Appendix F
Terrestrial Fauna Impact Assessment

EXECUTIVE SUMMARY

This fauna impact assessment report has been undertaken by Ecotone Ecological Consultants Pty Ltd for the Hunter 8 Alliance on behalf of the Australian Rail Track Corporation (ARTC) for the Maitland to Minimbah third track project (referred to as 'the Project'). This report has been prepared to assess the potential impacts of the construction of a third railway track between Maitland and Minimbah.

Seven threatened species on the TSC Act (squirrel glider, grey-crowned babbler, eastern freetail-bat, eastern bent-wing bat, little bent-wing bat and large-footed myotis) and four migratory species listed on the EPBC Act (Latham's snipe, rainbow bee-eater, rufous fantail and wanderer butterfly) were identified in the investigation area during field surveys. Potential habitat for a further 32 threatened species on the TSC Act and 12 threatened and/or migratory species on the EPBC Act was identified within the investigation area.

Assessments under the EP&A Act and EPBC Act found that the Project would be unlikely to significantly impact on any threatened and/or migratory fauna species listed on the TSC Act and/or EPBC Act.

The inclusion of mitigation measures 1 to 6 (**Section 7)** into the draft Statement of Commitments of the Environmental Assessment for the Project would further reduce the likely level of impact on fauna species and their habitats.

Further mitigation measures to reduce the level of potential impacts on fauna species are recommended and include:

- Establishment of runoff control measures.
- Development of a weed management strategy.
- The use of local plant species in rehabilitation areas.
- Development of a protocol to prevent the introduction or spread of root-rot fungus.

The adoption of the recommended mitigation measures and the development of a Compensatory Habitat Strategy, in consultation with DECCW, would see the Project at least meet the 'maintain' level of the 'improve or maintain' goal of a Part 3A EP&A Act impact assessment.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

GLOSSARY OF TERMS

Chainage	The chainage at a location along a rail line is the distance of that point in relation to Sydney (NSW only) based on 0.000 kilometres being located at the end of Central No. 1 Platform.
Culvert	A totally enclosed drain under a road or railway.
Cumulative impact	The sum on the environment resulting from the successive effects of several different impacts.
Cut	An excavation for constructing below the natural ground level.
Cut batters	The side slopes of cuttings.
Director-General's Requirements	Requirements for an environmental assessment issued by the Director-General of the NSW Department of Planning in accordance with the Environment Planning and Assessment Act 1979.
Erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle.
Fauna	The animals of a given region or period, taken collectively.
Flora	Plants of a particular region that make up the vegetation of a site.
Fill	Earth used to construct an embankment.
Groundwater	Subsurface water stored in pores of soil or rocks.
Hunter 8 Alliance	Hunter 8 Alliance, which has been formed to deliver a new third track and ancillary infrastructure between Maitland and Minimbah.
Key threatening process	A process specified in Schedule 3 of the NSW Threatened Species Conservation Act 1995 that adversely affects threatened species, populations or ecological communities, or could cause those that are not threatened to become so.
Level crossing	A crossing provided at grade across the railway corridor.
Mitigation	Reduction in severity.
Option	A concept design alternative developed for consideration.
Overbridge	Where a road or pedestrian footway is situated over the railway line.
Proponent	Australian Rail Track Corporation (ARTC).
Rail corridor	The area of land dedicated to the ARTC between Maitland and Minimbah.
Scats	Animal droppings.

GLOSSARY OF TERMS con't.

Site compound	Area enclosing construction machinery, stockpiles and site offices usually adjacent to construction sites.
Spoil	Excess of rock and/or earth material resulting from construction activities.
Study area	The Study Area for this project is defined as the *investigation area* shown in **Figure 2**.
Threatened species, populations and ecological communities	Species, populations and ecological communities specified in Schedules 1, 1A and 2 of the NSW Threatened Species Conservation Act 1995.
Underbridge	Where a road or pedestrian underpass is situated under the railway line.

1. INTRODUCTION

This fauna impact assessment report has been undertaken by Ecotone Ecological Consultants Pty Ltd as part of the Hunter 8 Alliance on behalf of the Australian Rail Track Corporation (ARTC) for the Maitland to Minimbah third track project (referred to as 'the Third Track Project'). This report has been prepared to assess the potential impacts of the construction of a third railway track adjacent to the existing two tracks (hereafter referred to as 'the proposal').

1.1 Background

ARTC was created by the Commonwealth and State Governments in 1998 to provide a single body responsible for the National Interstate Rail Network. ARTC is a Commonwealth Government corporation and currently has responsibility for the management of over 10,000 route kilometres of standard gauge interstate rail track in South Australia, Victoria, Western Australia and New South Wales (NSW), as well as the Hunter Valley Rail Network and other regional rail links in NSW.

The Hunter Valley Rail Network extends from the Port of Newcastle to Ulan and Narrabri in the west. It is used by passenger services, freight, wheat and coal services. The majority of trains carry coal from mines located across the Hunter Valley to either Carrington (Port Waratah) or Kooragang Island ports at Newcastle for loading onto ships for export.

Due to the forecast increase in coal throughput at the Port of Newcastle to 190 million tonnes per annum (mtpa) by 2012, a number of rail infrastructure improvements to the Hunter Valley Rail Network have been proposed by ARTC. One of the key improvement projects included in the ARTC ten-year strategic plan is a proposed third track adjacent to the existing Main Northern Railway between Maitland and Whittingham, known as the Maitland to Whittingham Third Track Project.

The Maitland to Whittingham Third Track Project is divided into two stages. Stage 1 consists of the construction of the third track between Minimbah and Whittingham. Project Approval for this project was granted by the Minister of Planning on 26 May 2009 and construction commenced in July 2009.

Stage 2 consists of the construction of the third track between Maitland and Minimbah, known as the Maitland to Minimbah Third Track Project. Stage 2 is the subject of this fauna impact assessment report and is referred to as 'the Project'.

The purpose of the Project is to increase rail reliability and future capacity between the Hunter Valley and the Port of Newcastle. In addition to providing increased track capacity, the Project aims to improve operational performance along the route. These improved efficiencies would be created through:

- Reduced impacts on coal traffic due to track maintenance activities.
- Reduced loss of train paths due to shadow path effects from passenger services.
- Reduced loss of available train paths due to train breakdowns.

The Project would also bring benefits to the local and broader community by generating up to 650 full time jobs during construction, creating opportunities for local and regional goods and service providers, and providing greater security for existing coal industry jobs.

1.2 Description of the Project

The Hunter 8 Alliance, on behalf of the ARTC, is proposing to construct a third track adjacent to the existing Main Northern Railway between Maitland and Minimbah. The proposed third track would commence in Farley approximately 2 kilometres west of Maitland Station at approximate chainage 194.500 kilometres and would run adjacent to the Main Northern Railway for approximately 30 kilometres concluding at Minimbah at approximate chainage 224.200 kilometres.

The proposed third track would be predominantly located on the Up side of the Main Northern Railway. Approximately 3 kilometres of track, from chainages 210.170 kilometres to 211.180 kilometres and 214.060 kilometres to 216.000 kilometres, would be located on the Down side.

The Project would involve the construction of approximately 30 kilometres of new rail track as well as construction and/ or modification of major infrastructure along the Main Northern Railway. A summary of the major elements of the Project is provided in **Table 1**.

Table 1. Major Project Elements

Project Elements	
Earthworks	• Major cut and fill earthworks along the route. • Other minor earthworks.
Track	• Approximately 30 km of new track including turnouts and junctions. • Relocation of turnouts from Minimbah and Branxton to Belford. • Upgrade of maintenance siding turnouts at Branxton. • Track reconditioning of existing Up Main at Greta and Branxton Stations and of the Branxton crossovers.
Drainage	• Central and cess track drainage. • Amendments to 53 culverts for cross drainage. • Re-alignment of Sawyers Creek. • Other drainage works around new structures.
Bridges	• A new rail underbridge at Stony Creek and Wollombi Road, Farley. • Closure of the stock crossing at Farley. • Demolition of the existing rail overbridge at Old North Road, Allandale. • A new rail underbridge at Allandale Road, Allandale. • A new rail underbridge for an unnamed tributary of Anvil Creek (chainage 207.776 km). • Demolition and replacement of the existing rail underbridge at an unnamed tributary of Anvil Creek, Greta (chainage 209.989 km). • A new rail underbridge at Sawyers Creek, Greta. • Modification of the existing rail overbridge at Bridge Street, Branxton. • A new rail underbridge at Black Creek, Belford. • A new rail underbridge at Jump Up Creek, Belford.
Station Modifications	• Modifications to Lochinvar Railway Station. • Modifications to Greta Railway Station. • Modifications to Branxton Railway Station.

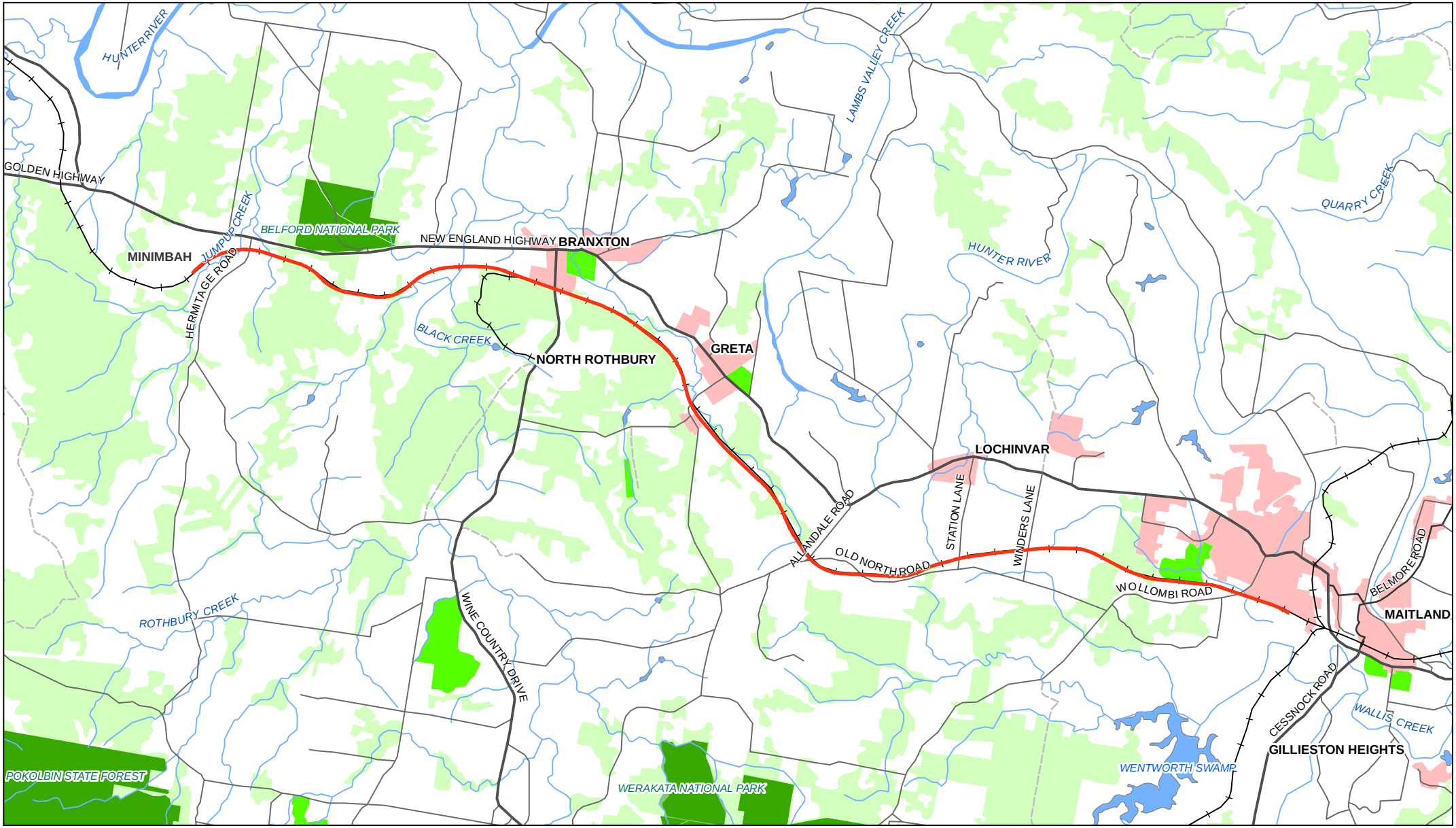
1.3 Investigation Area

The investigation area for this assessment is a linear corridor which follows the route of the Main Northern Railway between chainages 194.500 kilometres and 224.220 kilometres and is shown in **Figure 1**. The investigation area captures the footprint of disturbance for the third track and other associated works, including construction compounds, haul roads and spoil disposal areas.

1.4 Report Objectives

The general objectives of this assessment are to:

- Provide a literature search of all possible threatened or migratory species that are known to occur or likely to occur on the investigation area.
- Undertake field surveys to:
  - Survey representative habitat types.
  - Record the fauna species present within the dominant vegetation communities present.
  - Survey for threatened and migratory species that may be present (following the literature review).
- Identify the potential impacts of construction and operation of the Project for any threatened species or populations that occur or could be likely to occur in the investigation area.
- Assess the potential impacts of construction and operation of the Project on the fauna of the investigation area by application of the provisions of the relevant NSW and Commonwealth legislation.
- Assess whether or not the Project meets the 'improve or maintain' principle of the Part 3A assessment.
- Provide discussion on measures to manage potential impacts and effects of the proposal, using the principles of "avoid, minimise and mitigate" in that order of preference.
- Address the Director General's Requirements (DGRs) for the Environmental Assessment of the Project. The DGRs identify ecology as a key issue for the Environmental Assessment.



1:120,000 (at A4)

0 480 960 1,920 2,880 3,840

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Principal Road
- Secondary Road
- Minor Road
- Track
- Existing Rail
- Water Course
- Project Location
- Built Up Areas
- Watercourse Areas
- Recreation Areas
- Nature Conservation Reserve
- State Forest
- Forest Or Shrub

Maitland To Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

Location of the Investigation Area

Figure 1

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Locality_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2003. Created by: fmackay, msmiljkovski, tmorton

1.5 Report Structure and Terminology

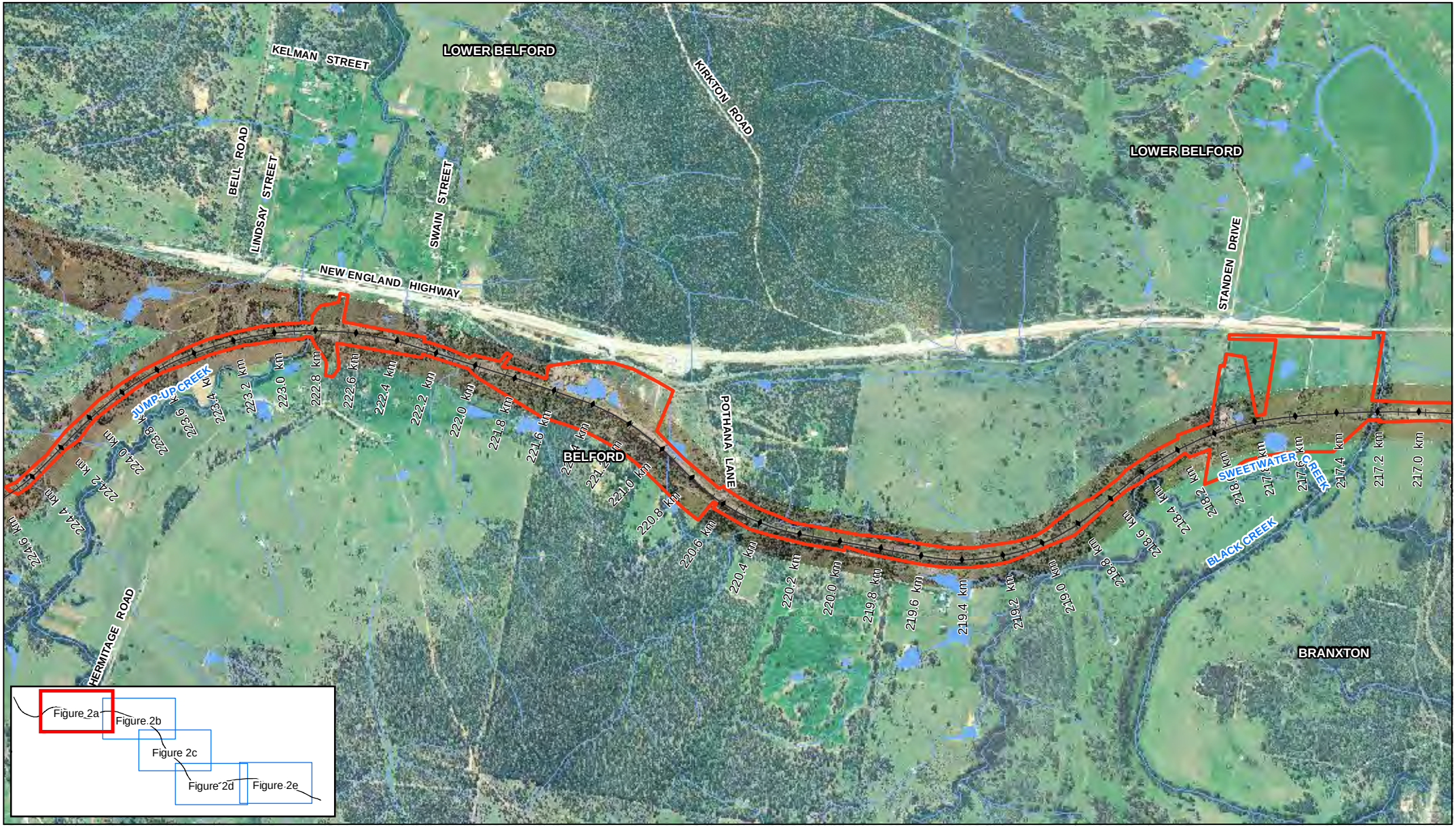
The environmental studies have been conducted in three stages:

1. A desktop review of available literature pertaining to the investigation area and surrounding locality.
2. A field survey of the investigation area.
3. Assessment of impact on fauna in accordance with the relevant NSW and Commonwealth legislation and planning instruments.

Within this report, reference is given to the relevant sections of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); NSW *Threatened Species Conservation Act 1995* (TSC Act); *National Parks and Wildlife Act 1974* (NP&W Act); *Environmental Planning and Assessment Act 1979* (EP&A Act); and subsequent amendments to these. Specific consideration is given to Part 3A of the EP&A Act.

For this report:

- The *study locality* is the area of land within ten kilometres (either side) of the 30 kilometre section of the proposed railway line (**Figure 1**).
- The *study area* consists of the investigation area plus the immediately surrounding land and watercourses that could be potentially affected, directly or indirectly by the Project.
- The *investigation area* is defined as the investigation area shown on **Figure 2.**



1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

Existing Railway
Watercourse
Investigation Area
Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

The Investigation Area

Figure 2a

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_StudyArea_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004. Created by: fmackay, tmorton

1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

The Investigation Area

Figure 2b

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_StudyArea_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004. Created by: fmackay, tmorton

1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

The Investigation Area

Figure 2c

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_StudyArea_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004. Created by: fmackay, tmorton

1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

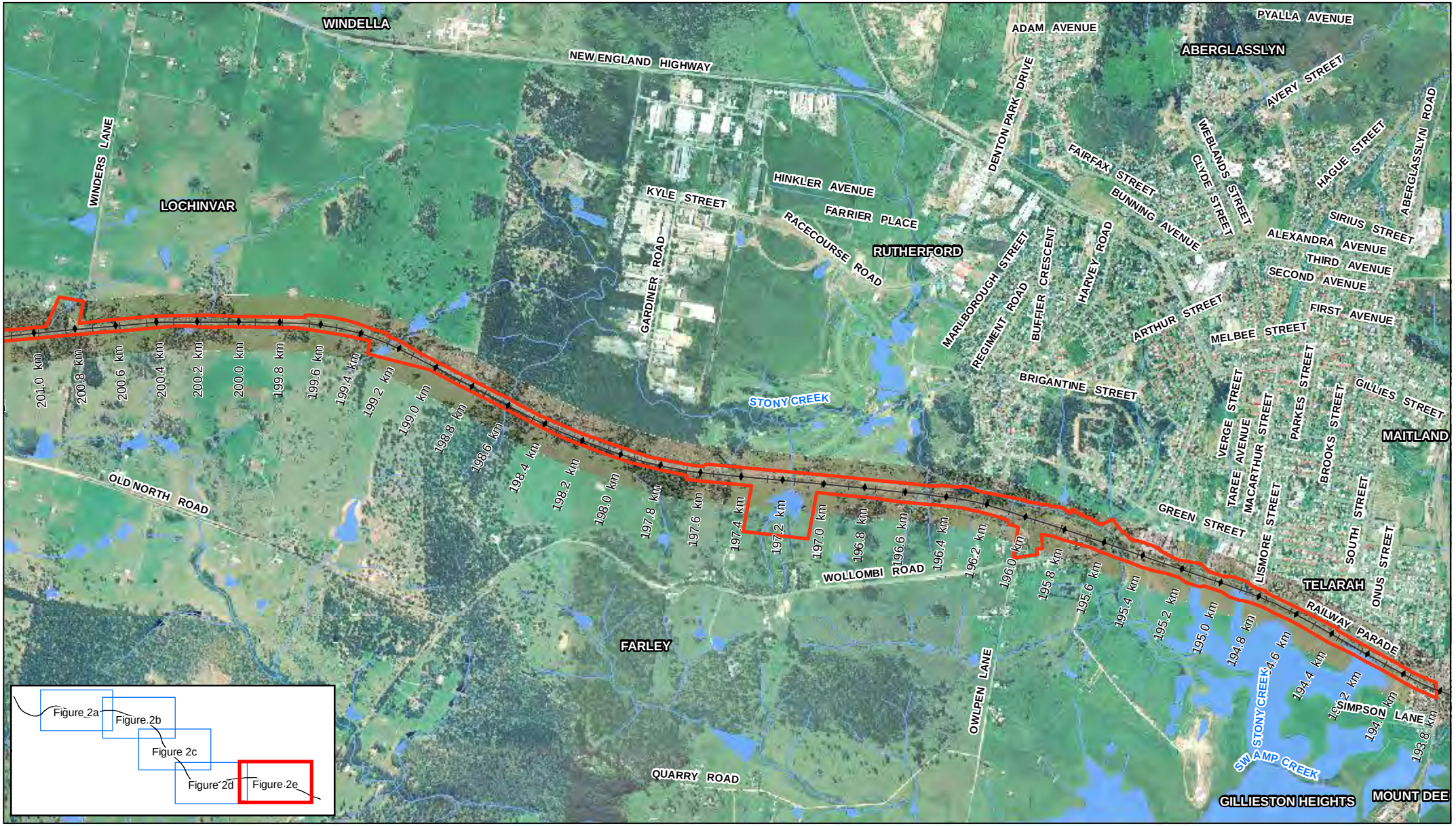
The Investigation Area

Figure 2d

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_StudyArea_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004. Created by: fmackay, tmorton



1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

The Investigation Area

Figure 2e

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_StudyArea_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004. Created by: fmackay, tmorton

2. EXISTING ENVIRONMENT

2.1 General Description of the Study Area

A broad description of the prominent natural and developed features of the study area and study locality is provided in **Table 2**.

