species was not recorded during the field survey; however, potential habitat exists for this species in the 7.76 hectares of vegetation that may be impacted by the proposal. The removal of this potential habitat is the focus of this assessment.

Section 5A Assessment
Bluegrass (*Dichanthium setosum*)
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
The proposal would result in removal of 7.76 hectares of potential marginal habitat for *D. setosum* from within the study area (see Table 17, Section 6.4.2). Approximately 204.68 hectares of similar habitat will be retained within the study area. The vegetation to be impacted is in a range of conditions, with some areas of extensive weed infestation as well as areas of dense Blady Grass and evidence of historical and ongoing disturbances associated with land clearing, cattle grazing and pasture improvement. The removal of up to 7.76 hectares of potential habitat may result in the loss of individuals that occur within the area to be impacted, however will not result in any changes to abiotic conditions such as fire regimes that may influence the dispersal or germination of this species elsewhere in the locality. The vegetation to be impacted by the proposal is likely to provide marginal habitat at best for the species, given that the habitat is degraded from cattle grazing. The 7.76 hectares of potential marginal habitat to be impacted by the proposal represents a small area of comparable habitat within the locality. Given that only marginal potential habitat would be removed as a result of the proposal, it is unlikely that the proposal would result in impacts such that a viable local population is placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
Not applicable to this threatened species.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
Not applicable to this threatened species.

Section 5A Assessment
Bluegrass (*Dichanthium setosum*)
d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
The proposal would remove up to 7.76 hectares of potential marginal habitat for the species from within the study area. Potential habitat to be impacted is of low value to this species, given the presence of a dense cover of exotic species. The species was not located within the habitat to be impacted during the field survey. The vegetation that may be indirectly impacted represents a very small portion of the native vegetation mapped within the locality.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
Fragmentation from past clearing activities is already evident within the study area, although there are still large tracts of native vegetation within the surrounding lands. The proposal would result in the loss of up to 7.76 hectares of marginal habitat for this species. The proposal would result in a minor increase to the level of fragmentation within the study area, compared to the existing conditions. The proposal would not result in any impacts to vegetation outside of the study area and would not impose any barriers to dispersal for this species in retained vegetation.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality
The marginal potential habitat for the species that would be impacted by the proposal does not contain any known individuals of the species. The vegetation to be impacted is unlikely to be important habitat for the species given that it is heavily degraded by cattle grazing. The area to be impacted represents only a small area of potential marginal habitat in relation to that in the surrounding locality. The potential habitat that would be removed is not considered important to the long-term survival of the species in the locality.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)
No critical habitat has been listed for the species.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
No recovery plan has been developed for *D. setosum*.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The proposal would contribute to the operation of three KTPs relevant to the species: • Clearing of vegetation – the proposal would remove up to 7.76 hectares of vegetation that represents marginal habitat for the species. • Invasion of exotic perennial grasses – clearing and disturbance within the study area could increase the incidence of this species in adjacent retained patches of vegetation. Mitigation

Section 5A Assessment
Bluegrass (*Dichanthium setosum*)
measures to minimise the potential for spread and or/introduction of any additional species are recommended in Section 7.
Conclusion of Assessment of Significance
Removal of up to 7.76 hectares of marginal habitat is unlikely to result in a significant impact on *D. setosum*, pursuant to section 5A of the EP&A Act, given that: • No individuals have been recorded in the locality of the study area. • Only marginal potential habitat would be removed that is likely to be of poor quality for the species due to habitat degradation. • The potential habitat to be removed is unlikely to be necessary for the long-term survival of this species within the locality given no known individuals would be impacted. • Clearing would not fragment habitat such that potential habitat in retained areas of vegetation would be impacted and no barriers to dispersal would be created outside of the proposal footprint. • Only a small area of habitat would be impacted compared to the large areas that exist elsewhere in the locality, including within the various conservation reserves in the area.