Table 2. Description of the Investigation area, Study Area and Locality

Client	THE HUNTER 8 ALLIANCE on behalf of ARTC.
Location	The proposed third track would commence in Farley approximately two kilometres west of Maitland at approximate chainage 194.500 kilometres and would run adjacent to the Main Northern Railway for approximately 30 kilometres concluding at Minimbah at approximate chainage 224.220 kilometres. 9132 Cessnock and 9232 Newcastle 1:100 000 map sheets
LGA	Maitland, Cessnock and Singleton
Bioregion	Sydney Basin
Botanical Subregion	North Coast
Local Catchment Management Authority	Hunter-Central Rivers
Elevation	Fifteen metres ASL in the east to 110 metres ASL near Allandale, to 65 metres ASL at the western end of the investigation area.
Investigation Area Description	The investigation area is approximately 30 kilometres long and between 50 and 200 metres wide along most parts. The study area is a mix of cleared areas, areas of scattered tree cover, areas of remnant woodland vegetation, residences and local townships.
Current Land Use	The investigation area comprises several land use types. The majority of the study area is agricultural grazing land, either cleared or containing areas of remnant woodland and/or riparian vegetation. Several rural residences occur within the study area, as do parts of the townships of Branxton, Greta, Farley and Maitland.
Watercourses, Drainage and Catchment	The following creek lines occur within the study area • Stony Creek • Anvil Creek • Sawyers Creek • Black Creek • Sweetwater Creek • Jump-up Creek All of the above creek lines flow directly or indirectly into the Hunter River.
Significant Ecological Features	Creek lines along the investigation area are significant riparian habitat areas which provide landscape linkages throughout the landscape for many species. Several medium and large remnant woodland blocks occur along or adjacent to the investigation area and provide significant habitat areas for species within the region.

3. DATABASE SEARCHES AND LITERATURE REVIEW

3.1 Database Searches

3.1.1 Review of Threatened and/or Migratory Species Within the Study Locality

A review was undertaken of the documented records of the locations of threatened fauna species within the study locality. Due to the linear shape of the investigation area four database search points (**Table 3**) were selected along the 30 kilometre length of the investigation area. A 10 kilometre radius search area was undertaken at each of the four point locations (to cover the entire investigation area). Threatened species records were accessed from the DECCW Atlas of NSW Wildlife Database for the Cessnock (9132) and Newcastle (9232) 1: 100,000 map sheets (updated to 20 August 2009). Threatened and migratory species protected under the EPBC Act likely to occur within the study locality were determined from a Protected Matters Database search (24 August 2009).

Table 3. Location of Atlas of NSW Wildlife Database and Protected Matters Database Search Points

General Location	Co-ordinate Location (WGS84)
Eastern end – Farley, NSW	56 H 356558E 6378495N
Station Lane, Lochinvar, NSW	56 H 354560E 6378577N
Nelson Street, Greta, NSW	56 H 348585E 6382125N
Western end – Hermitage Road, Belford, NSW	56 H 338103E 6385562N

3.1.2 Threatened Fauna Species on the TSC Act Recorded Within the Study Locality

A total of 38 threatened terrestrial fauna species listed on the TSC Act have previously been recorded within the study locality on the Atlas of NSW Wildlife Database (**Table 4**). Of these, five species (green and golden bell frog, black-necked stork, swift parrot, painted snipe and regent honeyeater) are listed as endangered on the TSC Act and 33 species are listed as vulnerable on the TSC Act. Six species are also listed on the EPBC Act, two as endangered (swift parrot and spotted-tailed quoll), one as endangered and migratory (regent honeyeater) and three as vulnerable (green and golden bell frog, grey-headed flying-fox and large-eared pied bat).

Table 4. NSW Atlas of Wildlife Threatened Species Records in the Study Locality.

Scientific Name	Common Name	Status (TSC)	Status (EPBC)	Earliest / Latest Record	Number of Records
	FROGS				
Litoria aurea	Green and golden bell frog	E1	V	1995-2008	7
Litoria littlejohni	Littlejohn's tree frog	V	-	1970	1
	BIRDS				
Oxyura australis	Blue-billed duck	V	-	1988-1990	4
Ephippiorhynchus asiaticus	Black-necked stork	E1	-	1987-2003	10
Ixobrychus flavicollis	Black bittern	V	-	2000-2005	2
Lophoictinia isura	Square-tailed kite	V	-	2006	1
Rostratula benghalensis australis	Painted snipe (Australian subspecies)	E1	-	1992	1
Calyptorhynchus lathami	Glossy black-cockatoo	V	-	1977-2001	3
Callocephalon fimbriatum	Gang-gang cockatoo	V	-	2005	3
Glossopsitta pusilla	Little lorikeet	V	-	2002-2007	14
Neophema pulchella	Turquoise parrot	V	-	2006	2
Lathamus discolor	Swift parrot	E1	E	2000-2005	10
Tyto novaehollandiae	Masked owl	V	-	1970	1
Ninox strenua	Powerful owl	V	-	1977-2004	5
Ninox connivens	Barking owl	V	-	1977-2005	2
Climacteris picumnus	Brown treecreeper	V	-	2003-2008	6
Pyrrholaemus saggitatus	Speckled warbler	V	-	1981-2008	17
Melithreptus gularis gularis	Black-chinned honeyeater (eastern subspecies)	V	-	2005	5
Xanthomyza phrygia	Regent honeyeater	E1	E, Mi	1977-2000	5
Grantiella picta	Painted honeyeater	V	-	1977	1
Melanodryas cucullata	Hooded robin	V	-	1986	1
Pomatostomus temporalis temporalis	Grey-crowned babbler (eastern subspecies)	V	-	1993-2008	72
Stagonopleura guttata	Diamond firetail	V	-	2005	1
	MAMMALS				
Dasyurus maculatus	Spotted-tailed quoll	V	E	1980-2006	13
Phascogale tapoatafa	Brush-tailed phascogale	V	-	2003-2006	3
Phascolarctos cinereus	Koala	V	-	1980-2006	9
Petaurus australis	Yellow-bellied glider	V	-	2003	1
Petaurus norfolcensis	Squirrel glider	V	-	2000-2008	47
Pteropus poliocephalus	Grey-headed flying-fox	V	V	1999-2008	48
Saccolaimus flaviventris	Yellow-bellied sheathtail-bat	V	-	2002-2007	2
Mormopterus norfolkensis	Eastern freetail-bat	V	-	1994-2008	26
Miniopterus australis	Little bentwing-bat	V	-	2000-2007	11
Miniopterus schreibersii oceanensis	Eastern bentwing-bat	V	-	1994-2007	41
Chalinolobus dwyeri	Large-eared pied bat	V	V	2005-2007	2
Falsistrellus tasmaniensis	Eastern false pipistrelle	V	-	2002-2007	3
Myotis adversus	Large-footed myotis	V	-	1994-2008	13
Scoteanax rueppellii	Greater broad-nosed bat	V	-	1999-2007	13
Vespadelus troughtoni	Eastern cave bat	V	-	2006	4

Notes:

TSC Act Status:

E1 Schedule 1, Part 1: Endangered species

V Schedule 2: Vulnerable species

EPBC Act Status:
E Endangered species
V Vulnerable species
Mi Migratory species
Please note: These records are based on information supplied by the Department of Environment, Climate Change and Water, and may contain errors or omissions.

An assessment of the likelihood of each of the species listed in **Table 4** occurring within the study area will be undertaken in **Section 6.1**.

3.1.3 Preliminary Determinations of Species Listings on the TSC Act

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

At the date of submission of this report there were 15 preliminary determinations of fauna species listed on the Department of Environment, Climate Change and Water (DECCW) website. Of the 15 species **Table 5** lists those species recorded in the study locality.

Table 5. Relevant Preliminary Determinations

Scientific Name	Common Name	Status (TSC)	Earliest / Latest Record	Number of Records
Circus assimilis	Spotted harrier	PD (V)	1983	1
Hieraaetus morphnoides	Little eagle	PD (V)	2000	1
Petroica phoenicea	Flame robin	PD (V)	2007	1
Petroica boodang	Scarlet robin	PD (V)	1986-2005	5
Daphoenositta chrysoptera	Varied sittella	PD (V)	2004-2006	6

Notes:
Status (TSC Act):
V Schedule 2: Vulnerable species
PD Preliminary Determination

An assessment of the likelihood of each of these species occurring within the investigation area will be undertaken in **Section 6.1**.

3.1.4 Endangered Fauna Populations

The Atlas of NSW Wildlife Database search identified two endangered fauna populations as occurring within a 10 kilometre radius of the investigation area. The two endangered populations are:

- Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area.
- Broad-toothed rat at Barrington Tops in the local government areas of Gloucester, Scone and Dungog.

An assessment of the current likelihood of each of these endangered fauna populations occurring within the investigation area will be undertaken in **Section 6.1**.

3.1.5 Critical Habitat

No areas of critical habitat were identified within the study locality following a search of the Atlas of NSW Wildlife Database.

3.1.6 EPBC Act Protected Matters Report

The EPBC Protected Matters Search Tool is accessed via the Australian Government Department of the Environment Water Heritage and the Arts (DEWHA) website and generates a list of matters protected under the EPBC Act that may occur in or nearby the search area. Potentially relevant matters are listed in **Table 6**.

Table 6. Summary of Potentially Relevant Matters under the EPBC Act 1999

Protected Matter	Potentially Relevant?	Details
Matters of National Environmental Significance		
Wetlands of International Significance (Ramsar sites)	Yes	One: Hunter Estuary Wetlands
Critical Habitats	Yes	None
Threatened Species – Fauna (Terrestrial Species only)	Yes	Twelve species: **Species or species habitat may occur within area according to EPBC modeling.** Australian painted snipe *Rostratula australis* (**V**) Spotted-tail quoll *Dasyurus maculatus maculatus* (SE mainland population) (**E**) Long-nosed potoroo *Potorous tridactylus tridactylus* (**V**) Brush-tailed rock-wallaby *Petrogale penicillata* (**V**) Large-eared pied bat *Chalinolobus dwyeri* (**V**) **Species or species habitat likely to occur within area according to EPBC modeling.** Stuttering frog *Mixophyes balbus* (**V**) Southern barred frog *Mixophyes iteratus* (**E**) Green and golden bell frog *Litoria aurea* (**V**) Swift parrot *Lathamus discolor* (**E**) Regent honeyeater *Xanthomyza Phrygia* (**E**) Hastings river mouse *Pseudomys oralis* (**E**) **Foraging, feeding or related behaviour known to occur within area.** Grey-headed flying-fox *Pteropus poliocephalus* (**V**)
Migratory Species (Terrestrial Species Only)	Yes	Thirteen species : **Species or species habitat likely to occur within area according to EPBC modeling.** White-bellied sea eagle *Haliaeetus leucogaster* (**Mi**) Regent honeyeater *Xanthomyza Phrygia* (**Mi, E**) **Species or species habitat may occur within area according to EPBC modeling.** White-throated needletail *Hirundapus caudacutus* (**Mi**) Rainbow bee-eater *Merops ornatus* (**Mi**) **Breeding may occur within area according to EPBC modeling.**

Protected Matter	Potentially Relevant?	Details
		Rufous fantail *Rhipidura rufifrons* (**Mi**) Black-faced monarch *Monarcha melanopsis* (**Mi**) **Breeding likely to occur within area according to EPBC modeling.** Spectacled monarch *Monarcha trivirgatus* (**Mi**) Satin flycatcher *Myiagra cyanoleuca* (**Mi**) Wetlands Species **Species or species habitat may occur within are according to EPBC modeling.** Cattle egret *Ardea ibis* (**Mi**) Great egret *Ardea alba* (**Mi**) Painted snipe *Rostratula benghalensis s. lat.* (**Mi**) Latham's snipe *Gallinago hardwickii* (**Mi**) Additional Migratory Marine Species **Species or species habitat may occur within are according to EPBC modeling.** Fork-tailed swift *Apus pacificus* (**Mi**) **Species or species habitat likely to occur within are according to EPBC modeling.** Bar-tailed godwit *Limosa lapponica* (**Mi**) Black-tailed godwit *Limosa limosa* (**Mi**) Broad-billed sandpiper *limicola falcinellus* (**Mi**) Common greenshank *Tringa nebularia* (**Mi**) Curlew sandpiper *Calidris ferruginea* (**Mi**) Eastern curlew *Numenius madagascariensis* (**Mi**) Lesser sand plover *Charadrius mongolus* (**Mi**) Marsh sandpiper *Tringa stagnatilis* (**Mi**) Pacific golden plover *pluvialis fulva* (**Mi**) Ruddy turnstone *Arenaria interpres* (**Mi**) Sharp-tailed sandpiper *Calidris acuminata* (**Mi**) Terek sandpiper *Xenus cinereus* **(Mi)** Whimbrel *Numenius phaeopus* (**Mi**)

Notes:
Status (EPBC Act):
E Endangered
V Vulnerable
Mi Migratory

An assessment of the likelihood of each of these species (excluding marine waders and shorebirds) occurring within the investigation area will be undertaken in **Section 6.1**.

3.2 Literature Review

3.2.1 Flora and Fauna Impact Assessment: Proposed Third Rail Track for the Minimbah Bank (Ecotone 2008)

In 2008, Ecotone carried out fauna investigations as part of a flora and fauna impact assessment for the Minimbah Bank (Stage One of Maitland to Whittingham) proposed third rail track. These investigations took place along and adjacent to the existing rail corridor between Whittingham Junction and Belford. The main fauna field survey work was undertaken in Spring 2008, supplementing a previous habitat assessment undertaken in October 2007.

A total of 80 fauna species were recorded within the Stage One study area, including three threatened species. The three species are:

- Brown treecreeper (vulnerable – TSC Act)
- Grey-crowned babbler (vulnerable – TSC Act)
- Grey-headed flying-fox (vulnerable – TSC Act and EPBC Act).

An assessment of the current likelihood of each of these threatened species occurring within the study area will be undertaken in **Section 6.1**.

3.2.2 Other Reports and Sources

A number of investigations have been undertaken by Ecotone Ecological Consultants in the general vicinity of the study area. A review of the reports for such investigations revealed that seven threatened fauna species were recorded within the study locality. The seven species are listed below:

- Speckled warbler (vulnerable – TSC Act)
- Grey-crowned babbler (vulnerable – TSC Act)
- Squirrel glider (vulnerable – TSC Act)
- Eastern freetail-bat (vulnerable – TSC Act)
- Little bentwing-bat (vulnerable – TSC Act)
- Eastern bentwing-bat (vulnerable – TSC Act)
- Greater broad-nosed bat (vulnerable – TSC Act)

In addition, based on familiarity of the local area, one additional species, the wanderer (monarch) butterfly (*Danaus plexippus*) has some potential to occur within the study locality. The wanderer butterfly is a migratory species under the EPBC Act.

An assessment of the current likelihood of each of the above species occurring within the study area will be undertaken in **Section 6.1**.

3.2.3 Waterway Analysis

The following six creek lines occur within the study area (**Figure 4**):

- Stony Creek
- Anvil Creek
- Sawyers Creek
- Black Creek (Figure 3c)
- Sweetwater Creek
- Jump Up Creek

East of approximate chainage 200.400km the study area drains into Stony Creek. Where it crosses the railway line at Farley, Stony Creek is a third order creek before draining into Wentworth Swamp south-east of the eastern end of the investigation area. Stony Creek drains into Wentworth Swamp which drains into Wallis Creek and the Hunter River.

In the Lochinvar area the investigation area drains: south-east into Wentworth Swamp via an un-named creek line; south into Wentworth Swamp via Bishops Creek; and north into the Hunter River via Lochinvar Creek. Lochinvar Creek is a first order stream where it crosses the railway line at Lochinvar.

Between Allandale and Branxton the study area is drained by Anvil Creek and Sawyers Creek. Sawyers Creek crosses the railway line at Greta as a third order stream before flowing into Anvil Creek north of the railway line. Anvil Creek flows into Black Creek, a tributary of the Hunter River.

Between Branxton and Pontana the study area is drained by Black Creek and Sweetwater Creek. Sweetwater Creek drains the Pontana area into Black Creek, which drains the western area of Branxton. Black Creek is a major creek line where it crosses the railway line. Black Creek flows into the Hunter River.

The Belford area is drained by Jump Up Creek which flows directly into the Hunter River. Jump Up Creek is a third order stream where it crosses the railway line.

A number of small to large farm dams occur in the study area. All farm dams appeared to be used for stock watering. Farm dam condition ranged from dams lacking any aquatic or bank-side vegetation to a small number of dams containing areas of reed beds and other aquatic vegetation.

3.2.4 Corridors

The study area does not form part of any officially mapped wildlife corridor, however remnant woodland areas in the investigation area provided habitat areas and potential movement paths for species between Kurri Kurri in the south-east and Singleton in the north-west. Additionally while there is no clear continuous corridor of remnant vegetation north-south through the local area and region, the remaining remnant woodland provides habitat areas and refuge sites for species during potential movements north-south through the study area.

The creek lines that drain the study area and their associated riparian vegetation also provide potential corridors for many species in the landscape.

3.2.5 Regional Context

For the purposes of this report the regional area is defined as a 100 kilometre radius around the investigation area. Regionally the investigation area is located in predominately agricultural land (containing scattered and isolated remnant woodland areas) between two very large remnant woodland/forest areas. Barrington Tops National Park and Mount Royal National Park and associated remnant areas occur approximately 50 kilometres the north, and Yengo National Park and Wollemi National Park and associated remnant areas occur approximately 30 kilometres to the south. The investigation area is positioned approximately centrally within a 50 to 80 kilometre wide gap in an otherwise more-or-less continuous remnant woodland and forest vegetation along the east coast of New South Wales that stretches from Brisbane in the north to the Victorian boarder in the south.

3.3 Summary of Local Threatened and/or Migratory Species

From the above literature review and database searches the following 60 threatened and/or migratory species have previously been identified or are predicted to occur within the study locality:

- Stuttering frog
- Southern barred frog
- Green and golden bell frog
- Littlejohn's tree frog
- Blue-billed duck
- Black-necked stork
- Black bittern
- Cattle egret
- Great egret
- Square-tailed kite
- Spotted harrier (preliminary determination)
- White-bellied sea-eagle
- Little eagle (preliminary determination)
- Australian painted snipe
- Latham's snipe
- Glossy black-cockatoo
- Gang-gang cockatoo
- Little lorikeet
- Turquoise parrot
- Swift parrot
- Masked owl
- Powerful owl
- Barking owl
- White-throated needletail
- Fork-tailed swift
- Rainbow bee-eater
- Brown treecreeper
- Speckled warbler
- Black-chinned honeyeater
- Regent honeyeater
- Painted honeyeater
- Hooded robin
- Flame robin (preliminary determination)
- Scarlet robin (preliminary determination)
- Grey-crowned babbler
- Varied sittella (preliminary determination)
- Rufous fantail
- Spectacled monarch
- Black-faced monarch
- Satin flycatcher
- Diamond firetail
- Spotted-tailed quoll
- Brush-tailed phascogale
- Koala
- Yellow-bellied glider
- Squirrel glider
- Long-nosed potoroo
- Brush-tailed rock-wallaby
- Grey-headed flying-fox
- Yellow-bellied sheath-tail bat
- Eastern freetail-bat
- Little bentwing-bat
- Eastern bentwing-bat
- Large-eared pied bat
- Eastern false pipistrelle
- Large-footed myotis
- Greater broad-nosed bat
- Eastern cave bat
- Hastings River mouse
- Wanderer (monarch) butterfly

An assessment of the current likelihood of each of these threatened and/or migratory species occurring within the investigation area will be undertaken in **Section 6.1**.

4. METHODOLOGY

Three recent studies associated with the Project are relevant to this terrestrial fauna assessment report. Three terrestrial fauna impact assessments were undertaken for three Review of Environmental Factor (REF) areas within the investigation area and are associated with the construction of overpasses for this Project. The three REF study areas were Hermitage Road near Belford (Ecotone 2009a), Nelson Street at Greta (Ecotone 2009b) and Station Lane near Lochinvar (Ecotone 2009c). Each REF area was visited on two separate days during August 2009.

Assessment of the entire 30 kilometre investigation area of the Project was undertaken between 1 and 12 October 2009.At each of the three REF areas a habitat assessment and opportunistic fauna survey was undertaken. Due to the relatively small areas of the three REF areas individual habitat trees were mapped within the REF boundaries. No targeted fauna survey was undertaken within the three REF areas.

The level of survey and methods undertaken along the 30 kilometre investigation area were designed using the Department of Environment and Conservation (now Department of Environment, Climate Change and Water [DECCW]) threatened biodiversity survey and assessment guidelines (DEC, 2004). The methods employed were tailored to the habitat types and site characteristics of the investigation area. Due to the long linear nature of the investigation area, intensive trapping survey was not undertaken and was considered unlikely to add additional threatened species not detected by non-trapping techniques. A targeted fauna survey (non-trapping) and habitat assessment was selected as the most appropriate and feasible method to identify the species occurring within the investigation area.

4.1 Survey Site Selection

To identify the key habitat areas along the investigation area a drive through of the entire 30 kilometre area was undertaken and combined with regional aerial photograph interpretation. Key habitat areas are those areas that provide the highest quality habitat areas within the area of study.

Aerial photograph interpretation identified seven regionally important woodland or riparian areas along the investigation area (**Table 7**).

Table 7. Regionally Important Habitat Areas Along the Investigation Area

	General Area	Habitat Type	Chainage (kilometres)
1	Rutherford	Open woodland	197.500 to 199.100
2	Anvil Creek, Allandale to Greta	Riparian woodland	207.000 to 210.800
3	Greta to Branxton	Open woodland	211.500 to 214.600
4	Branxton to Belford	Open woodland	215.100 to 216.900
5	Black Creek, Belford	Riparian woodland	217.200 to 217.300
6	Belford	Open woodland	220.200 to 222.100
7	Belford	Farm dams	221.300 to 221.600

A drive through of the entire 30 kilometre investigation area (within the rail corridor) on 29 September confirmed areas 2 to 7 in **Table 7** as key habitat areas for fauna species. Area 1 at Rutherford was found to be predominately cleared and no longer a large open woodland remnant. All other habitat areas along the investigation area were smaller representatives of the open

woodland and riparian woodland habitat areas identified as key habitats. Additionally open woodland areas 3, 4 and 6 (in **Table 7**) contained mature trees with hollows that were typically absent from the smaller woodland areas along the investigation area.

Access restrictions prevented the sampling of habitat areas 4 and 5 (**Table 7**) and left habitat areas 2, 3 and 6 as potential survey sites. Areas 2, 3 and 6 all occurred approximately within the western half of the investigation area and another habitat area was sought in the eastern half of the investigation area to provide geographical coverage of the investigation area. The nearest and largest woodland remnant close to the open woodland at Rutherford that was found to be predominately cleared (Area 1, **Table 7**), occurred between approximate chainages 200.800 and 201.300 km. Five targeted fauna survey sites were thus identified (**Table 8** and **Figure 3**).

Table 8. Fauna Survey Sites

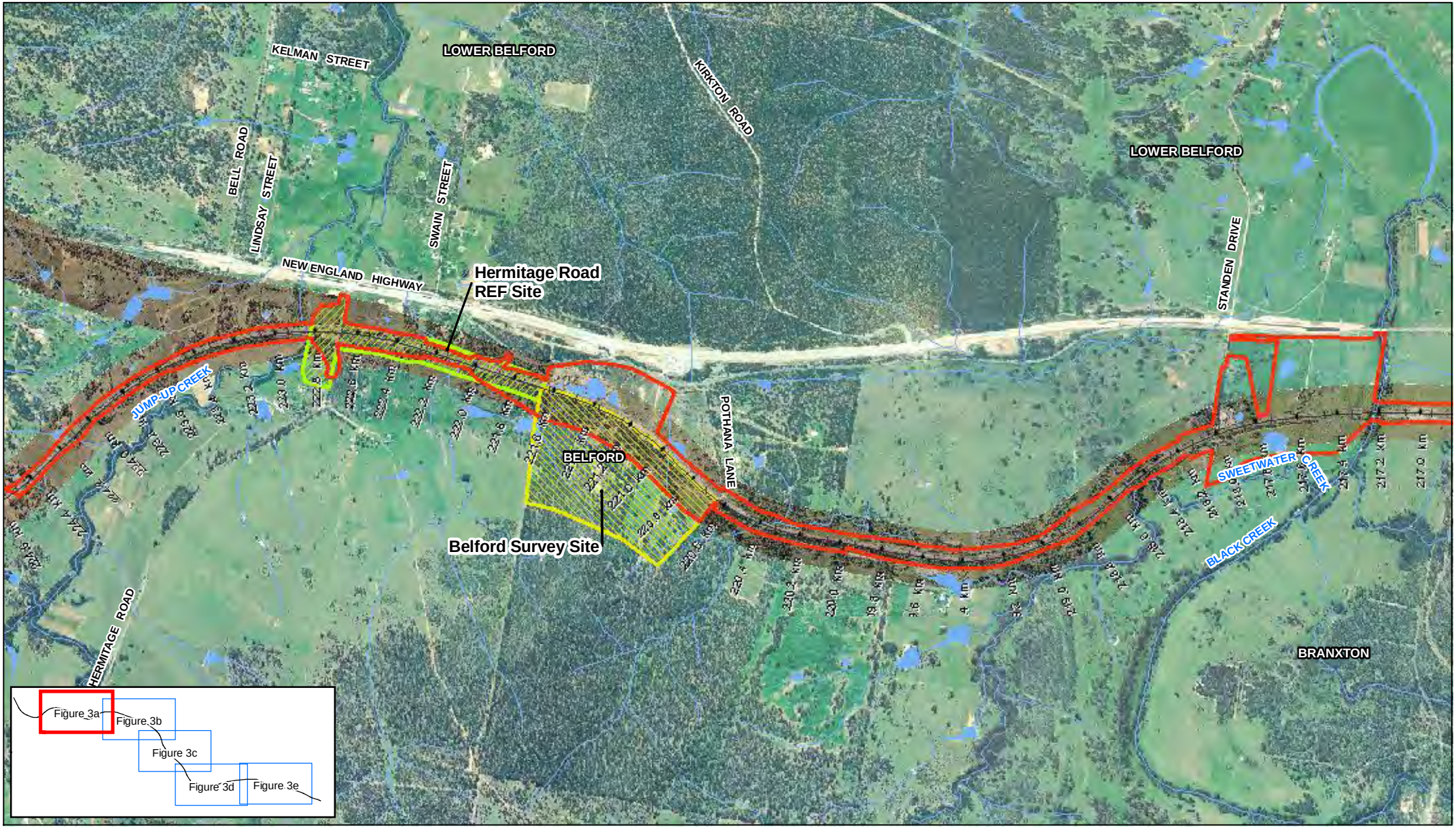
	General Area	Habitat Type	Chainage (kilometres)
1	Lochinvar	Open woodland	200.800 to 201.300
2	Anvil Creek, Allandale to Greta	Riparian woodland	207.000 to 210.800
3	Greta	Open woodland	211.500 to 214.600
4	Belford	Open woodland	220.200 to 222.100
5	Belford	Farm dams	221.300 to 221.600

4.2 Survey Effort

Targeted fauna survey was undertaken at the five sites identified in **Table 8**. The Lochinvar, Greta and Belford sites were visited on two days and a single night between 1 and 12 September 2009. The Anvil Creek site was visited on two separate days and the Belford farm dams sites was visited on a single night. Surveys included bird transects, diurnal and nocturnal reptile and amphibian searches, spotlighting, nocturnal owl and mammal call playback, and Anabat micro-bat echolocation survey.

4.2.1 Bird Surveys

Each bird survey comprised one person hour of survey (**Table 9**) completed by two observers for 30 minutes. Birds were identified using a 15-45×60mm spotting scope or 8×40 mm binoculars and from characteristic calls. Two bird surveys (each on a different day) were completed at each of the open and riparian woodland survey sites (**Figure 4**). Bird sightings were also recorded opportunistically during all other survey activities. Bird surveys were not undertaken at the Belford farm dam site as the site was selected purely for nocturnal reptile and amphibian searches.



1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area
- REF Site
- Survey Site

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

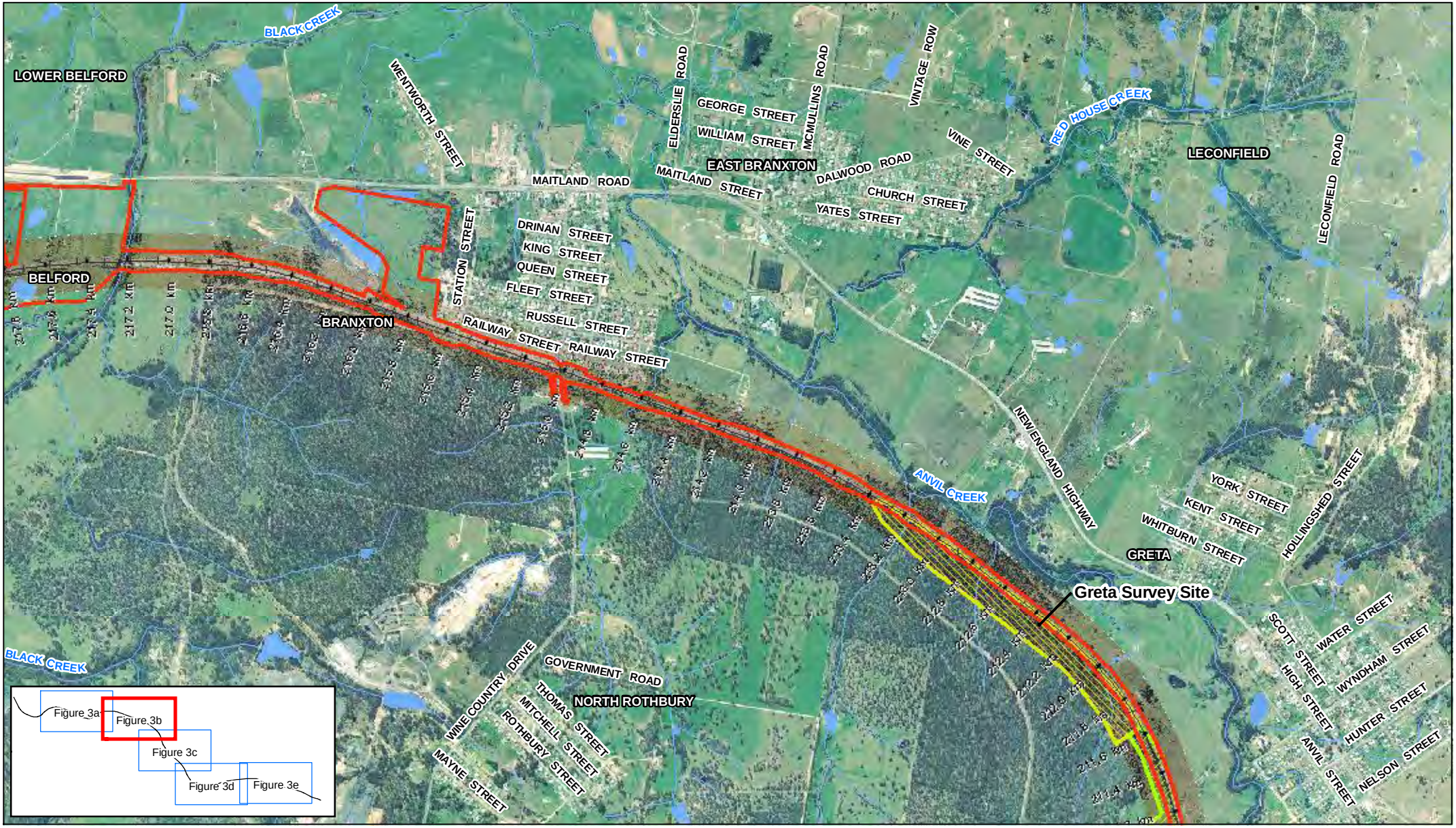
Survey Sites

Figure 3a

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_SurveySites_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004; Ecotone Ecological Consultants Pty Ltd: Fauna Survey Site Data - October 2009. Created by: fmackay, tmorton



1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area
- REF Site
- Survey Site

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

Survey Sites

Figure 3b

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_SurveySites_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004; Ecotone Ecological Consultants Pty Ltd: Fauna Survey Site Data - October 2009. Created by: fmackay, tmorton

1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area
- REF Site
- Survey Site

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

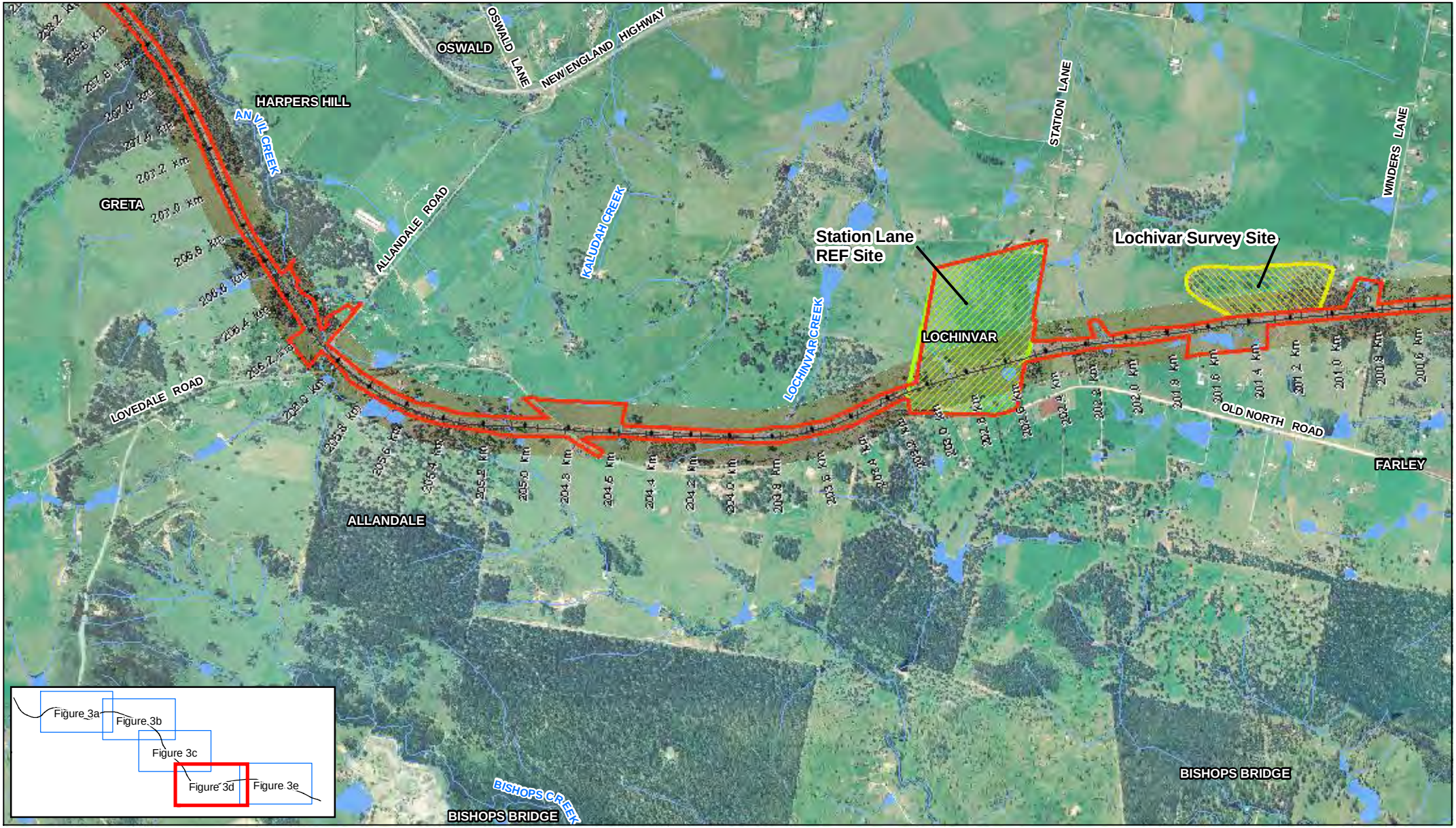
Survey Sites

Figure 3c

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_SurveySites_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004; Ecotone Ecological Consultants Pty Ltd: Fauna Survey Site Data - October 2009. Created by: fmackay, tmorton



1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area
- REF Site
- Survey Site

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

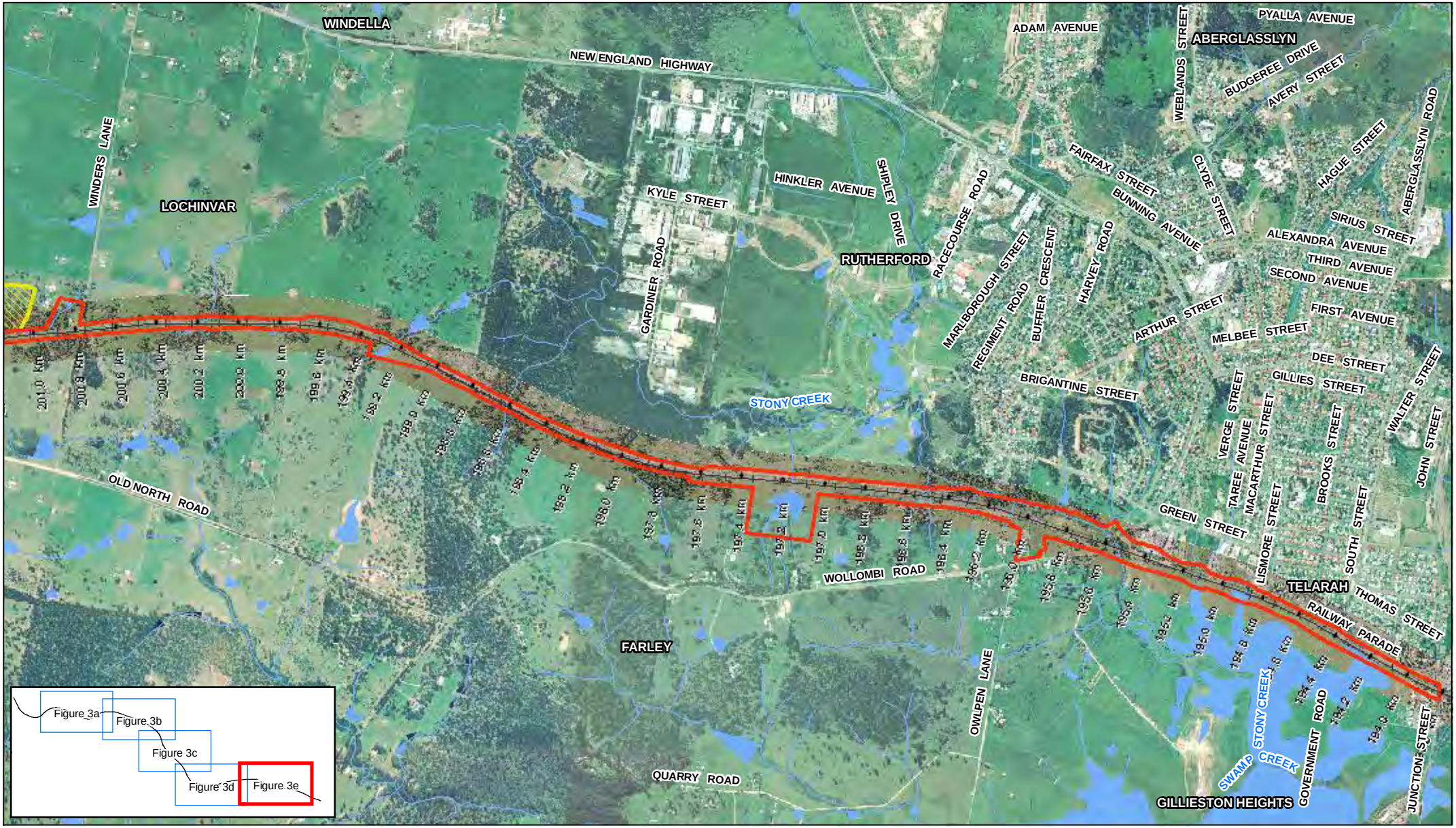
Survey Sites

Figure 3d

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_SurveySites_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004; Ecotone Ecological Consultants Pty Ltd: Fauna Survey Site Data - October 2009. Created by: fmackay, tmorton



1:25,000 (at A4)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Existing Railway
- Watercourse
- Investigation Area
- Watercourse Area
- REF Site
- Survey Site

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

Survey Sites

Figure 3e

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_SurveySites_20091203_A.mxd

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

Data Source: Geoscience Australia: Topography - 2002; Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Department of Lands: Cadastre - 2004; Ecotone Ecological Consultants Pty Ltd: Fauna Survey Site Data - October 2009. Created by: fmackay, tmorton

4.2.2 Diurnal Reptile and Amphibian Searches

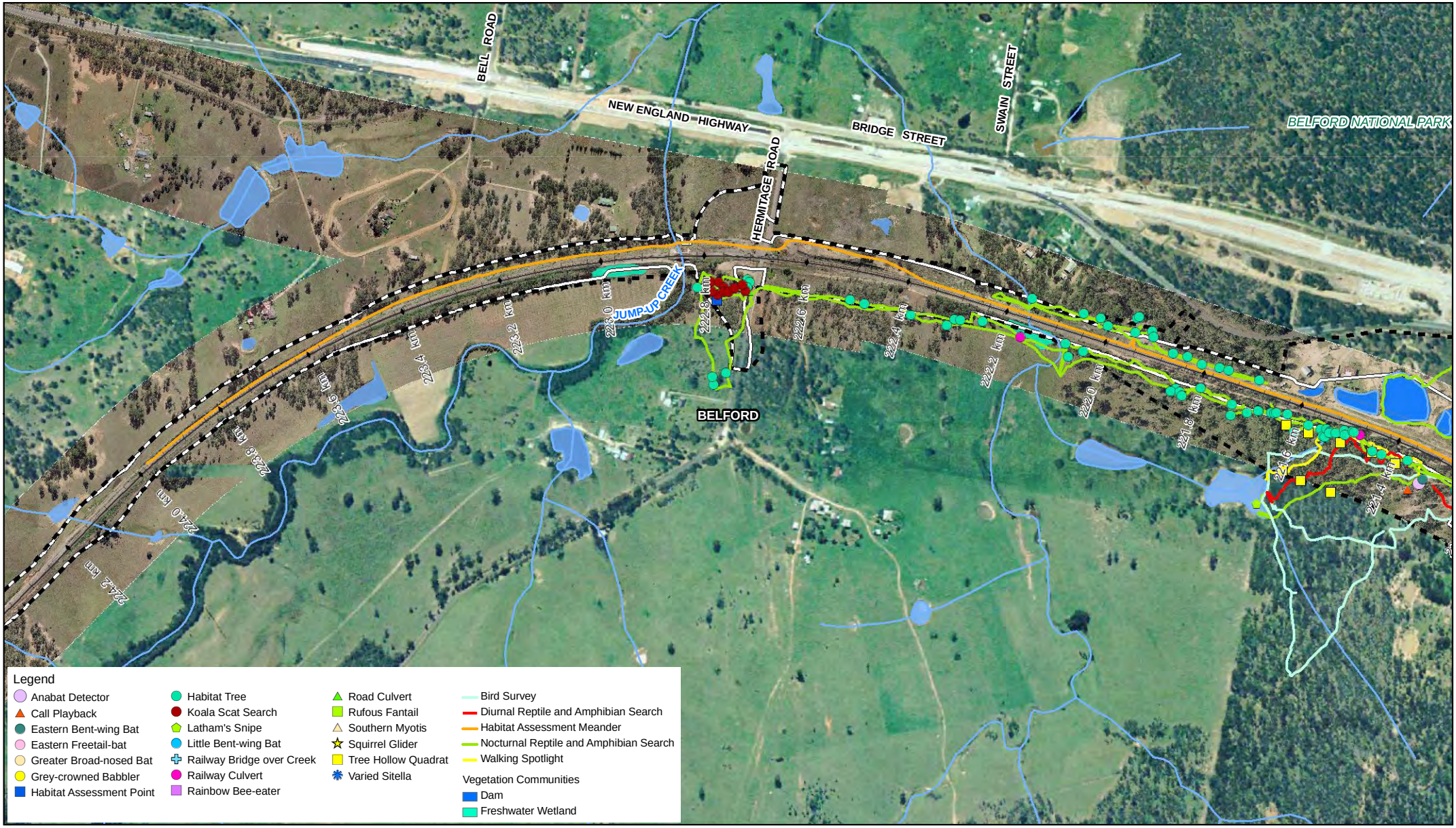
Diurnal reptile and amphibian searches were undertaken during late morning and mid to late afternoon. Each survey comprised one person hour of survey (**Table 9**) completed by two observers for 30 minutes. Two diurnal reptile and amphibian searches were completed at each of the open and riparian woodland survey sites (on different days) (**Figure 4**). Habitat features investigated during diurnal reptile and amphibian searches included fallen timber, rocks, tree trunks, leaf litter and grassland areas. Diurnal reptile and amphibian searches surveys were not undertaken at the Belford farm dam site as the site was selected purely for nocturnal reptile and amphibian searches.

4.2.3 Nocturnal Reptile and Amphibian Searches

Nocturnal reptile and amphibian searches were undertaken during early evening. Nocturnal reptile and amphibian searches were restricted to terrestrial habitats at the Lochinvar site due to a lack of water sources (**Table 8**). All other nocturnal reptile and amphibian searches were undertaken at and around farm dams. A single nocturnal reptile and amphibian search was completed at each of the open and riparian woodland survey sites (**Figure 4**) (**Table 9**). Each terrestrial survey comprised one person hour of survey completed by two observers. Nocturnal reptile and amphibian searches were undertaken with hand-held torches and head lamps. Nocturnal reptile and amphibian searches were undertaken at four survey sites. Nocturnal fieldwork was not undertaken at the Anvil Creek site due to a lack of suitable habitat for the green and golden bell frog, a target species during nocturnal reptile and amphibian species. Survey effort was concentrated at sites that contained with farm dams with potential habitat for the green and golden bell frog.

4.2.4 Walking Spotlight Survey

Walking spotlight surveys were undertaken between dusk and 11 pm. Each survey comprised a single person hour of survey (two observers). Walking spotlight surveys were undertaken with hand held Lightforce spotlights (35 Watt). One walking spotlight survey was completed at each of the open and riparian woodland survey sites (**Figure 4**) (**Table 9**). Walking spotlight surveys were not undertaken at the Belford farm dam site. Nocturnal fieldwork was not undertaken at the Anvil Creek site due to a lack of suitable habitat for arboreal mammal species.