Threatened Woodland birds

Section 5A Assessment	
Regent Honeyeater (Critically Endangered)	**Swift Parrot (Endangered)**
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,	
The proposal would not isolate any areas of habitat or cause significant habitat fragmentation that would affect the breeding, foraging or dispersive movements of these highly mobile species. The proposal would lead to an increase in noise, vibration and dust generation from quarrying activities during daylight hours. Mitigation measures including limiting blasting and installing noise shielding devices have been proposed to limit the impact of this noise increase on residential receivers as part of the Noise Impact Assessment (see relative section of EIS document). These measures would also reduce the impact of this noise on fauna in retained habitats around the proposal. It is therefore considered unlikely that the proposal would disrupt the breeding cycle of any locally occurring individuals. The Swift Parrot and Regent Honeyeater are known to make large (up to several thousand kilometres) migratory movements. The species would therefore be likely to forage within the site on an opportunistic basis, in response to flowering events or local conditions, when present in the locality. There are extensive areas of alternative foraging habitat available for locally occurring individuals of these species outside the study area. In this context, the removal of up to 7.76 hectares of potential foraging habitat is unlikely to impact the lifecycle of these highly mobile species such that viable local population would be placed at risk of extinction.	
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,	
Not applicable to these threatened species.	

Section 5A Assessment	
Regent Honeyeater (Critically Endangered)	**Swift Parrot (Endangered)**
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
Not applicable to these threatened species.	
d) in relation to the habitat of a threatened species, population or ecological community:	
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
The proposal would not remove any areas of suitable breeding habitat Swift Parrot or Regent Honeyeater. The proposal would remove up to 7.76 hectares of known or potential foraging habitat for these species, representing a small proportion of available habitat in the locality.	
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
Clearing for the proposal would not isolate any areas of native vegetation. Habitat connectivity would be retained around the edges of the indicative footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile, aerial species.	
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	
The proposal would remove up to 7.76 hectares of marginal foraging habitat for these species. The vegetation to be removed would represent a very small proportion of the home ranges of these highly mobile species. There are extensive areas of similar vegetation in adjoining areas and in the broader locality. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of these species in the locality.	
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	
No critical habitat has been listed for these species.	
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	
No recovery plan has been prepared for these species at the state level. National Recovery Plans have been prepared for the Swift Parrot and Regent Honeyeater. Targeted management strategies for the species are currently being developed under the Saving our Species program. The proposal would remove only marginal habitat for these species and is therefore not consistent with the overall objectives of the recovery strategies. The small area of foraging habitat to be removed would be unlikely to interfere with the recovery of these species, particularly given the lack of breeding habitat to be affected and the presence of extensive areas of alternative habitat in the locality.	
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	

Section 5A Assessment	
Regent Honeyeater (Critically Endangered)	**Swift Parrot (Endangered)**
The proposed action would contribute to the operation of two KTPs of relevance to these species as follows: • Clearing of vegetation – the proposal would remove about 7.76 hectares of EEC vegetation that represents potential foraging habitat for these species. As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality. The proposal would therefore represent a minor increase in the operation of these KTPs.	
Conclusion of Assessment of Significance	
The proposal is unlikely to have a significant impact on the Regent Honeyeater or Swift Parrot pursuant to section 5A of the EP&A Act, given that: • The Regent Honeyeater and Swift Parrot would be unlikely to breed within habitats to be removed; • Vegetation to be removed comprises a negligible proportion of native vegetation present and conserved in surrounding areas and the broader locality; and • Habitat connectivity would be retained for these highly mobile species	

Appendix D – Vegetation within the study area

Ribbon Gum Woodland vegetation to be retained in the western portion of the study area

Heavily grazed grassland dominated by exotic herbs and grasses (August 2016)

Grassland vegetation – recovered from grazing (March 2017)

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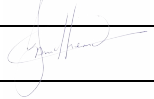
2	G Whyte	B Luffman		J McPherson		31/05/2017

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