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

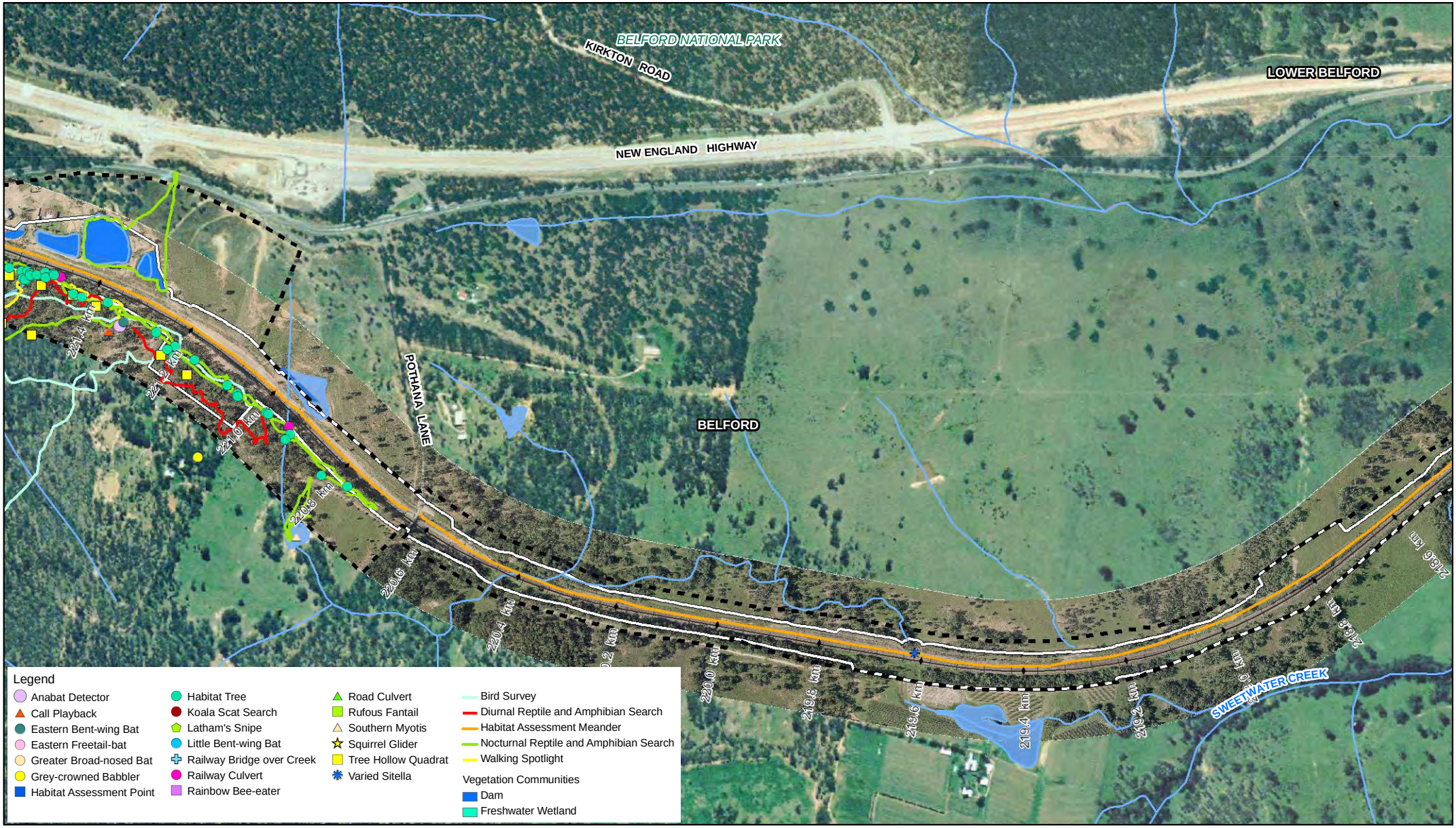
Job Number 22-14471
Revision A
Date MAY 2010

Survey Effort and Threatened Species Locations

Figure 4a

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd
Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com.au W www.ghd.com.au

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

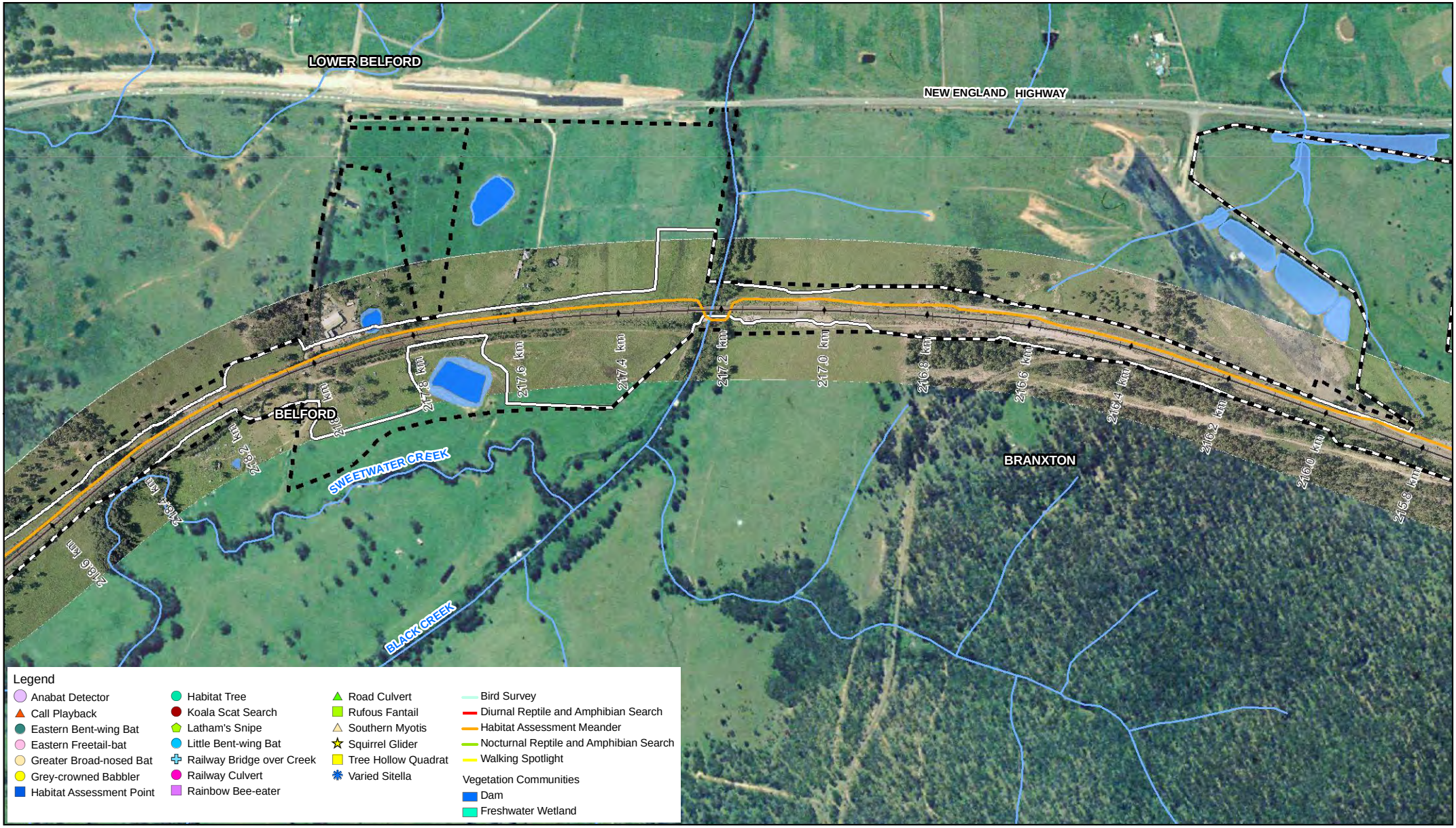
Survey Effort and Threatened Species Locations

Figure 4b

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

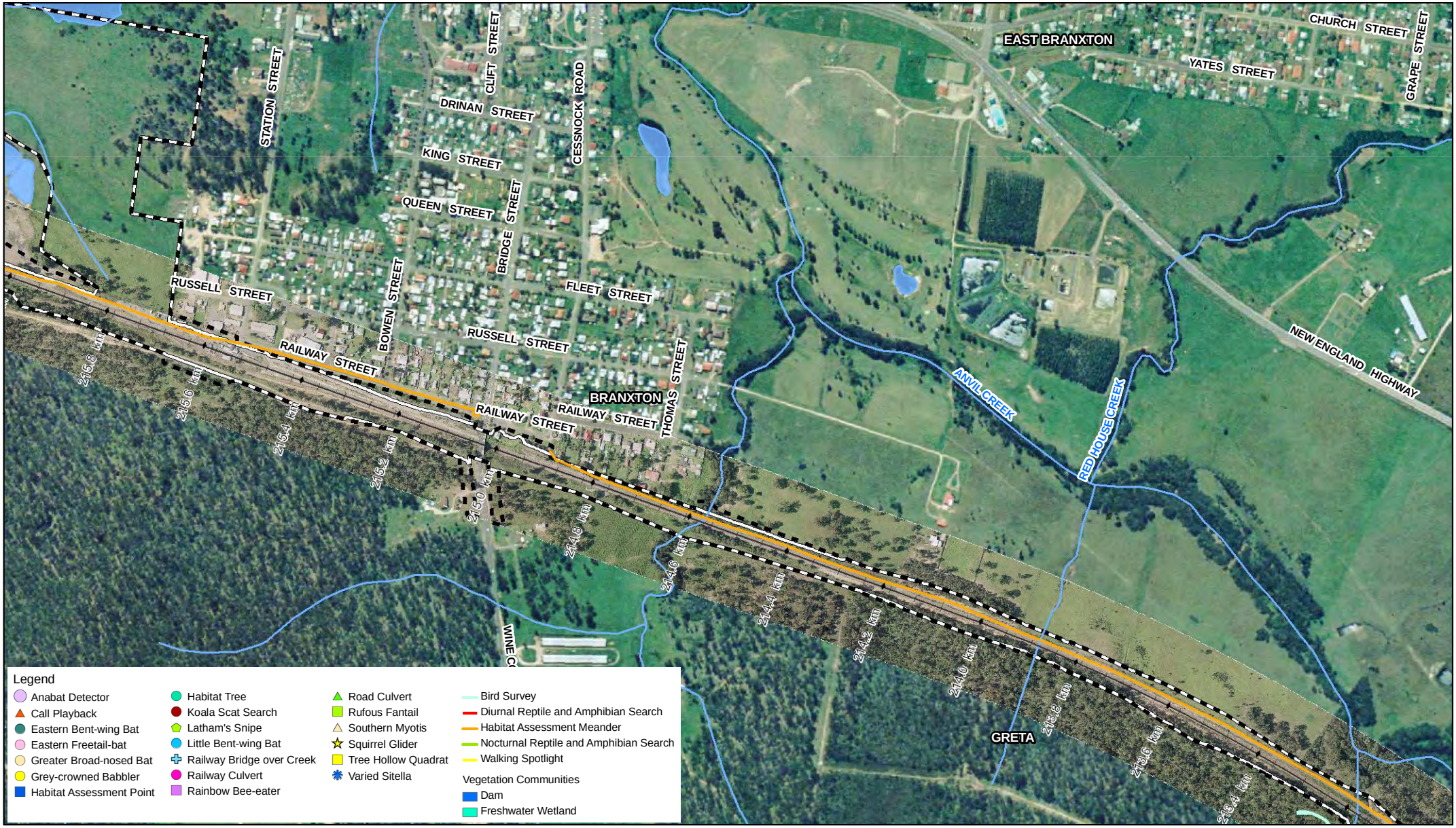
Survey Effort and Threatened Species Locations

Figure 4c

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

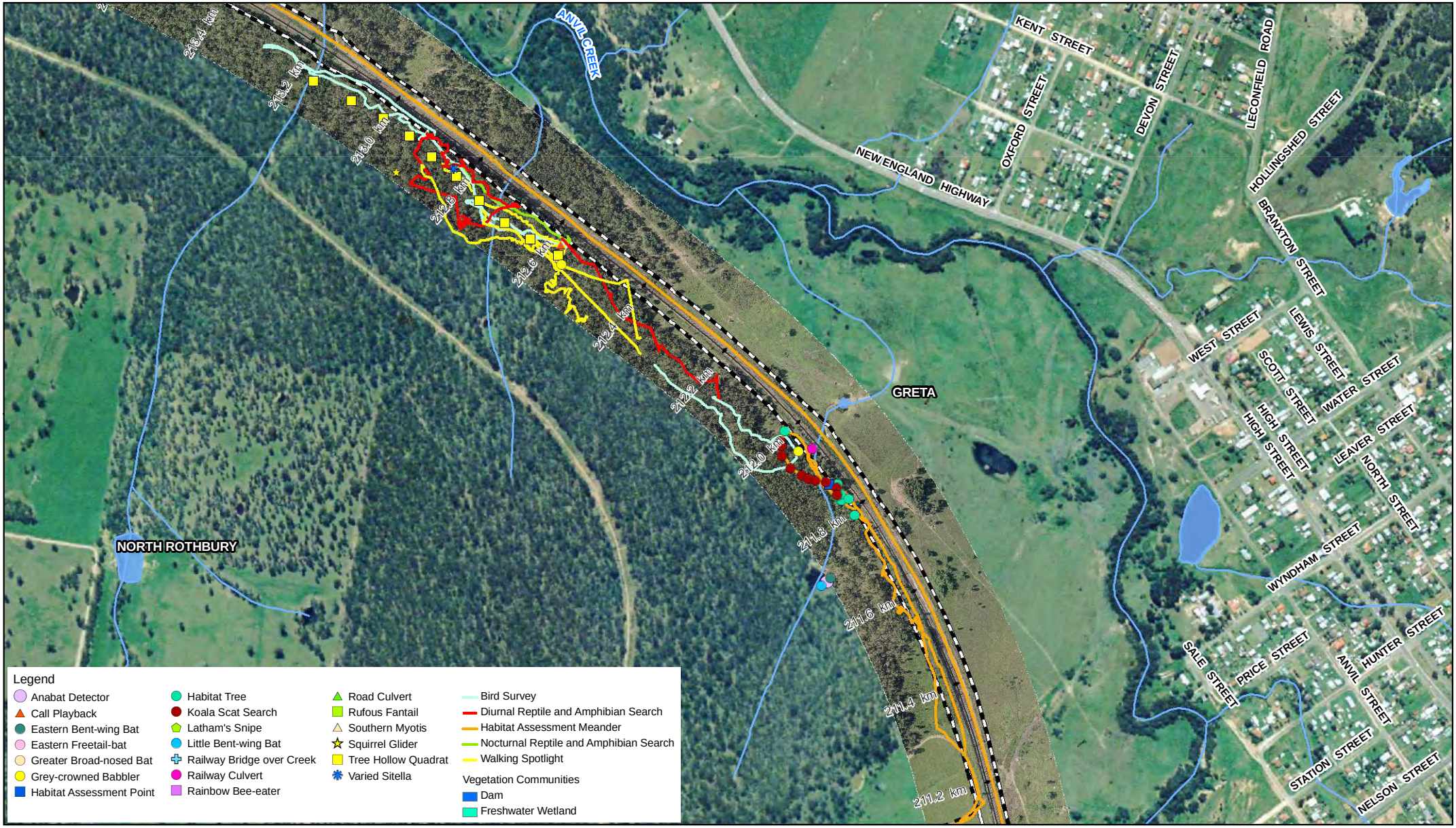
Survey Effort and Threatened Species Locations

Figure 4d

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

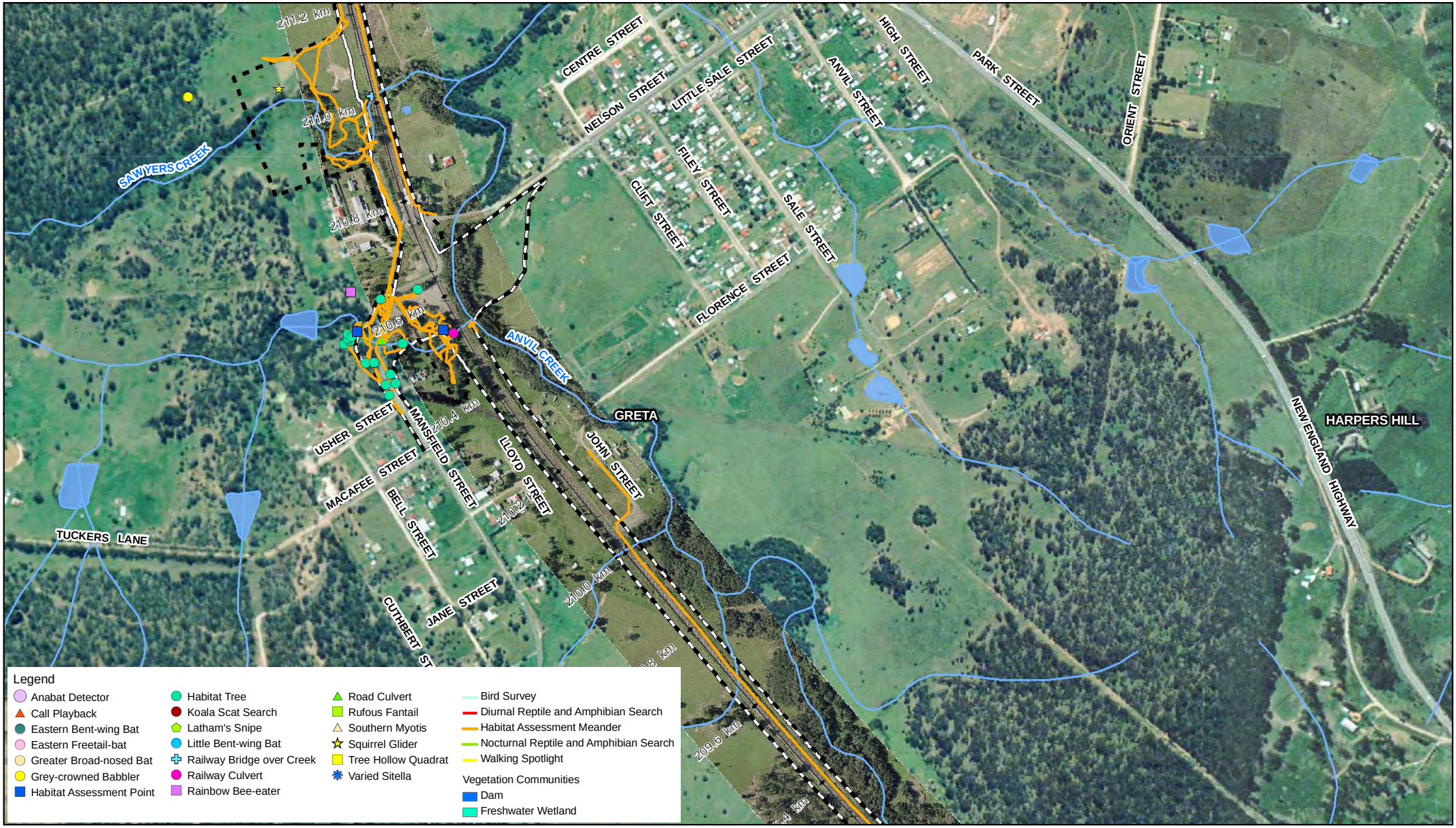
Survey Effort and Threatened Species Locations

Figure 4e

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

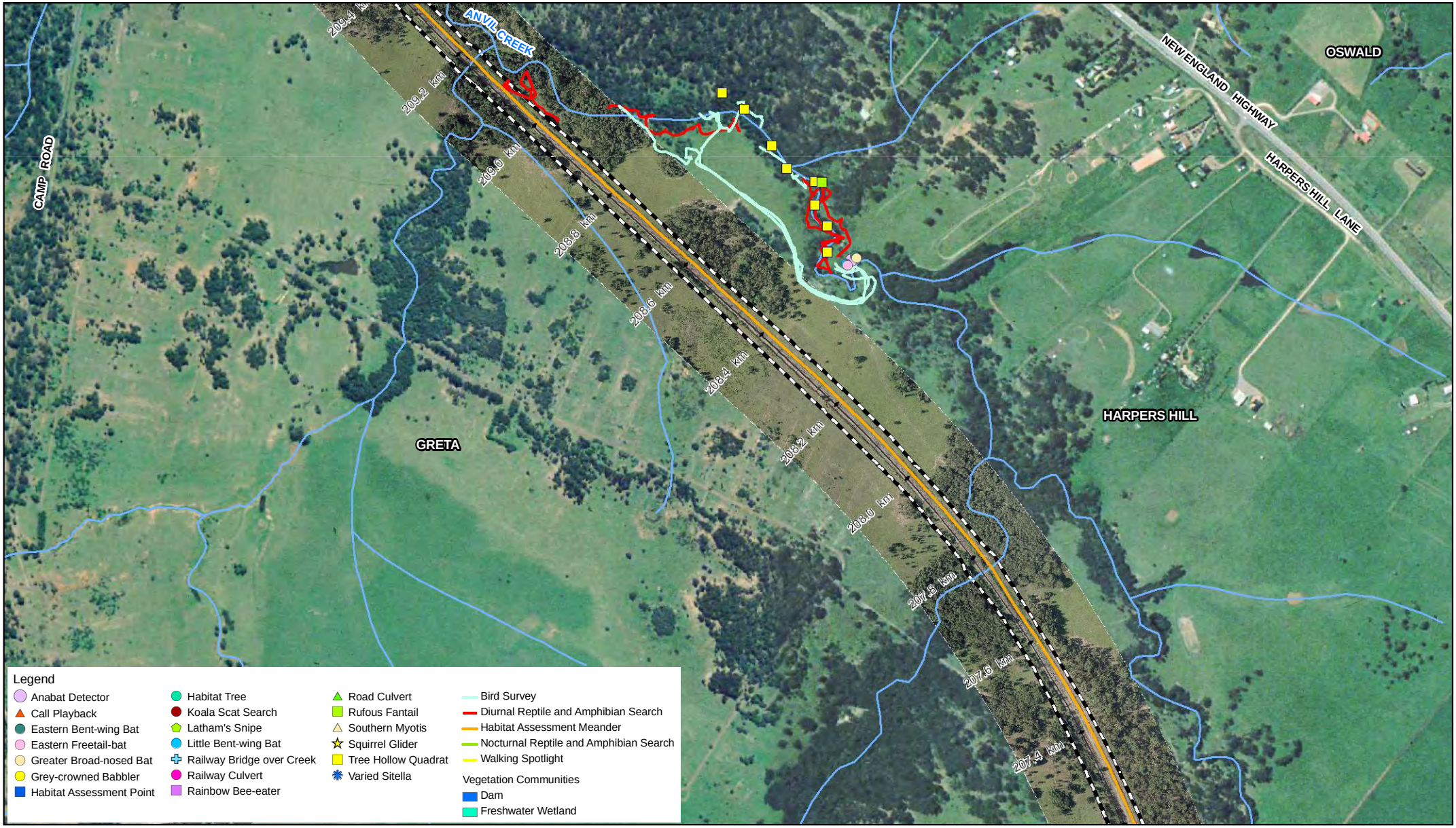
Survey Effort and Threatened Species Locations

Figure 4f

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

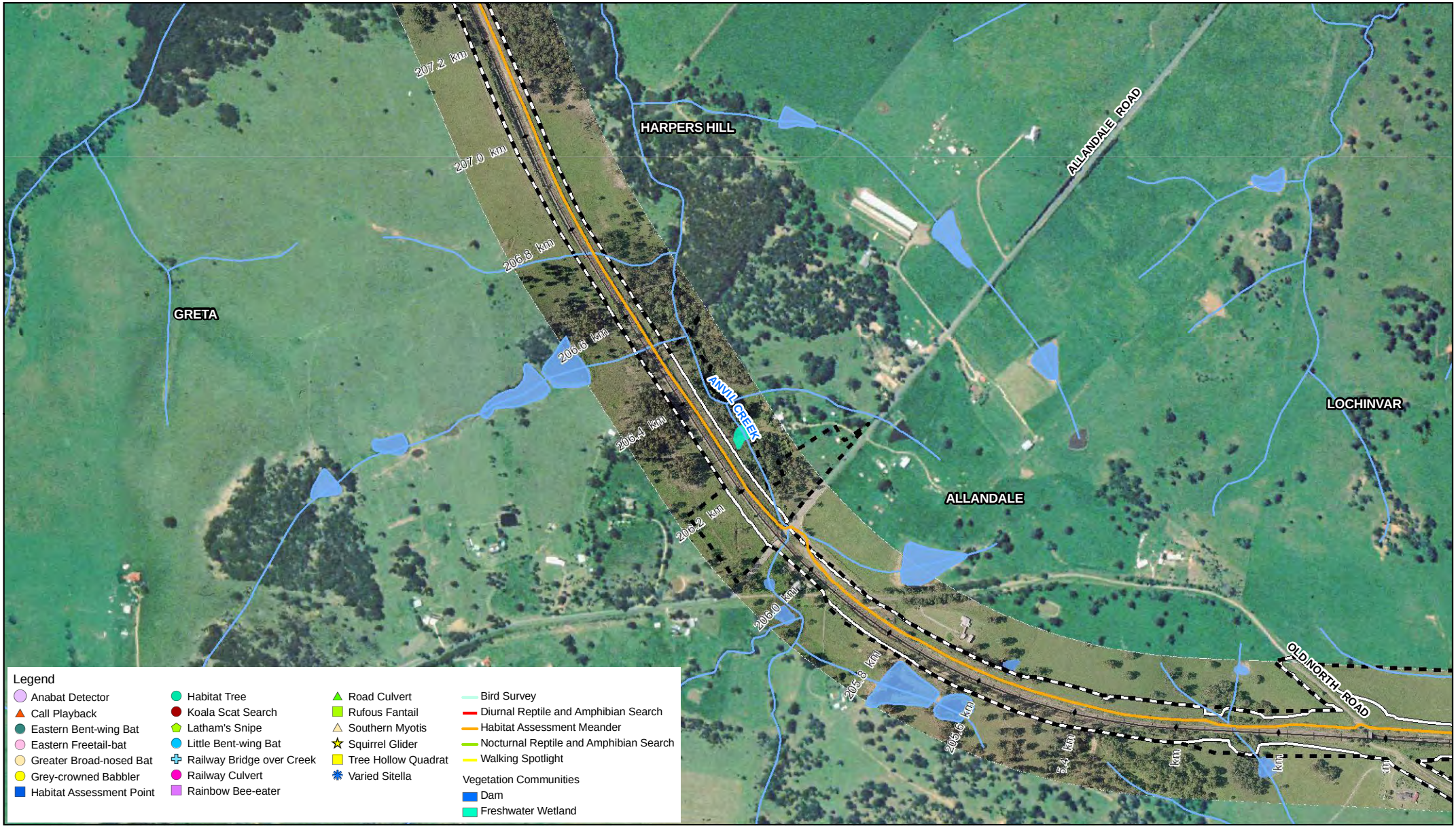
Survey Effort and Threatened Species Locations

Figure 4g

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

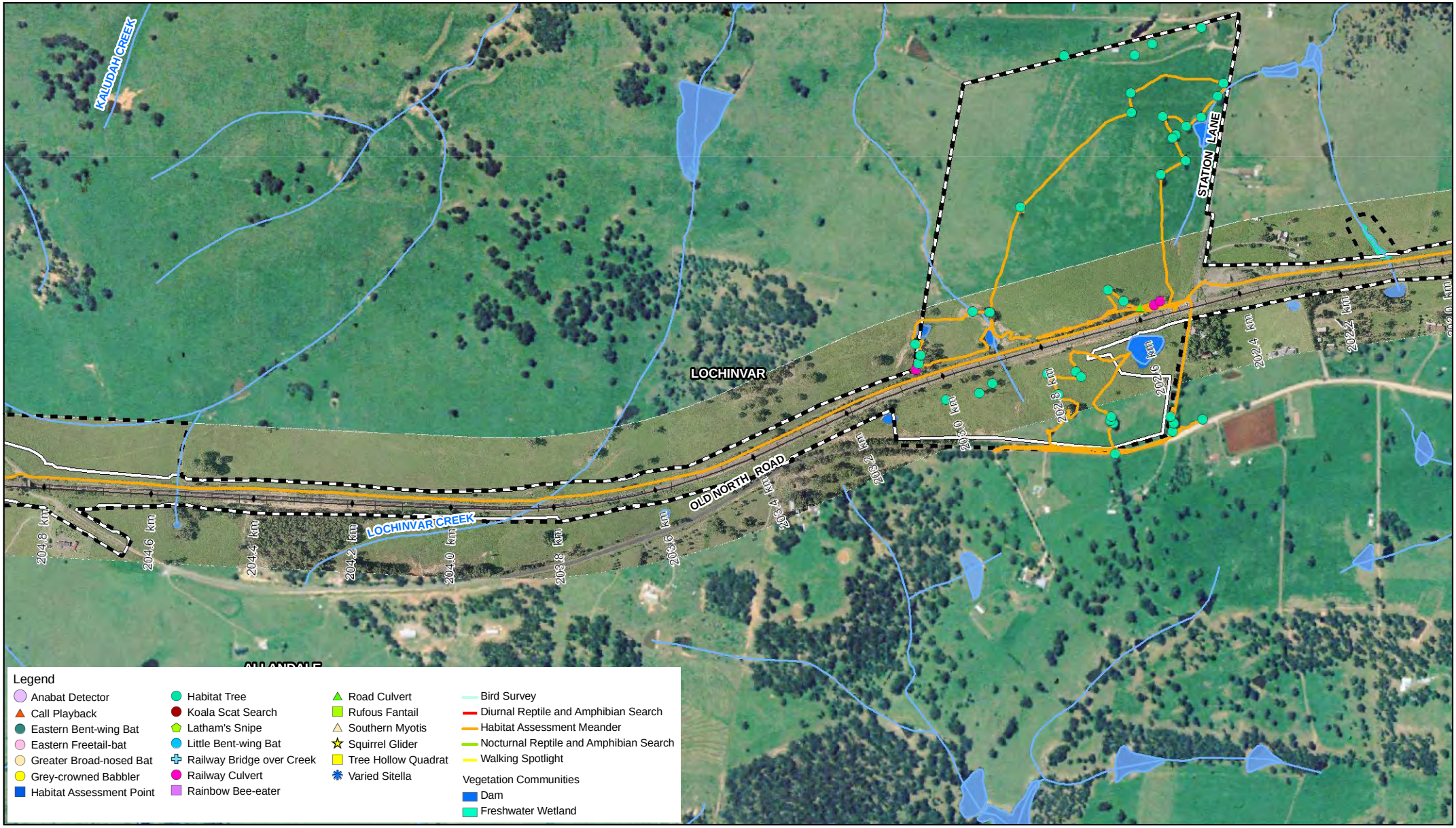
Survey Effort and Threatened Species Locations

Figure 4h

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

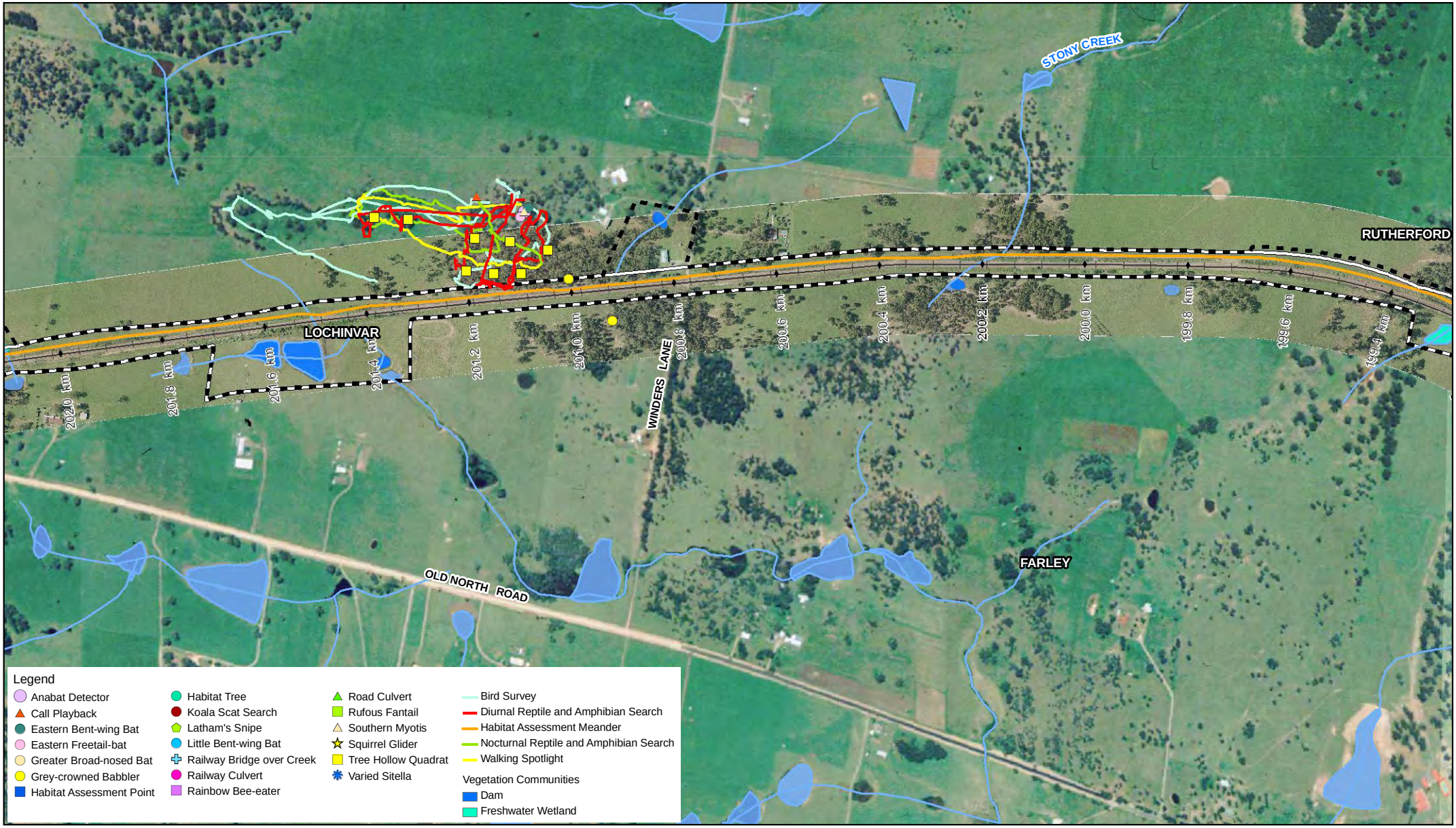
Survey Effort and Threatened Species Locations

Figure 4i

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

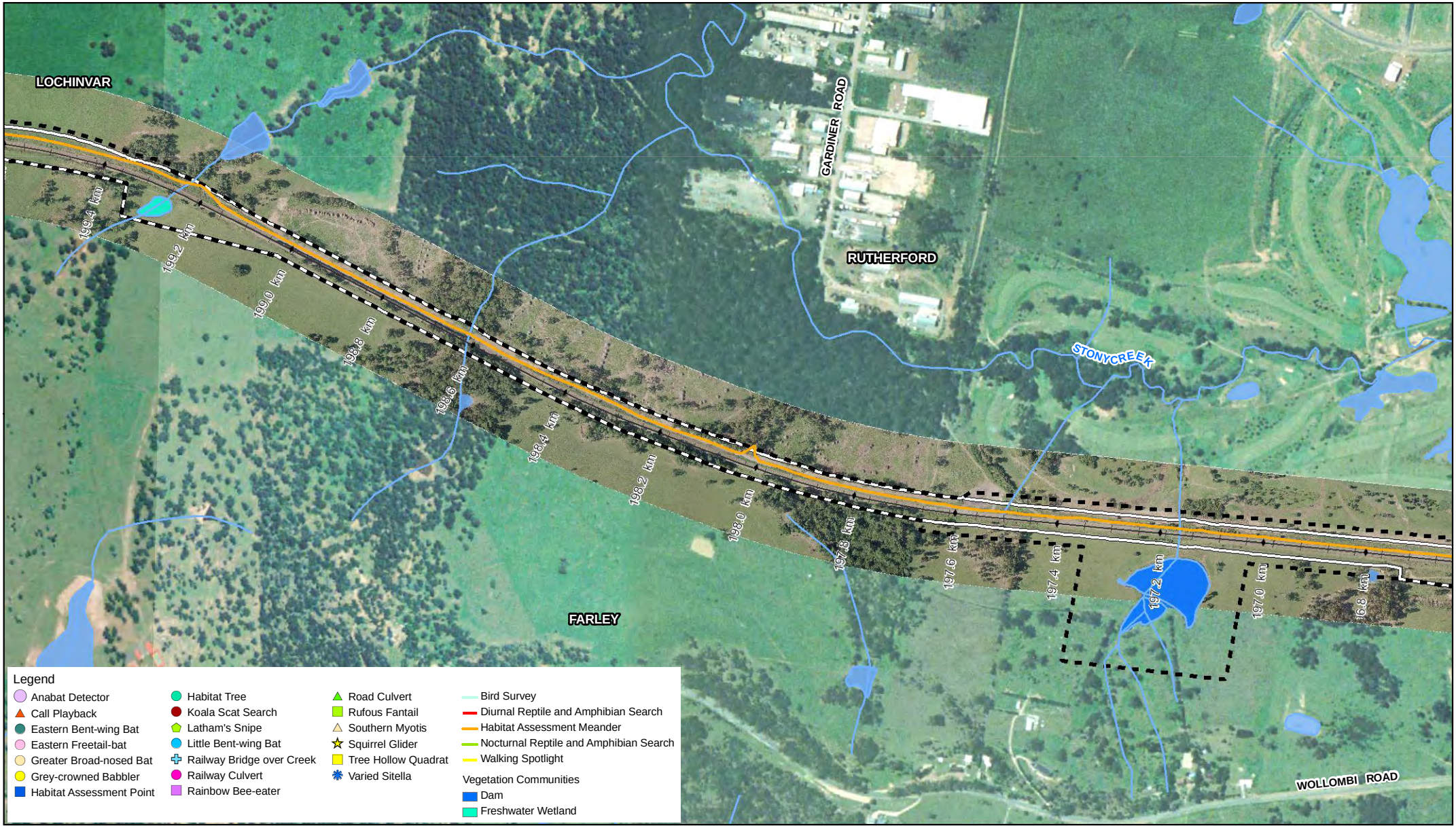
Survey Effort and Threatened Species Locations

Figure 4j

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

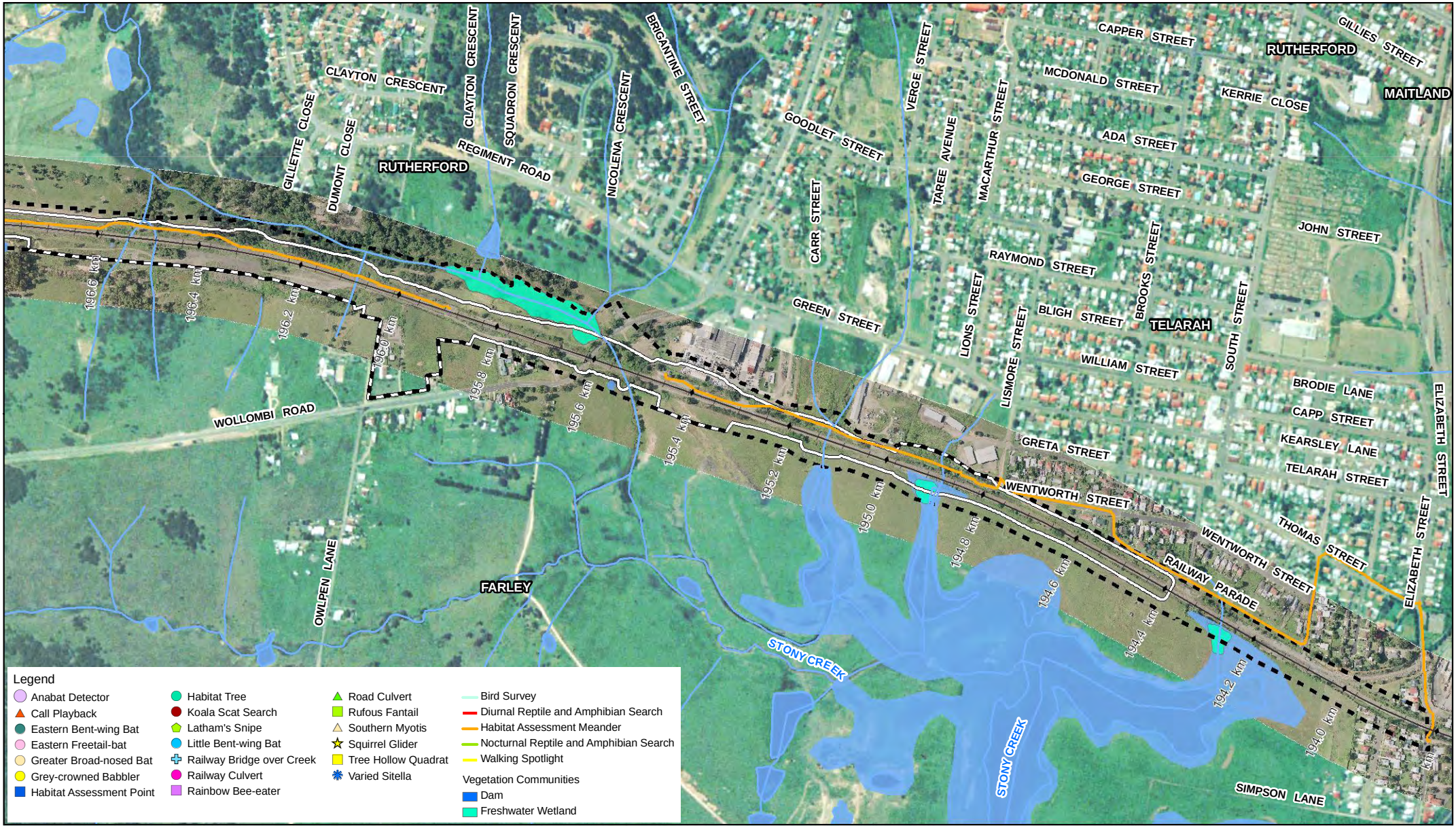
Survey Effort and Threatened Species Locations

Figure 4k

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton



1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966
Grid: Integrated Survey Grid, Zone 56-1

N

LEGEND

- Investigation Area
- Existing Railway
- Construction Impact Zone
- Watercourse
- Watercourse Area

Hunter ALLIANCE

Maitland to Minimbah Third Track
Terrestrial Fauna Impact Assessment

Job Number 22-14471
Revision A
Date MAY 2010

Survey Effort and Threatened Species Locations

Figure 4l

G:\22\14471\GIS\Maps\Deliverables\EA\Ecology (fauna) Specialist Report\FSR_Threat_Species_20091203_A.mxd

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

Data Source: Department of Lands: Aerial - 2005; Fugro: Aerial - 2008; Ecotone Ecological Consultants Pty Ltd: Fauna Mapping Data - 2009. Created by: fmackay, tmorton

4.2.5 Nocturnal Call Playback

Call playback for owl and nocturnal mammal species was undertaken at dusk at each of the open and riparian woodland survey sites (**Figure 4**) (**Table 9**). The nocturnal calls of the following species were played using a TOA megaphone (model ER-409, 15W rated output):

- Bush stone-curlew
- Squirrel glider
- Koala
- Masked owl
- Barking owl
- Powerful owl

After listening for five minutes during dusk, the calls of the above species were broadcast for approximately four minutes each and were separated by a listening period of four minutes. At the end of each four minute listening period a brief spotlighting scan was made of surrounding trees for owls that may have approached silently. The calls were broadcast in the order shown above. At the completion of the final species call a listening period of five minutes was undertaken and followed by a final scan of the surrounding trees. Call playback surveys were not undertaken at the Belford farm dam site as the site was selected purely for nocturnal reptile and amphibian searches. Nocturnal fieldwork was not undertaken at the Anvil Creek site due to a lack of suitable habitat for arboreal mammal and owl species.

4.2.6 Koala Scat Searches

Koala scat searches were undertaken at the Greta and Belford woodland sites (**Figure 4**). A one metre radius around each tree trunk was searched for scats. Searches included the moving of shrubs and grasses and searching below the top level of litter. Trees were selected non-randomly from the available trees and included forest red gum (*Eucalyptus tereticornis*) a tree species listed on Schedule 2 of SEPP 44. All trees were greater than 200 millimetres in diameter at breast height (DBH). Large trees were selected over smaller trees.

4.2.7 Micro-bat Survey

Anabat micro-bat echolocation detectors and recorders (hereafter referred to as 'Anabat detectors') were used to record the echolocation calls of micro-bats (**Figure 4**). Anabat detectors (in weather proof cases) were positioned at approximately 4 m high on bare tree trunks and at a slope of 15 degrees above the horizontal. All Anabat detectors began recording at dusk and recorded echolocation calls throughout the night, automatically switching off at sunrise. Anabat detectors were set for two nights at the Belford and Greta sites and for three nights at the Lochinvar and Anvil Creek sites (**Table 9**). Anabat files were analysed in-house by Ecotone team members with Anabat file analysis experience. Micro-bat survey was not undertaken at the Belford farm dam site as the site was selected purely for nocturnal reptile and amphibian searches.

Table 9. Survey Effort

Survey Method	Site 1	Site 2	Site 3	Site 4	Site 5	Totals
	Person Hours					
Bird Surveys	2	2	2	2	0	8
Diurnal Reptile and Amphibian Surveys	2	2	2	2	0	8
Nocturnal Reptile and Amphibian Surveys	1	0	1	1	1	4
Walking Spotlight Surveys	1	0	1	1	0	3
	Call Playback Sessions					
Owl and Mammal Call Playback	1	0	1	1	0	3
	All Night Anabat Surveys					
Anabat Survey	3	3	2	2	0	10

4.2.8 Tree Hollow Provision

At each of the four survey sites the level of tree hollow provision was quantified. Ten 20 by 20 metre quadrats were paced 50 metres apart from a non-randomly selected starting position within the woodland areas. Where possible the ten quadrats were positioned in a straight line, otherwise they were orientated in more than one straight line within the available woodland habitat. Within each quadrat the number of each size-class of hollows was counted, as was the total number of trees containing hollows.

4.2.9 Habitat Assessment

Habitat assessment was undertaken at each of the survey sites. Habitat features investigated during habitat assessments included:

- Topographic features (such as slope, aspect and landscape position).
- Dominant vegetation community composition, structure and condition at all strata levels (from ground to canopy cover).
- Ground cover type and percentage cover.
- Form, quality and location of water sources.
- The presence and number of habitat trees.
- The presence, condition and construction of culverts.
- The presence and condition of water sources (particularly farm dams).
- The presence, number and condition of unique habitat features (such as caves, crevices, loose tree bark, rocks on rock and mistletoe).
- The level of disturbance.

4.3 Adequacy of Survey Effort

Where possible the level of survey effort complied with the current best practise level of survey effort, the DEC (2004) Draft Threatened Biodiversity Survey and Assessment: Guidelines for development and activities, and the DECC (2009) Threatened Biodiversity Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians (**Table 10**). However given the linear nature of the investigation area not all recommended survey effort could be undertaken.

Table 10. Application of Recommended Fauna Field Survey Techniques1.

Field Survey Techniques Applied	Suggested Minimum Effort	Applied (✓)	Effort Achieved & Commentary
Amphibians			
Green and golden bell frog - Combination of tadpole surveys, call surveys (this species has a distinctive call) and active searching both during the day and night. Small areas of habitat (less than 0.3 hectares) should be surveyed for a minimum of one hour on three separate occasions during the species' activity period. Larger areas, which may include whole wetlands and lagoon margins, are more difficult to survey and require a minimum of three separate four-hourly searches during the species' activity period. This species has been known to respond to call playback. Survey August to February.			At the Lochinvar, Greta, Belford and Belford farm dam sites all farm dams were searched on a single night. The complete margin of each dam was surveyed.
Littlejohn's tree frog - Combination of tadpole surveys, call surveys and nocturnal searches in suitable habitat and weather conditions. Minimum of one 200-metre transect per water body repeated on a minimum of two separate nights. If using a dip net to survey for tadpoles, both a nocturnal and diurnal survey are recommended. Survey July to April.			At the Lochinvar, Greta, Belford and Belford farm dam sites all farm dams were searched on a single night. The complete margin of each dam was surveyed.
Stuttering frog - Combination of tadpole surveys, call surveys and nocturnal searches along flowing streams in suitable weather conditions. Minimum of one 200-metre transect per water body repeated on a minimum of two separate nights. This species may respond to call playback or a good imitation of their call. Survey September to April.			At the Lochinvar, Greta, Belford and Belford farm dam sites all farm dams were searched on a single night. The complete margin of each dam was surveyed.
Southern barred frog - Combination of tadpole surveys, call surveys and nocturnal searches along flowing streams in suitable weather conditions. Minimum of one 200-metre transect per stream repeated on a minimum of two separate nights. This species may respond to call playback or a good imitation of their call. Survey September to March.			At the Lochinvar, Greta, Belford and Belford farm dam sites all farm dams were searched on a single night. The complete margin of each dam was surveyed.
Reptiles			
Habitat search	30 minute search on two separate days targeting specific habitat.	✓	**Exceeded minimum effort**. Double the suggested minimum effort was achieved at the Belford, Greta, Lochinvar and Anvil Creek sites. One person hour of diurnal reptile and amphibian survey was completed on each of two days.
Pitfall traps	24 trap nights, preferably using six traps for a minimum of four consecutive nights.		Trapping was not a feasible option.
Spotlighting	30 – Minute search on two separate nights targeting specific habitat.	✓	**Exceeded minimum effort**. One person hour of nocturnal reptile and amphibian survey was completed on each of two nights at the Belford, Greta and Lochinvar sites.
Diurnal Birds			
Area search	Species time curve approach should be utilized.		Two one person hour bird surveys were completed over two separate days at each of the Greta, Belford, Lochinvar and Anvil Creek sites.
Wetland census	A one-hour census at dawn or dusk, for each identified wetland.		Sampled opportunistically.
Water source census	A 20 minute census at dawn or dusk, for each identified water source.		Sampled opportunistically.

Field Survey Techniques Applied	Suggested Minimum Effort	Applied (✓)	Effort Achieved & Commentary
Nocturnal Birds			
Call playback	Sites should be separated by 800m to 1km and each site must have the playback session repeated as follows: • At least 5 visits per site, on different nights are required for the powerful owl, barking owl and the grass owl. • At least 6 visits per site for the sooty owl, and 8 visits per site for the masked owl are required. Sites for bush stone-curlew surveys should be 2-4km apart and conducted during the breeding season.		A single call playback session was completed at the Greta, Belford and Lochinvar sites.
Day habitat search	Search habitat for pellets and likely hollows. Flushing of bush stone-curlews by walking through potential habitat.	✓	Undertaken opportunistically.
Stag watching	Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.		Suitable sized hollows existed but none were more suitable that others. As such stag watching was not undertaken due to the extremely low chance of selecting a potential roost hollow. Spotlighting and call playback also sampled nocturnal birds.
Spotlighting	Spotlighting for plains wanderer and bush stone-curlew by foot or from a vehicle driven in first gear.	✓	One person hour of nocturnal walking spotlight searches was completed at the Greta, Belford and Lochinvar sites.
Mammals (excluding bats)			
Small Elliot traps (Small mammals)	100 trap nights over 3-4 consecutive nights.		Trapping was not a feasible option.
Large Elliot traps (Medium to large animals)	100 trap nights over 3-4 consecutive nights.		Trapping was not a feasible option.
Arboreal Elliot traps (Arboreal animals)	24 trap nights over 3-4 consecutive nights.		Trapping was not a feasible option.
Wire cage traps (Medium to large animals)	24 trap nights over 3-4 consecutive nights.		Trapping was not a feasible option.
Pitfall traps with drift nets (Small mammals)	24 trap nights over 3-4 consecutive nights.		Trapping was not a feasible option.
Hair tubes (Small to medium animals)	10 large and 10 small tubes in pairs for at least 4 days and 4 nights.		Trapping was not a feasible option.
Arboreal hair tubes (Arboreal animals)	3 tubes in each of 10 habitat tree up to 100 hectares of stratification unit, for at least 4 days and 4 nights.		Trapping was not a feasible option.
Spotlighting on foot (Arboreal and terrestrial mammals)	2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights.		One person hour of walking spotlighting on a single night was completed at each of the open woodland sites.

Field Survey Techniques Applied	Suggested Minimum Effort	Applied (✓)	Effort Achieved & Commentary
Spotlighting from vehicle (Arboreal and terrestrial mammals)	2 x 1km of track at maximum speed of 5km per hour, up to 200 hectares of stratification unit, on 2 separate nights.		Access tracks were not located appropriately for vehicle spotlighting.
Sand plots (Mostly medium to large terrestrial mammals)	6 soil plots for 4 nights.		Sand plots were not undertaken. Spotlighting surveys and opportunistic sightings sampled terrestrial mammals.
Call playback (Gliders, koalas)	2 sites per stratification unit up to 200 hectares, plus an additional site per 100 hectares above 200 hectares. Each playback site must have the session conducted twice on separate nights.		A single call playback session was completed at the Greta, Belford and Lochinvar sites.
Stag-watching (Gliders and possums)	Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.		Suitable sized hollows existed but none were more suitable than others. As such stag watching was not undertaken due to the extremely low chance of selecting a potential den hollow. Spotlighting and call playback also sampled arboreal mammals.
Search for scats and signs (All mammals)	30 minutes searching each relevant habitat, including trees for scratch marks.		Undertaken opportunistically during all other survey activities.
Track search (Mostly medium to large terrestrial mammals)	1km of track search with emphasis where substrate is soft.		Undertaken opportunistically during all other survey activities.
Collection of predator scats (All mammals)	Opportunistic collection of predators scats for hair analysis.		Undertaken opportunistically during all other survey activities.
Bats			
Harp trapping	Four trap nights over two consecutive nights (with one trap placed outside the flyways for one night)		Trapping was not undertaken as the level of Anabat survey undertaken was considered sufficient to sample the micro-bat species present.
Ultrasonic call recording	Two sound activated recording devices utilized for the entire night (a minimum of four hours) starting at dusk for two nights.	✓	**Minimum effort exceeded**. Two to three entire night Anabat surveys were completed at the A single call playback session was completed at the Greta, Belford, Lochinvar and Anvil Creek sites.
Mist netting	For targeted survey: one trap set for at least two hours duration starting at dusk, for two nights.		Not undertaken due to the requirement for a specific licence. All night Anabat surveys sampled bat species.
Trip line	For targeted survey of water bodies; at least two hours duration starting at dusk, for two nights.		Not undertaken as Anabat surveys were considered an adequate level of survey effort.
Spotlighting and transect walking	For targeted survey near likely food sources: 2 x 1 hour spotlighting on two separate nights.	✓	One person hour of walking spotlighting was completed at each open woodland site.
Day habitat search	Search for bat excreta at or near potential habitats.	✓	Undertaken opportunistically.

1- Adapted from (DEC, 2004).

As a precautionary measure, all threatened species with potential to occur with the investigation area have been assessed in **Section 6.1**.

4.4 Fauna Survey Limitations

The following limitations may have reduced the detectability of threatened or non-threatened fauna species at the investigation area:

4.4.1 Weather Conditions

The weather conditions during the surveys may have affected the detectability of some species (for example some frog species require warm thunderstorm nights to be detectable – for example the green and golden bell frog). The weather during the survey was characterised by cool nights and mild to hot days (**Table 11**). The weather was too cool for some amphibian and many reptile species.

Table 11. Weather Conditions During Field Surveys[1].

Date	Rain	Wind[2]	Cloud Cover[2]	Min. Temp.	Max. Temp
04.08.2009[3]	None	9 km/hr W	7/8	3.9	19.3
10.08.2009[3]	None	2 km/hr NE	7//7	0.0	20.3
13.08.2009[3]	None	Calm	0/8	2.3	21.8
24.08.2009[3]	None	17 km/hr W	2/8	9.9	29.3
28.08.2009[3]	None	Calm	0/8	2.8	26.5
01.10.2009[4]	None	4 km/hr WNW	8/8	3.8	33.2
06.10.2009[4]	1.0 mm	17 km/hr SW	6/8	8.3	24.1
08.10.2009[4]	None	19 km/hr S	3/8	9.5	19.5
09.10.2009[4]	None	9 km/hr S	8/8	9.5	17.0
12.10.2009[4]	5.2 mm	2 km/hr WSW	7/8	7.5	25.5

1 – Weather conditions were recorded by the Bureau of Meteorology's Maitland weather station (http://www.bom.gov.au/index.shtml).
2 – Recorded at 3 p.m.
3 – Habitat assessment and opportunistic fauna survey of REF areas within the 30 kilometre investigation area.
4 – Targeted fauna survey of key habitat areas.

4.4.2 Survey Timing

The field survey was undertaken during August and October, or late winter and mid spring. Late spring and summer migrant species were not detectable, as were many species that are active during warmer months of the year but undetectable during cold months (such as many reptile and amphibian species).As a precautionary measure to counter the potential limitation of survey timing, all threatened species with potential to occur within the study area have been addressed in this report (**Section 6.1**).

4.4.3 Level of Survey Effort

Not all survey methods at the preferred level of survey effort could be undertaken and as a result some species may not have been detected. As a precautionary measure to counter the reduced survey effort, all threatened species with potential to occur within the study area have been addressed in this report (**Section 6.1**).

4.4.4 Access Restrictions

Access restrictions prevented access to some parts of the investigation area. Species occurring solely within those areas were not recorded. As a precautionary measure to counter the restricted access to some areas, all threatened species with potential to occur within the study area have been assessed in this report (**Section 6.1**).

5. RESULTS

A total of 126 fauna species were opportunistically recorded within the study area, comprising seven frogs, eight reptiles, 88 birds, 22 mammals and one invertebrate species (**Appendix 1**). Seven threatened, one preliminarily listed fauna species on the TSC Act and four migratory species on the EPBC Act were recorded (**Table 12**). Four introduced species were recorded (**Appendix 1**).

Table 12. Threatened and/or Migratory Species Identified During Field Surveys

Scientific Name	Common Name
Vulnerable Species – TSC Act	
Pomatostomus temporalis	Grey-crowned babbler
Petaurus norfolcensis	Squirrel glider
Mormopterus norfolkensis	Eastern freetail-bat
Miniopterus schreibersii oceanensis	Eastern bent-wing bat
Miniopterus australis	Little bent-wing bat
Myotis macropus	Large-footed myotis
Scoteanax rueppellii	Greater broad-nosed bat
Preliminary Listed Vulnerable Species – TSC Act	
Daphoenositta chrysoptera	Varied sitella
Migratory Species – EPBC Act	
Gallinago hardwickii	Latham's snipe
Merops ornatus	Rainbow bee-eater
Rhipidura rufifrons	Rufous fantail
Danaus plexipus	Wanderer (monarch) butterfly

5.1 Fauna Habitat Features

Five main types of habitat were recorded within the investigation area. They were:

- Remnant woodland vegetation.
- Open pasture paddocks.
- Creek lines and associated riparian vegetation.
- Farm dams.
- Drainage culverts and bridges.

5.1.1 Remnant Woodland Vegetation

Remnant woodland occurred at a large number of locations along the investigation area. Open woodland was the dominant vegetation type at the Lochinvar, Greta and Belford survey sites.

5.1.1.1 Lochinvar Survey Site

The vegetation of the Lochinvar survey site comprised a grey box – spotted gum woodland habitat area (Hunter 8 Alliance 2009). The canopy was dominated by a stand of regenerating (100 – 200 mm DBH) and middle aged trees (201 – 400 mm DBH) reaching 20 metres in height (**Plate A**). Mature (400 – 600 mm DBH) trees also occurred but at lower frequencies within the canopy. No old growth trees (600+ mm DBH) trees were recorded. Saplings (< 100 mm diameter stems) were rare ranging between one and five metres in height. Stags (dead standing trees) were uncommon, reaching up to 15 metres in height. The canopies of individual trees were typically affected by slight levels of dieback and mistletoe infestation during the time of the field surveys and appeared to be free of insect attack. The dominant canopy species were Spotted Gum (*Corymbia maculata)* and Grey Box (*Eucalyptus moluccana).*

Naturally formed tree stumps (> 100 mm diameter; not cut by humans) were scattered and typically hollow in nature. No shrub layer was present. Ground cover was dominated by litter cover. Areas of soil and grass cover also occurred. Log cover (fallen trees and branches) was moderate and dominated by small (< 100 mm diameter) and medium (101 – 300 mm diameter) sized logs. Log cover was predominately comprised of solid (with and without bark) logs, however some hollow logs were also recorded.

Species specific habitat areas of loose tree bark were recorded. No areas of rock on rock, rock overhangs, caves or litter at the base of trees were recorded. Forest red gum (*Eucalyptus. tereticornis*) one of the ten koala food tree species listed on Schedule Two of SEPP 44 was present at a density greater than 15 percent of the canopy cover. No potential food trees of the glossy-black cockatoo were recorded.

The Lochinvar survey site was disturbed by a few cut stumps and moderate grazing pressure from cattle and kangaroos. No evidence of a past fire history, erosion, rubbish dumping or weed infestation were recorded. Study areas were typically characterised by gentle (0-5 degrees) slopes and a south-westerly aspect.

5.1.1.2 Belford Survey Site

The vegetation of the Belford survey site comprised areas of grey box – spotted gum – ironbark open woodland and areas of red gum open woodland (Hunter 8 Alliance 2009). The canopy was dominated by a stand of regenerating (100 – 200 mm DBH) trees reaching approximately 16 metres in height. Middle aged (201 – 400 mm DBH) and mature (400 – 600 mm DBH) trees also occurred but at lower frequencies within the canopy (**Plate B**). No old growth trees (600+ mm DBH) trees were recorded. Saplings (< 100 mm diameter stems) were common ranging between one and six metres in height and comprising between 25 and 50 percent cover. Stags (dead standing trees) were scattered and typically comprised of solid trees without bark. The canopies of individual trees were typically affected by slight levels of dieback, moderate levels of mistletoe and appeared to be free of significant insect attack during the time of the field survey. The dominant canopy species were Narrow-leaved Ironbark *(Eucalyptus crebra)*, Spotted Gum (*Corymbia maculata)* and Grey Box (*Eucalyptus moluccana).*

A scattered shrub layer ranged between one and 1.5 metres in height and was comprised of a small number of species. Ground cover was dominated by litter and grass cover. Areas of soil also occurred. Log cover (fallen trees and branches) was scattered and dominated by small (< 100 mm diameter) and medium (101 – 300 mm diameter) logs. Log cover was predominately comprised of solid (with and without bark) logs, however some hollow and rotten (collapse if stepped on) logs were also recorded.

Species specific habitat areas of litter at the base of trees were recorded while no areas of rock on rock, rock overhangs, caves or significant areas of loose tree bark were recorded. Forest red gum, one of the ten koala food tree species listed on Schedule Two of SEPP 44 was recorded at an greater than 15 percent of the canopy cover in parts of the Belford survey site. No potential food trees of the glossy-black cockatoo were recorded.

The Belford survey site was disturbed by slight grazing pressure from horses, kangaroos and wallabies, and small areas of sheet erosion. No evidence of a past fire history, rubbish dumping or weed infestation were recorded. The Belford survey site was typically characterised by gently (0-5 degrees) sloping terrain.

5.1.1.3 Greta Survey Site

The vegetation of the Greta survey site comprised areas of spotted gum – ironbark open woodland, red gum open woodland and slaty red gum (Hunter 8 Alliance 2009). The canopy was dominated by a stand of regenerating (100 – 200 mm DBH) trees reaching 18 metres in height and comprising between 26 to 50 percent of the canopy cover. Middle aged (201 – 400 mm DBH) and mature (400 – 600 mm DBH) trees also occurred but at lower frequencies within the canopy. No old growth trees (600+ mm DBH) trees were recorded. Saplings (< 100 mm diameter stems) were scattered ranging between one and ten metres in height. Stags (dead standing trees) were scattered and typically comprised of solid trees without bark. The canopies of individual trees were typically affected by slight levels of dieback and mistletoe infestation and appeared to be free of significant areas of insect attack during the time of the field survey. The dominant canopy species were Narrow-leaved Ironbark *(Eucalyptus crebra)*, Spotted Gum (*Corymbia maculata),* Forest Red Gum (*Eucalyptus tereticornis),* Grey Gum (*E. punctata*) and Slaty Red Gum (*E. glaucina*).

The scattered shrub layer was typically less than two metres in height and was comprised of a relatively small number of species. Ground cover was dominated by grass and litter cover. Log cover (fallen trees and branches) was moderate and comprised of small (< 100 mm diameter), medium (101 – 300 mm diameter) and large (> 100 mm diameter) logs. Log cover was predominately comprised of solid (with and without bark) logs however some hollow and rotten (collapse if stepped on) logs were also recorded.

Species specific habitat areas of litter at the base of trees and loose tree bark were recorded. No areas of rock on rock, rock overhangs or caves were recorded. Forest red gum, one of the ten koala food tree species listed on Schedule Two of SEPP 44 was recorded at greater than 15 percent of the canopy cover in parts of the Greta survey site. No potential food trees of the glossy-black cockatoo were recorded.

The study area was disturbed by; a moderate number of cut stumps, slight grazing pressure from kangaroos and wallabies and a slight level of weed infestation dominated by lantana (*Lantana camara*). No evidence of a past fire history, erosion or rubbish dumping were recorded. The Greta survey site was typically characterised by gently (0-5 degrees) sloping terrain.

Plate A. Open Woodland of Belford Survey Site

Plate B. Open Woodland of the Greta Survey Site (at sunset)

5.1.1.4 Anvil Creek Survey Site

The vegetation of the Anvil Creek survey site was dominated by a swamp oak riparian forest with fringing areas of spotted gum – ironbark open woodland and red gum open woodland (Hunter 8 Alliance 2009). The canopy was dominated by a stand of middle aged (201 – 400 mm DBH) trees reaching 20 metres in height. Regenerating (100 – 200 mm DBH) and mature (400 – 600 mm DBH) trees also occurred but at lower frequencies within the canopy (**Plate D**). No old growth trees (600+ mm DBH) trees were recorded. Saplings (< 100 mm diameter stems) were abundant ranging between one and 10 metres in height. Stags (dead standing trees) were predominately absent. The canopies of individual trees were typically affected by moderate levels of dieback and moderate levels of mistletoe infestation during the time of the field surveys and appeared to be free of insect attack. The dominant canopy species was Swamp Oak (*Casuarina glauca*).

Tree stumps (> 100 mm diameter; not cut by humans) were absent. The shrub layer was absent in many parts, while in another part a dense stand of lantana dominated the understorey and reached three metres in height. Ground cover was dominated by grass cover to 0.3 metres in height. Areas of litter cover also occurred. Log cover (fallen trees and branches) was scattered and comprised small (< 100 mm diameter) and medium (101 – 300 mm diameter) logs. Log cover was predominately comprised of solid (with and without bark) logs.

Species specific habitat areas of litter (needles) at the base of trees were recorded. No areas of rock on rock, rock overhangs, caves or loose tree bark were recorded. None of the ten koala food tree species listed on Schedule Two of SEPP 44 were recorded at an individual or combined total of 15 percent of the canopy cover. One potential food tree of the glossy-black cockatoo, swamp oak (*Casuarina glauca*) was recorded.

The Anvil Creek survey site was disturbed by slight grazing pressure from cattle and kangaroos and a moderate level of weed infestation. While some sections of the riparian zone along Anvil Creek were covered in dense patches of lantana, including smaller patches of blackberry, other areas were weed free. No evidence of a past fire history, erosion or rubbish dumping were recorded.

5.1.2 Creek-lines and Associated Riparian Vegetation

Several creek lines pass through the investigation area. With the exception of Black Creek, creek lines were typically less than five metres wide and contained small to medium sized pools. Water depth was unlikely to be greater than two metres and scattered emergent vegetation was recorded at most creek crossings. Some creek lines, particularly sections of Anvil and Black Creeks appeared to contain long sections of pools separated by short sections of flowing water (riffle sections). Banks were typically stable and covered by pasture and weed species.

Black Creek was the largest creek in the investigation area, with pools up to 15 metres wide and over one hundred metres long. Pools were likely around two metres deep, contained a moderate density of snags and presented excellent fish and water bird habitat (**Plate C**).

Plate C. Black Creek

Plate D. Riparian Woodland Along Anvil Creek

5.1.3 Habitat Trees and Tree Hollow Provision

Tiny, small and medium tree hollows were common at all woodland sites, averaging 28 to 42 hollows per hectare at open woodland sites (**Table 13**). Large hollows were uncommon and very large hollows were rarely encountered in open woodland habitats and were absent in the areas of riparian woodland sampled.

Table 13. Tree Hollow Provision

Site	Habitat Type	Number of Hollows (size classes in millimetres)					Number of Habitat Trees per Hectare
		Tiny 5-25	Small 26-50	Medium 51-100	Large 101-300	Very Large 301+	
Belford	Open Woodland	30	10	3	0	0	13
Greta	Open Woodland	20	25	25	10	5	35
Lochinvar	Open Woodland	75	81	56	6	0	53
	Average	*42*	*39*	*28*	*5*	*2*	*34*
Anvil Creek	Riparian Woodland	56	33	17	0	0	36

5.1.4 Open Pasture Paddocks

Open pasture paddocks were dominated by pasture and weed species. At the time of the field survey grasses were typically less than 0.5 metres in height. Ground cover was entirely grass cover with no significant areas of rock, log or soil cover.

5.1.5 Farm Dams

A moderate number of farm dams occurred along the investigation area, ranging from small (20 metres wide) to large (< 100 metres wide) farm dams. Many of the farm dams contained beds of emergent aquatic vegetation and presented good quality habitat for water birds and freshwater aquatic fauna species (**Plate E**).

5.1.6 Drainage Culverts and Bridges

An unknown number of culverts occurred along the investigation area (see the surface water impact assessment for further details on the number and types of culverts) and provide potential roosting sites for micro-bats and nesting sites for some bird species. Culvert type varied between small cement (approximately 300 millimetre diameter) and large brick culverts (approximately two metre diameter). All culverts inspected (less than 12) were solid structures that did not appear to contain cracks or holes.

A number of bridges occurred along the investigation area where the railway crossed creek lines or road traffic passed over the railway line. Bridges varied from aging wooden to solid concrete or brick structures (**Plate F**).

Culverts provide potential roosting sites for micro-bats and nest sites for fairy martins. Bridges provide potential roosting and breeding sites for micro-bats, and potential nest sites for fairy martins and welcome swallows. Active fairy martin nests were opportunistically recorded under the railway

bridge over Black Creek. No micro-bats, fairy martins or welcome swallows were recorded using any other bridges or culverts during opportunistic observations.

Plate E. Farm Dam Adjacent to the Belford Survey Site

Plate F. Bridge Over Black Creek

5.2 Threatened Fauna Species

Seven threatened and one preliminarily listed fauna species on the TSC Act were recorded during field surveys.

- Squirrel Glider (Vulnerable)

The squirrel glider was recorded during spotlighting at the Greta survey site on two occasions. A single individual was spotted on each occasion.

- Grey-crowned Babbler (Vulnerable)

The grey-crowned babbler was recorded at each of the survey sites, either from the identification of groups of birds (four to seven birds) or from the presence of nests.

- Eastern Freetail-bat (Vulnerable)

The Eastern freetail-bat was recorded on Anabat detectors at the Lochinvar and Anvil Creek survey sites. At both sites the echolocation calls were identified at the 100 percent definite identification level.

- Eastern Bent-wing Bat (Vulnerable)

The eastern bent-wing bat was identified at all four survey sites on Anabat detectors. At all four sites the echolocation calls were identified at the 100 percent definite identification level.

- Little Bent-wing Bat (Vulnerable)

The little bent-wing bat was identified at the Anvil Creek and Greta survey sites on Anabat detectors. At both sites the echolocation calls were identified at the 100 percent definite identification level.

- Large-footed Myotis (Vulnerable)

The large-footed myotis was identified at the Lochinvar survey site on an Anabat detector and at the Belford farm dam site by visual identification. At the Lochinvar survey site the echolocation calls were identified at the probably level of identification. The nearest farm dam to the Anabat detector was approximately 200 metres away. During the nocturnal reptile and amphibian search at the Belford farm dam site a single Large-footed myotis was observed 'fishing' on the surface of a large farm dam.

- Greater Broad-nosed Bat (Vulnerable)

The greater broad-nosed bat was identified at the Anvil Creek survey site on an Anabat detector. The echolocation calls were identified at the greater than 60 percent probable identification level.

- Varied Sittella (Preliminary Determination – Vulnerable)

The varied sittella was recorded at the Greta survey site. The distinctive call of the varied sittella was recorded during one of two bird surveys.

A number of other threatened species have potential to occur on the investigation area, at least on an occasional basis, and are identified in **Section 6.1** of this report.

5.3 Migratory Species

Four migratory species listed on the EPBC Act were recorded during field surveys.

- Latham's Snipe

A single probable Latham's snipe was identified at the Belford survey site. The bird was accidentally flushed from the reeds of a farm dam and quickly disappeared out of sight.

- Rainbow Bee-eater

A single rainbow bee-eater was recorded along the access track to the Greta survey site.

- Rufous Fantail

Two rufous fantails (possibly the same bird) were recorded at the same approximate location along Anvil Creek during two separate bird surveys.

- Wanderer Butterfly

The wanderer butterfly was recorded at the four main survey sites. The wanderer butterfly also likely occurs at the Belford farm dam site but was not detected as only nocturnal surveys were carried out at that site. Approximately 10 butterflies were recorded per hour during general survey activities.

A number of other migratory species have potential to occur in the investigation area, at least on an occasional basis, and are identified in **Section 6.1** of this report.

5.4 Non-threatened Species

A total of 114 non-threatened (protected or introduced) species were recorded during field surveys (**Appendix 1**). The 83 non-threatened birds recorded comprised all the bird groups typically recorded within the region. Water birds such as the Australian wood duck (*Chenonetta jubatta*) and Australasian grebe (*Tachybaptus novaehollandiae*) were recorded at farm dams. Species requiring tall reeds at farm dams such as the purple swamphen (*Porphyrio porphyrio*) and clamourous reed-warbler (*Arcocephalus stentoreus*) were also recorded. Common woodland bird species were recorded such as the eastern rosella (*Platycercus eximius*), laughing kookaburra (*Dacelo novaeguineae*), striated pardalote (*Pardalotus striatus*), yellow thornbill (*Acanthiza nana*) and white-winged chough (*Corcorax melanorhamphus*). Two introduced birds species, the common starling (*Sturnus vulgaris*) and common myna (*Acridotheres tristis*) were recorded.

Eight non-flying non-threatened mammal species were recorded, including the short-beaked echidna (*Tachyglossus aculeatus*) and the three macropod species, eastern grey kangaroo (*Macropus giganteus*), red-necked wallaby (*Macropus rufogriseus*) and swamp wallaby (*Wallabia bicolour*). Two introduced mammal species were recorded, the fox (*Vulpes vulpes*) and rabbit (*Oryctolagus cuniculus*). Eight flying non-threatened mammal species were recorded including two wattled bats (*Chalinolobus* spp.) and two forest bats (*Vespadelus* spp.) (**Appendix 1**).

Seven non-threatened frog species were recorded including the common eastern froglet (*Crinia signifera*) and four tree frogs (*Litoria* spp.) (**Appendix 1**). Eight non-threatened reptile species were recorded including one tortoise, one snake, one dragon and five skinks (**Appendix 1**).

6. IMPACT ASSESSMENT

6.1 Determination of Local Threatened Fauna as Subject Species

Sections 3.3 and **3.1.4** identified 60 threatened and/or migratory fauna species and two endangered fauna populations previously recorded or likely to occur in the study locality. Subject species within this report are defined as threatened and/or migratory species listed on the TSC Act and/or the EPBC Act known or considered likely to occur in the habitats present within the study area. Following a habitat assessment and non-trapping field survey of the investigation area (**Section 4**) **Table 14** identifies the likelihood of each species or population occurring in the investigation area and being classified as subject species.

Table 14. An Assessment of the Likelihood of 60 Threatened and/or Migratory Fauna Species and Two Endangered Fauna Populations Occurring Within the Investigation area.

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
SPECIES KNOWN TO OCCUR (Recorded during field surveys)						
Latham's snipe (*Gallinago hardwickii*) M – EPBC Act	EPBC modelling - species or habitat may occur.		Wetlands with low vegetation in shallows. Recorded at a farm dam during field surveys.	N	Y	Y
Rainbow bee-eater (*Meraps ornatus*) M – EPBC Act	EPBC modelling - species or habitat may occur.		Migrate throughout mainland from northern Australia in September to April. Occurring in woodland, open forest, semi-arid scrub, grasslands and timbered plains, avoiding dense forest. Pursue flying insects. Nest in ground tunnels. Recorded during field surveys.	Y	Y	Y
Grey-crowned babbler (*Pomatostomus temporalis temporalis*) V – TSC Act	2008	72	Open eucalypt woodlands with a grassy groundcover and sparse, tall shrub layer. May also be observed along streams in cleared areas and grassy road verges. Raucous groups of 2-13 individuals foraging for insects in all substrates. Groups build several dome shaped and football sized stick nests which are used year round for roosting and during the breeding season for nesting. Nests are typically located in shrubs or regenerating eucalypts, or less frequently in the outer lower branches of large eucalypt trees. Breeding generally occurs between July and February. Territories range from one to 50 hectares, averaging 10 ha, and are defended year-round. Recorded during field surveys.	Y	Y	Y
	Ecotone 2008					
	Local Ecotone reports					
Varied sittella (*Daphoenositta chrysoptera*) PD (V) – TSC Act	2006	6	Occur in eucalypt forest, woodland, mallee, farm trees, shelter belts, roadside trees and parks and gardens. Occur in most treed habitats except rainforest. Recorded during field surveys.	Y	Y	Y

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Rufous fantail (*Rhipidura rufifrons*) M – EPBC Act	EPBC modelling – breeding may occur.		Rainforest, wet eucalypt forest, paperbark and mangrove swamps, also riverside vegetation. Will use more open habitats when migrating. Recorded during field surveys.	Y	Y	Y
Squirrel glider (*Petaurus norfolcensis*) V – TSC Act	2008	47	Usually inhabits dry open sclerophyll forest and woodlands, but has also been observed in moist regenerating forest and moist gullies. Forages on acacia gum, eucalypt sap, nectar, honeydew and manna, invertebrates and pollen, utilising areas with an abundance of flowering eucalypts and tall shrubs (such as banksias). Acacia species are the preferred sap feeding trees. This species requires an abundance of suitably sized hollow-bearing trees for den sites. Recorded during field surveys.	Y	Y	Y
	Local Ecotone reports					
Eastern freetail-bat (*Mormopterus norfolkensis*) V – TSC Act	2008	26	The habitat preference of this species is unclear. It has been predominantly recorded in dry eucalypt forest and woodland, but has been recorded in moist and edge environments. The wing morphology indicates that this species is adapted to the more open habitats. This species primarily roosts in tree hollows, although the roofs of buildings are also used. Recorded during field surveys.	Y	Y	Y
	Local Ecotone reports					
Little bentwing-bat (*Miniopterus australis*) V – TSC Act	2007	11	Forages in a range of habitats, including forest, woodland, heath, coastal swamps and rainforest. A nightly foraging range of 20km from roost sites has been reported. Reliant on suitable roosting habitat in caves and mine tunnels, though has been recorded roosting in hollowed out tree bases and dense foliage. Recorded during field surveys.	N	N	Y
	Local Ecotone reports					
Eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) V – TSC Act	2007	41	Forages within a variety of habitat types including moist and dry eucalypt forest, woodland, rainforest, heath and open environments, including urban areas. Reliant on suitable roosting/breeding habitat in caves and mine tunnels, though will also roost in stormwater channels, road culverts and other comparable structures (including buildings). Estimated nightly foraging range of 20 kilometres. Recorded during field surveys.	N	N	Y
	Local Ecotone reports					
Large-footed myotis (*Myotis macropus*) V – TSC Act	2008	13	Habitats adjacent to large bodies of water for hunting aquatic insects. Usually forages over streams or pools, catching insects and small fish by raking its feet across the water surface. Roosts in caves, mines, tunnels, bridges, culverts and dense foliage. Recorded during field surveys.	Y	Y	Y
Wanderer butterfly (*Danaus plexippus*) M – EPBC Act	Ecotone local knowledge		Known to occur in a wide variety of habitats, including suburban gardens. Recorded during field surveys.	Y	Y	Y

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
SPECIES LIKELY TO OCCUR						
Great egret (*Ardea alba*) M – EPBC Act	EPBC modelling - species or habitat may occur.		Wetlands, flooded pastures, estuarine mudflats, dams, mangroves and reefs. The cattle egret is likely to forage at farm dams from time to time.	N	Y	Y
White-throated needletail (*Hirundapus caudacutus*) M- EPBC Act	EPBC modelling - species or habitat may occur.		High open spaces of sky above all habitat types. The white-throated needletail is likely to forage over the investigation area on an occasional basis, particularly during approaching summer storms.	Y	Y	Y
Fork-tailed swift (*Apus pacificus*) M – EPBC Act	EPBC modelling - species or habitat may occur.		Low to very high airspace over varied habitat – rainforest to semi-desert. The fork-tailed swift is likely to forage over the investigation area on an occasional basis, particularly during approaching summer storms.	Y	Y	Y
Speckled warbler (*Pyrrholaemus sagittatus*) V – TSC Act	2008	17	The speckled warbler lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. Woodland areas in the investigation area may provide habitat for the speckled warbler. The speckled warbler may occur.	Y	Y	Y
	Local Ecotone reports					
Spotted-tailed quoll (*Dasyurus maculatus*) V- TSC Act E – EPBC Act	2006	13	Inhabits a variety of habitat types from moist and wet sclerophyll through to dry forests and woodlands on the edge of open grasslands. Individuals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky cliff faces as den sites. Use latrine sites, often on rocks or boulders. Feed on a wide variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, insects, domestic fowls. Also eats carrion. Female home ranges range up to 750 ha, males 3500 ha. Woodland areas of the investigation area may provide suitable habitat for the spotted-tailed quoll.	Y	Y	Y
	EPBC modelling - species or habitat may occur					

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Grey-headed flying-fox (*Pteropus poliocephalus*) V – TSC Act V – EPBC Act	2008	48	Found within 200km of the eastern coast of Australia. Regularly occurs along the eastern coastal plain through NSW. Roosts in camps, usually in dense riparian habitats. At dusk disperses in search of the preferred food source, mainly Eucalypt nectar and pollen, and rainforest fruits. Occurs in subtropical and temperate rainforest, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and planted fruit crops. May travel up to 50 km each night in search of food. The grey-headed flying fox may occur in any area with suitable flowering eucalypt trees. A known camp occurs at nearby Singleton. The species is likely to occur in the investigation area when eucalypt species are flowering.	N	Y	Y
	Ecotone 2008					
	EPBC modelling – foraging, feeding or related behaviour known to occur within area.					
SPECIES THAT MAY OCCUR						
Green and golden bell frog (*Litoria aurea*) E – TSC Act V – EPBC Act	2008	7	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as plague minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs. Preyed upon by various wading birds and snakes. Farm dams and creek lines in the investigation area may provide suitable habitat for the green and golden bell frog.	Y	Y	Y
	EPBC modelling - species or habitat likely to occur					

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Blue-billed duck (*Oxyura australis*) V – TSC Act	1990	4	The blue-billed duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Blue-billed ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland. They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies. Blue-billed ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Blue-billed ducks usually nest solitarily in cumbungi over deep water between September and February. They will also nest in trampled vegetation in lignum, sedges or spike-rushes, where a bowl-shaped nest is constructed. As a highly mobile species the blue-billed duck may appear at any farm dam throughout the study area, particularly those with tall reed beds.	N	Y	Y
Black-necked stork (*Ephippiorhynchus asiaticus*) V- TSC Act	2003	10	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water on a variety of prey including fish, frogs, eels, turtles, crabs and snakes. Breeds in late summer in the north, and early summer further south. A large nest, up to 2 m in diameter, is made in a live or dead tree, in or near a freshwater swamp. The black-necked stork may forage at the farm dams for short periods during rare visits to the region.	N	Y	Y
Cattle egret (*Ardea ibis*) M – EPBC Act	EPBC modelling - species or habitat may occur.		Shallow open wetlands and mudflats. Moist pastures with tall grass. Often associated with grazing cattle. The cattle egret may occur in the farm paddocks from time to time, grazing around the farm dams and alongside cattle.	Y	Y	Y
Square-tailed kite (*Lophoictinia isura*) V – TSC Act	2006	1	Specialised canopy predator, feeding on small birds, eggs and insects. Primarily hunts over open forest, woodlands and mallee communities that are rich in passerines, as well as over adjacent heaths and other low scrubby habitats and in wooded towns. Appears to prefer a structurally diverse landscape. Remnant woodland within the investigation area may provide suitable habitat for the square-tailed kite.	Y	Y	Y

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Spotted harrier (*Circus assimilis*) PD(V) – TSC Act	1983	1	Open grasslands, spinifex, open shrublands, saltbush, very open woodlands, crops and similar low vegetation that allows the low 'harrying' mode of hunting. Nests in trees and only rarely on the ground. Nests are often placed in mistletoe clumps or amongst dense regrowth at the end of a broken limb. The spotted harrier may occur in the investigation area during periods of tall grass growth.	Y	Y	Y
Little eagle (*Hieraeetus morphnoides*) PD(V) – TSC Act	2000	1	Forests, woodlands, open shrublands, tree-lined watercourses of interior. Most abundant where open country intermixes with wooded or forested hills (as in farmland/irrigated land). Avoids dense forest, but will use clearings and margins on dense eucalypt and rainforest. Prefers hilly country. Woodland areas in the investigation area may provide suitable habitat for the little eagle.	Y	Y	Y
Glossy black-cockatoo (*Calyptorhynchus lathami*) V – TSC Act	2001	3	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly black she-oak (*Allocasuarina littoralis*), forest she-oak (*A. torulosa*) or drooping she-oak (*A. verticillata*) occur. In the Riverina area, inhabits open woodlands dominated by belah (*Casuarina cristata*). Feeds almost exclusively on the seeds of several species of she-oak (casuarina and allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. Suitable feed tree species are present in the investigation area and the glossy-black cockatoo may occur.	Y	Y	Y
Gang-gang cockatoo (*Callocephalon fimbriatum*) V – TSC Act	2005	3	Tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter it occurs in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Requires hollow trees for nesting. Woodland areas in the investigation area may provide suitable habitat for the gang-gang cockatoo.	Y	Y	Y
Little lorikeet (*Glossopsitta pusilla*) V – TSC Act	2007	14	Forests, woodlands, favours open country along watercourses and paddock trees. Trees in the investigation area may provide suitable habitat for the little lorikeet.	Y	Y	Y

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Turquoise parrot (*Neophema pulchella*) V – TSC Act	2006	2	Open eucalypt woodland or forest with a grassy or sparsely shrubby understorey. Favours grasslands on the edge of these habitat types, particularly timbered grassland on mountain slopes and ridges. Feeds on seeds of native and introduced grasses and other herbs. Requires suitable hollows in tree limbs, logs or fence posts for breeding. Usually seen in pairs or small, possibly family groups and have also been reported in flocks of up to thirty individuals. Grassy woodland areas in the investigation area may provide suitable habitat for the turquoise parrot.	Y	Y	Y
Swift parrot (*Lathamus discolor*) E – TSC Act E – EPBC Act	2005	10	The migratory nature of this species makes them difficult to assess. Known to frequent sclerophyll forest and woodlands with winter flowering trees (such as. spotted gum, red ironbark, *Eucalyptus crebra*, *E. siderophloia*, forest red gum and swamp mahogany) on an opportunistic basis along the coast and ranges of NSW. The swift parrot may occur in any area with suitable flowering eucalypt trees. The species may occur in the investigation area when eucalypt species are flowering.	N	Y	Y
	EPBC modelling - species or habitat likely to occur					
Masked owl (*Tyto novaehollandiae*) V – TSC Act	1970	1	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Woodland areas in the investigation area may provide suitable foraging habitat for the masked owl.	Y	Y	Y
Powerful owl (*Ninox strenua*) V – TSC Act	2004	5	The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The powerful owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation. The main prey items are medium-sized arboreal marsupials, particularly the greater glider, common ringtail possum and sugar glider. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of powerful owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400-1450 ha. Powerful owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. Remnant woodland in the investigation area may provide suitable habitat for the powerful owl.	Y	Y	Y

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Barking owl (*Ninox connivens*) V – TSC Act	2005	2	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Dense vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as acacia and casuarina species, or the dense clumps of canopy leaves in large eucalypts. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts. Remnant woodland in the investigation area may provide suitable habitat for the barking owl.	Y	Y	Y
Brown treecreeper (*Climacteris picumnus victoriae*) V – TSC Act	2008	6	Found in eucalypt woodlands (including box-gum woodland) and dry open forest of the inland slopes and plains inland of the great dividing range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and river red gum (*Eucalyptus camaldulensis*) forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Sedentary and considered to be resident in many locations throughout its range. Gregarious and usually observed in pairs or small groups of eight to 12 birds; terrestrial and arboreal in about equal proportions; active, noisy and conspicuous while foraging on trunks and branches of trees and amongst fallen timber; spend much more time foraging on the ground and fallen logs than other treecreepers. Up to 80% of the diet is comprised of ants, with other invertebrates making up the remainder. Nectar from mugga ironbark (*E. sideroxylon*) and paperbarks, and sap from an unidentified eucalypt are also eaten, along with lizards and food scraps. Hollows in standing dead or live trees and tree stumps are essential for nesting. The brown treecreeper was not detected at any of the survey sites. The species may occur at other woodland patches not surveyed.	Y	Y	Y
	Ecotone 2008					

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Black-chinned honeyeater (*Melithreptus gularis gularis*) V – TSC Act	2005	5	Dry eucalypt savannah woodland and forest with an annual rainfall range of 400-700mm, particularly with box-ironbark associations and river red gums. Considered to be locally nomadic requiring remnants of greater than 200ha in area. Forages within foliage and bark of eucalypt trees on spiders, insects, lerp and nectar. Woodland areas in the investigation area may provide habitat for the black-chinned honeyeater. The black-chinned honeyeater may occur.	Y	Y	Y
Regent honeyeater (*Xanthomyza phrygia*) E – TSC Act E – EPBC Act M – EPBC Act	2000	5	Inhabits dry open forest and woodland, particularly box-ironbark woodlands, and riparian forests of river-sheoak. Feeds on nectar from a wide range of eucalypts and mistletoe. When nectar is scarce feeds on lerp, honeydew and insects. Regent honeyeaters undertake large-scale nomadic movements most likely in search of flowering areas, or other unknown resource requirements. Every few years regent honeyeaters are found foraging coastal swamp mahogany and spotted gum forests, particularly on the Central Coast of NSW. The nomadic nature of this species makes it difficult to assess. Known to frequent areas with densely blossoming winter-flowering trees on an opportunistic basis along the coast and ranges of NSW. The species may occur in the investigation area when eucalypt species are flowering.	N	Y	Y
	EPBC modelling - species or habitat likely to occur					
Painted honeyeater (*Grantiella picta*) V – TSC Act	1977	1	Inhabits boree, brigalow and box-gum woodlands and box-ironbark forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches. Mistletoe clumps in the investigation area may provide foraging habitat for the painted honeyeater.	Y	Y	Y
Hooded robin (*Melanodryas cucullata cucullata*) V – TSC Act	1986	1	Prefers open areas adjacent to large blocks of woodland, particularly with areas of dead timber and sparse shrub cover. Also recorded in open forests and acacia shrublands. The edge zone between woodland and open pasture paddocks may provide suitable habitat for the hooded robin.	Y	Y	Y
Flame robin (*Petrocia phoenicea*) PD (V) – TSC Act	2007	1	Inhabits eucalypt forests, woodlands, open woodlands and farmland. The flame robin may occur in the open farmland and woodland in the investigation area.	Y	Y	Y

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Scarlet robin (*Petroica multicolour*) PD (V) – TSC Act	2005	5	Inhabits forests and woodlands. Heavier vegetation when breeding and more open and cleared country in autumn and winter. Remnant woodland in the investigation area may provide suitable habitat for the scarlet robin.	Y	Y	Y
Satin flycatcher (*Myiagra cyanoleuca*) M – EPBC Act	EPBC modelling – breeding likely to occur.		Forests and woodlands, mangroves and coastal heath scrubs. The satin flycatcher may occur in woodland areas of the investigation area.	Y	Y	Y
Diamond firetail (*Stagonopleura guttata*) V – TSC Act	2005	1	Found in grassy woodlands, open forest with a grassy groundcover, woodland, mallee, acacia scrub lands and timber belts along watercourses and roadsides. Often found in riparian area and sometimes in lightly wooded farmland. Feeds entirely on the ground, eating grass and herb seeds, green leaves and insects. Small globular nests are built in dense understorey or high in the canopy, often under raven and hawk nests. Breeding occurs between August and January. Roost in dense shrubs or small roost nests. Grassy woodland areas in the investigation area may provide suitable habitat for the diamond firetail.	Y	Y	Y
Brush-tailed phascogale (*Phascogale tapoatafa*) V – TSC Act	2006	3	Found in dry sclerophyll open forests and woodlands, with a preference for sparse ground cover. Also inhabits heath, swamps, rainforest and wet sclerophyll forest. Requires large areas of intact habitat. Nests and shelters in tree hollow. Woodland areas of the investigation area may provide suitable habitat for the brush-tailed phascogale.	Y	Y	Y
Koala (*Phascolarctos cinereus*) V – TSC Act	2006	9	Forest and woodland habitats that contain suitable regional eucalypt feed trees. The koala may occur anywhere there are suitable food trees. Eucalypt species in the investigation area may be suitable food tree species.	Y	Y	Y
Yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*) V – TSC Act	2007	2	Wide range of habitats, including open forest. Forages above the canopy in wooded areas and lower down in more open areas or along creek lines. Reliant on suitable trees with hollows for roosting. Breeds from mid-December to March. May occur in the larger woodland remnants of the investigation area.	Y	Y	Y

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Large-eared pied bat (*Chalinolobus dwyeri*) V – TSC Act V – EPBC Act	2007	2	Range of well-wooded habitats, including dry sclerophyll forests and woodlands of coastal and semi-arid areas. Occasionally in sub-alpine woodlands and at the edge of rainforest and semi-arid areas. Reliant on suitable roosting habitat including caves and mine tunnels (though may use other structures, eg. abandoned fairy martin nests). Woodland areas in the investigation area may provide suitable foraging habitat for the large-eared pied bat.	N	N	Y
	EPBC modelling - species or habitat may occur.					
Eastern false pipistrelle (*Falsistrellus tasmaniensis*) V – TSC Act	2007	3	Tall forest, woodland or heath/ grassland edges. Roosts in hollow trunk of the largest trees and sometimes buildings. Hunts flying insects above or just below the canopy. Woodland areas in the investigation area may provide suitable foraging and roosting habitat for the eastern false-pipistrelle.	Y	Y	Y
Greater broad-nosed bat (*Scoteanax rueppellii*) V – TSC Act	2007	13	Forages for insects over a range of natural and altered habitats, including tall forest, woodland or heath/grassland edges, often along the tree line boundary. Prefers tree hollows in large, often isolated, mature trees for roosting. Usually associated with tall moist open forest. Woodland areas in the investigation area may provide suitable foraging and roosting habitat for the greater broad-nosed bat.	Y	Y	Y
	Local Ecotone reports					
Eastern cave bat (*Vespadelus troughtoni*) V – TSC Act	2006	4	The eastern cave bat inhabits tropical mixed woodland and wet sclerophyll forest on the coasts and drier forests on the western slopes and inland. This species is a cave dweller, using shallow sandstone caves, boulder piles, buildings and sites near the entrance of mine tunnels. Little is known about the diet and breeding of the eastern cave bat. Woodland areas in the investigation area may provide suitable foraging habitat for the eastern cave bat.	N	N	Y

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
SPECIES UNLIKELY TO OCCUR						
Stuttering barred frog (*Mixophyes balbus*)	EPBC modelling - species or habitat likely to occur.		Terrestrial inhabitants of rainforest, Antarctic beech or wet sclerophyll forest along permanent streams. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation of the forest floor. Breed in streams during summer after rain. Eggs are laid on rock shelves or shallow riffle areas of slow flowing streams. Tadpoles use deep permanent pools. No suitable habitat exists in the investigation area.	N	N	N
Giant (southern) barred frog (*Mixophyes iteratus*) E – EPBC Act	EPBC modelling - species or habitat likely to occur		Giant barred frogs forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams from late spring to summer. Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. Tadpoles grow to a length of 80 mm and take up to 14 months before changing into frogs. When not breeding the frogs disperse hundreds of metres away from streams. They feed primarily on large insects and spiders. No suitable habitat exists in the investigation area.	N	N	N
Littlejohn's tree frog (*Litoria littlejohni*) V – TSC Act	1970	1	It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It hunts either in shrubs or on the ground. Breeding is triggered by heavy rain and can occur from late winter to autumn, but is most likely to occur in spring when conditions are favourable. Males call from low vegetation close to slow flowing pools. Eggs are laid in loose gelatinous masses attached to small submerged twigs. Eggs and tadpoles are mostly found in slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools. No suitable habitat exists in the investigation area.	N	N	N

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Black bittern (*Ixobrychus flavicollis*) V – TSC Act	2005	2	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds. Generally solitary, but occurs in pairs during the breeding season, from December to March. Like other bitterns, but unlike most herons, nesting is solitary. Nests, built in spring are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks. While some areas of reed beds occur on some farm dams the reed beds are likely too small to provide habitat for the black bittern. The black bittern is unlikely to occur.	N	Y	Y
Painted snipe (*Rostratula benghalensis*) NB. probably only the Australian Painted Snipe in Australia now. E – TSC Act	1992	1	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves. Breeding is often in response to local conditions; generally occurs from September to December. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter. The painted snipe is unlikely to occur due to the lack of mud-flats and only small areas of shallow water at farm dams.	N	Y	Y
Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area Endangered Population – TSC Act	Atlas of NSW Wildlife Database		The emu occupies a range of predominantly open habitats, including plains, grasslands, woodlands and shrubs, and may occur occasionally in forest. The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA represents the north-eastern limit of the species in NSW. The majority of recent records are concentrated between Coffs Harbour and Ballina, with occasional records inland of the coastal ranges (DECC 2009). The investigation area occurs well outside the known distribution of the Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area. No suitable habitat exists in the investigation area.	N	N	N
White-bellied sea-eagle (*Haliaeetus leucogaster*) M – EPBC Act	EPBC modelling - species or habitat likely to occur		Inhabit areas near large bodies of water. No suitably large water bodies occur nearby.	N	N	N

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Spectacled monarch (*Monarcha trivirgatus*) M – EPBC Act	EPBC modelling – breeding may occur.		Mainly rainforests and mangroves No suitable habitat exists in the investigation area.	N	N	N
Black-faced monarch (*Monarcha melanopsis*) M- EPBC Act	EPBC modelling – breeding may occur.		Rainforests, mangroves and adjacent eucalypt woodlands. No suitable habitat exists in the investigation area.	N	N	N
Yellow-bellied glider (*Petaurus australis*) V – EPBC Act	2003	1	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Den, often in family groups, in hollows of large trees. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. No suitable tall mature eucalypt forest occurs in the investigation area for the yellow-bellied glider.	N	N	N
Long-nosed potoroo (*Potorous tridactylus*) V – EPBC Act	EPBC modelling - species or habitat may occur		Coastal heath and dry and wet sclerophyll forests - relatively thick ground cover is essential and it prefers areas with light, sandy soils. No suitable habitat exists in the investigation area.	N	N	N
Brush-tailed rock-wallaby (*Petrogale penicillata*) E – TSC Act V – EPBC Act	EPBC modelling - species or habitat may occur.		Occupy rocky cliffs, escarpments and outcrops, with a preference for complex structures with fissures, caves and ledges facing north. Eat grasses and forbs, as well as fruit and foliage of shrubs and trees. Home range areas average 15 ha and family groups, typically of 2 to 5, are highly territorial. Breeding is likely to be year-round. No suitable habitat exists in the investigation area.	N	N	N
Broad-toothed rat at Barrington Tops in the local government areas of Gloucester, Scone and Dungog Endangered Population – TSC Act	Atlas of NSW Wildlife Database		Found in alpine and sub-alpine heathlands and open eucalypt woodlands in areas that are characterised by high rainfall, a cool summer, and a cool to cold winter. Appears to be restricted to patches where there's a dense ground cover of grasses, sedges and shrubs (DECCW 2008). No suitable habitat of dense ground cover occurs for the broad-toothed rat.	N	N	N

Common Name and Status	Record Source		Preferred Habitat* and Comments	Habitat Available		
	Most Recent Record	Number Recorded Within 10 km		Breeding	Shelter	Foraging
Hastings River mouse (*Pseudomys oralis*) E – TSC Act E – EPBC Act	EPBC modelling - species or habitat likely to occur		Known from habitat near creek lines within open eucalypt forest with dense ground cover of sedges, grasses and/ or ferns. Creek line ground cover is unlikely to be dense enough for the species and adjacent areas are to open for the Hastings River Mouse too occur.	N	N	N

*Compiled from: Australian Museum Fact Sheets, Barrett 2003, Churchill 1998, Cogger 1995, CSIRO 2006, Garnett 2000, Morcombe 2004 and Strahan 2002.

N – No suitable habitat, Y – Suitable habitat present to some extent.

6.2 Threatened and/or Migratory Species to be Assessed

The following 48 statutory-listed species (note that some species are protected under both the TSC Act and the EPBC Act) are known or considered to have potential to occur within the study area.

TSC Act

Endangered Species

- Green and golden bell frog
- Swift parrot
- Regent honeyeater

Vulnerable Species

- Blue-billed duck
- Black-necked stork
- Square-tailed kite
- Glossy black-cockatoo
- Gang-gang cockatoo
- Little lorikeet
- Turquoise parrot
- Masked owl
- Powerful owl
- Barking owl
- Brown treecreeper
- Speckled warbler
- Black-chinned honeyeater
- Painted honeyeater
- Hooded robin
- Grey-crowned babbler
- Diamond firetail
- Spotted-tailed quoll
- Brush-tailed phascogale
- Koala
- Squirrel glider
- Grey-headed flying-fox
- Yellow-bellied sheath-tailed bat
- Eastern freetail-bat
- Eastern bentwing-bat
- Little bentwing-bat
- Large-eared pied bat
- Eastern false pipistrelle
- Large-footed myotis
- Greater broad-nosed bat
- Eastern cave bat

Vulnerable Species – Preliminary Determination

- Spotted harrier
- Little eagle
- Flame robin
- Scarlet robin
- Varied sittella

The likely level of impact on each of the 39 threatened species listed above and on the TSC Act (or preliminary listed) from the Project will be undertaken in **Section 6.4** of this report.

EPBC Act

Endangered Species

- Swift parrot
- Spotted-tailed quoll
- Regent honeyeater

Vulnerable Species

- Green and golden bell frog
- Grey-headed flying-fox
- Large-eared pied bat

Migratory species

- Cattle egret
- Great egret
- Rainbow bee-eater
- Regent honeyeater

- White-throated needletail
- Fork-tailed swift
- Latham's snipe
- Rufous Fantail
- Satin flycatcher
- Wanderer butterfly

The likely level of impact on each of the 16 threatened and/or migratory species listed above and on the EPBC Act from the Project will be undertaken in **Section 6.5** of this report.

6.3 Overview of Potential Impacts Associated with the Project

Details of the proposed third track are thoroughly covered in the 'Description of the Project' section of the Environmental Assessment prepared by the Hunter 8 Alliance.

6.3.1 Environmental Risk and Impact Assessment

A detailed Environmental Risk and Impact Assessment (Risk Assessment) was conducted as part of the Environmental Assessment process to evaluate the potential impacts that the Project could have on a wide range of environmental, social and economic assets and beneficial uses, which has contributed to help form the conclusions of this study.

In summary:

- The Risk Assessment was conducted to identify the potential environmental, social and economic impacts on the wider environment and community of implementing the Project.
- Heighten confidence and provide rigour for decision making and planning.
- The Risk Assessment was based on the Description of the Project included in the Environmental Assessment and the outputs of the risk assessment represent the risk and impacts of implementing the Project as described in the Description of the Project.
- The Risk Assessment was conducted in close consultation with all of the technical specialists and is based on input provided by those technical specialists. All of the Risk Assessment inputs including consequence and likelihood ratings were provided by the technical specialists.
- Incorporates the outputs of the Community Consultation which occurred as part of the Environmental Assessment, although separate to the risk assessment process. The values and outcomes of the community consultation were incorporated to inform the risk assessment process.
- The Risk Assessment approach used a multi-disciplinary group of technical specialists to assess the consequence and likelihood of the identified risks. To assess risks consistently, consequence tables were developed that clearly define levels of consequence, from insignificant to catastrophic, in terms of magnitude, space and time. Consequence, having regard to 'reasonable worst- case scenarios' (considering activity controls), and the likelihood of that consequence occurring are defined for all identified risks and impacts, allowing risks to be ranked.

The consequence table relevant to this study and the likelihood descriptions are provided in **Appendix 1**. The consequence tables used for estimating diverse consequence types on an even basis were developed specifically for the Project based on consultation and advice from the technical specialists. The likelihood table was developed to incorporate the scoping requirements concept of predicted and potential risks and impacts. The scale ranges from rare to almost certain.

The risk ranking was calculated via the risk matrix, considering both consequence and likelihood allocations. The risk matrix and the risk outputs relevant to this report are both presented in **Appendix 1**.

6.3.2 Vegetation Removal

The Project would result in the removal or modification of areas of vegetation from the investigation area. **Table 15** lists the area of each vegetation community that would be removed or modified by the Project. Further description of the vegetation communities and areas to be disturbed can be found in the Flora and Aquatic Ecological Assessment prepared by the Hunter 8 Alliance for the Project.

Table 15. Areas of Vegetation Communities that will be Removed or Modified

Description	Hectares
Spotted Gum Ironbark forest	13.2
Red Gum open forest	23.3
Swamp Oak riparian forest	14.9
Grey Box Spotted Gum Ironbark open forest	12.7
Freshwater wetland	0.6
Hakea scrub	0.7
Plantation	0.06
Open pastureland	153.1
Farm dam water surface	2.2

The removal of vegetation would result in a decreased potential foraging area and a reduction in potential roosting and nesting sites for woodland, grassland, wetland and farm dam species. The removal of vegetation would also increase the level of local habitat fragmentation by a small degree and increase the potential impacts of edge effects by a similar degree. Where vegetation will be removed, remaining woodland remnants would decrease in size by a small degree and the resulting change in ratio of edge to area of remnant would increase edge effects.

Removal of riparian vegetation would result in larger increases in the degree of fragmentation and edge effects of riparian habitat areas due to the relatively narrow and linear nature of such habitats within the study locality.

6.3.3 Construction and Operational Potential Impacts

In addition to vegetation removal, during the construction of the Project construction activities and associated vehicle/machinery movements would be likely to result in an increase in the degree of noise, dust and vibration impacts on local species. The impact of potential increases in noise, dust and vibration on fauna species is likely to be secondary to the potential impacts associated with the removal of vegetation (**Section 6.3.2**). However potential increases in noise, dust and vibration may cause some individuals to move out of the local area or to abandon nesting attempts.

The completion of the Project would result in an effective doubling of the rail traffic within the investigation area. The increase in the number of trains would be likely to result in an increased number of collisions with fauna species. A small number of grey kangaroo carcasses were recorded within the investigation area. The number of fauna species hit by trains would be likely to increase in a proportional manner to the increase in train movements.

6.4 NSW State Legislative Requirements

6.4.1 Part 3A of the Environmental Planning & Assessment Act 1979 (EP&A Act)

Under Part 3A, The Department of Planning prepares the matters that the proponent must address in the environmental assessment for the Project, known as the Director-General's requirements for environmental assessment. The requirements are developed in consultation with State agencies such as the Department of Environment and Climate Change and other relevant authorities including local councils. Under Part 3A, the proponent is required to include a written impact assessment including a statement of commitments to demonstrate how the project's likely environmental impacts will be minimised or managed. If the project is approved, the proponent will be required to honour these commitments as part of the conditions of approval.

6.4.1.1 Director-General's Requirements

The Director-General's requirements for environmental assessment of the Project (Section 75F of the EP&A Act) that are relevant to flora and fauna are as follows:

Director-General's Requirements	**Relevant Section of this Report**
Terrestrial and aquatic flora, fauna and habitat, with specific consideration of Endangered Ecological Communities, threatened flora, fauna and populations.	**Section 5**
Vegetation clearing and resultant foraging, roosting and nesting habitat loss, fragmentation, connectivity and edge effects, increase in rail movements, and changes to watercourses and riparian zones.	**Sections 3.2.4, 3.2.5, 6.3.2, 6.3.3, 6.4.1.2** & **6.4.2(d)** Vegetation clearing is covered in the Flora report prepared by the Hunter 8 Alliance. Aquatic assessment are coverd in the Aquatic Assessment and Surface Water Assessment both prepared by the Hunter 8 Alliance
Taking into account of: the *Draft Guidelines for Threatened Species Assessment* (DEC), *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC), *Threatened Species survey and assessment: field survey methods for fauna Amphibians* (DECC), *Principles for use of Biodiversity offsets in NSW* (DECC) and *Fish Passage requirements for Waterway Crossings* (NSW Fisheries).	**Sections 4.3 & 6.4.2**

DECCW Submission for DG Requirements

DECCW made a submission to the Department of Planning during the development of the Director-General's Requirements that form the Environmental Assessment Requirements. While the submission is itself not part of the DGRs it provides a list of the criteria that DECCW are likely to assess this report against. The DECCW submission is detailed below.

DECCW Submission to the DG Requirements	Relevant Section of this Report
Part 3A proponents are required to provide an assessment of the potential impacts on threatened species, populations, endangered ecological communities and their habitats as part of their environmental assessment. There are two assessment tools that can be used by proponents for this purpose: 1. The factors identified in the *Threatened Species Assessment Guidelines – The Assessment of Significance* (DECC 2007 and NSW DPI 2008) or 2. The BioBanking Assessment Methodology. Further information can be found on the DECCW website at: *http://www.environment.nsw.gov.au/biobanking/assessmethodology.htm*.	Assessment was undertaken according to option 1 – The Assessment of Significance See **Section 6.4.2**
Any offsets proposed must comply with DECCW's '*Principles for the use of Biodiversity Offsets in NSW*' identified in Attachment B. Justification for any area(s) proposed as compensatory habitat is to include assessment of the threatened species values impacted on by the proposed works and whether the proposed area(s) provides equivalent values	See the **Flora and Aquatic Ecological Assessment** prepared by the Hunter 8 Alliance
The EA must: • document all the known and likely threatened species, their habitats, population and ecological communities of the site (including any adjacent areas that may be indirectly impacted upon by the proposal). The accompanying report must provide details of survey methodologies and / or techniques utilised;	**Sections 2.0, 4 & 5**
The EA must: • provide a detailed assessment of the impacts on such species, habitats, population and ecological communities; and	**Section 6.0**
The EA must: • detail the actions that will be taken to avoid or mitigate impacts, or compensate or offset for unavoidable impacts of the project on threatened species, populations, ecological communities and their habitat.	**Section 7**
The proponent will need to engage a suitably qualified and experienced environmental consultant to conduct an appropriate flora and fauna survey, and provide an assessment report. This report will need to evaluate and mitigate any adverse impacts on such species, populations and communities in the investigation area, within the immediate vicinity and including both direct and indirect impacts (e.g. adverse hydrological changes). A recognised expert, from institutions such as the Australian Museum (Sydney), the National Herbarium at the Royal Botanic Gardens (Sydney) or the Queensland Herbarium (Brisbane), or who is otherwise considered acceptable by DECCW, must be used to determine or confirm the identification of species that are unknown or which have been only provisionally identified.	**This Report**

DECCW Submission to the DG Requirements	Relevant Section of this Report
Survey methods adopted must be those considered by experienced wildlife surveyors to be the ones most likely to detect the targeted subject species (more than one survey method must be utilised for those subject species for which complementary methods have the potential to result in a significant increase in detection). Ecological field survey requirements should apply the draft *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DECC 2004) and the *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009) (Attachment B).	**Section 4**
Survey effort (including intensity, repetition and coverage) must be at a level that can be reasonably expected to detect the subject species if present in the study area. Surveys are required to be undertaken during optimal climatic and seasonal conditions for all potentially occurring flora and fauna species and need to consider issues such as migratory species movements, the availability of shelter, breeding, pollination patterns and prerequisites, and also the relative availability of food resources and habitat. Recent (less than 5 years old) surveys and assessments may be used however, previous surveys will not be considered to have addressed this requirement if they have: • been undertaken in seasons or weather conditions when the target subject species are unlikely to be detected or present; or • utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate ones for detecting the target subject species; unless these differences can be clearly demonstrated to be likely to have had an insignificant impact upon the outcomes of the surveys. If a proposed survey methodology is likely to vary significantly from widely accepted methods, the proponent should discuss the proposed methodology with the DECCW prior to undertaking the surveys to determine whether DECCW considers alternative survey methods appropriate.	**Section 4**
In addition to general consideration of threatened species (and their habitat), endangered populations and ecological communities, particular attention should be given to impacts and proposed mitigation measures for threatened species and their breeding, nesting and foraging habitat known to occur on site or within the vicinity, including any likely indirect impacts on habitat and Endangered Ecological Communities which occur adjacent to or nearby to the proposal.	**Section 6.4**
<u>Compensatory strategies</u> The EA must document actions that will be taken to avoid or mitigate impacts, or compensate or offset for unavoidable impacts of the project on threatened species and their habitat. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented. The EA needs to clearly state whether it meets each of the key thresholds set out in the Guidelines detailed at Attachment B. Where significant modification of the proposal to minimise impacts on threatened species, populations or endangered communities is not possible then compensatory strategies should be considered (if applicable). These may include offsite or local area proposals that contribute to long term conservation of affected threatened species, populations or endangered ecological communities. Where such proposals involve other lands, or where involvement of community groups is envisaged in such proposals, such groups are to be consulted and proposals should contain evidence of support from these	**Section 7** Also see the **Flora and Aquatic Ecological Assessment** prepared by the Hunter 8 Alliance which details the

DECCW Submission to the DG Requirements	Relevant Section of this Report
stakeholders and relevant land managers. Compensatory benefits likely to result from such measures proposed for alternative sites are to be discussed and evaluated along with a discussion of mechanisms of how they might best occur. The tenure of lands, land use and potential future uses of lands proposed to support compensatory habitat should be considered. DECC would typically consider suitable measures to ensure conservation in perpetuity, such as (but not limited to) a Section 88B-E covenant of the *Conveyancing Act 1919* (Note: that a covenant under the *Conveyancing Act 1919* will require such an instrument to be lodged for registration under a new deposited plan or a plan of survey [refer to: http://rgdirections.lands.nsw.gov.au/plans/easementsandcovenants), a Voluntary Conservation Agreement under the *National Parks and Wildlife (NP&W) Act 1974*, a bio-banking agreement under the *Threatened Species Conservation Act 1995* and/or reservation of land under Part 4 of the *NP&W Act 1974*. The principles do not apply where there is legislation defining requirements for biodiversity offsets (e.g. under the *Native Vegetation Act 2003*).*"*	

6.4.1.2 Threatened Species Assessment under Part 3A of the EP&A Act

In accordance with the DoP DG requirements the following assessment addresses the potential effects of the Project on threatened fauna species or their habitats according to Appendix 3 of the *Draft Guidelines for Threatened Species Assessment* under Part 3A of the Environmental Planning and Assessment Act 1979 (DECC & DPI, 2005). Threatened fauna species known or with potential to occur within the study area are in **Section 6.2**. For the purposes of this report, where appropriate the subject species have been grouped according to similar behavioural characteristics or habitat requirements.

a) How is the proposal likely to affect the lifecycle of a threatened species and/or endangered population?

- Green and Golden Bell Frog (*Litoria aurea*) - Endangered

The green and golden bell frog was not recorded during field surveys of seven dams. Seven records on the Atlas of NSW Wildlife occur within 10 kilometres of the investigation area. Farm dams within the investigation area may provide suitable habitat for the species, particularly those with beds of tall reeds. The seven farm dams surveyed sampled the most likely habitat areas for the species (farm dams with tall reed beds). Surveys were undertaken during the DECC (2009) recommended survey period of August to February. While the species may occur at other farm dams due to its ability to turn up at unexpected locations, the probability of such an occurrence is considered unlikely. If the green and golden bell frog does occur on one or more of the dams within the investigation area and the dam(s) is/are isolated from other nearby occupied dams then the removal of the dam(s) would likely negatively affect the lifecycle of the population occurring at that/those dam(s). However given the species was not recorded during surveys of suitable habitat areas and is considered unlikely to occur at non-sampled dams, the removal of some farm dams would be unlikely to have an adverse affect on the life cycle of the species.

- Blue-billed Duck (*Oxyura australis*) - Vulnerable

The blue-billed duck was not recorded during field surveys however, limited habitat occurs in the form of farm dams along the investigation area. Farm dams may provide opportunistic foraging habitat for the species. Some farm dams within the investigation area will be removed (2.25 hectares). A large number of farm dams occur in the surrounding landscape and provide similar potential foraging locations for the blue-billed duck in the study locality. The removal of some farm dams would be unlikely to have an adverse affect on the life cycle of the species.

- Black-necked Stork (*Ephippiorhynchus asiaticus*) – Vulnerable

The black-necked stork was not recorded during field surveys however the black-necked stork may occasionally forage at the farm dams on the site during rare visits to the region. A large number of farm dams occur in the surrounding landscape and provide adequate foraging locations for the black-necked stork in the study locality. The Project is unlikely to have an adverse affect on the life cycle of the black-necked stork.

Raptors

- Square-tailed Kite (*Lophoictinia isura*) - Vulnerable
- Spotted Harrier (*Circus assimilis*) – Vulnerable (Preliminary Determination 8th May 2009)
- Little Eagle (*Hieraeetus morphnoides*) – Vulnerable (Preliminary Determination 8th May 2009)

The square-tailed kite, spotted harrier and little eagle were not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the three species. As each of the species are highly mobile species and have large home range areas the Project would be unlikely to have an adverse affect on the life cycle of the square-tailed kite, spotted harrier or little eagle.

Hollow Dependent Woodland Bird Species

- Glossy-black Cockatoo (*Calyptorhynchus lathami*) - Vulnerable
- Gang-gang Cockatoo (*Callocephalon fimbriatum*) - Vulnerable
- Little Lorikeet (*Glossopsitta pusilla*) – Vulnerable
- Turquoise Parrot (*Neophema pulchella*) - Vulnerable
- Brown Treecreeper (Climacteris picumnus) - Vulnerable
- Masked owl (*Tyto novaehollandiae*) - Vulnerable
- Powerful owl (*Ninox strenua*) – Vulnerable
- Barking owl (*Ninox connivens*) – Vulnerable

None of the above eight hollow dependent woodland birds were recorded during field surveys. The above eight woodland bird species require tree hollows for breeding and either woodland areas or woodland/grassland ecotone areas for foraging. The loss of potential foraging and nesting trees during clearing activities is unlikely to affect the lifecycles of the above hollow dependent bird species due to the small areas of vegetation to be removed from the woodland remnants along the investigation area. Additionally seven of the species have large home ranges and removal of some woodland areas along the investigation area would be unlikely to significantly reduce the home range area of any of the above species should they occur on the site. The brown treecreeper has a smaller home range area and the removal of woodland areas within the investigation area could result in the abandonment of home range areas within the investigation area. However the brown

treecreeper is a highly conspicuous bird and was not detected at any of the survey sites. There is the potential for some individuals to perish during tree felling activities (even with a tree felling protocol) however the chance of any of the above species nesting or roosting within the investigation is very low. The life cycles of the eight above woodland species would be unlikely to be affected by the Project.

Non-migratory and Non-hollow Dependent Woodland Bird Species

- Speckled Warbler (*Pyrrholaemus saggitatus*) - Vulnerable
- Black-chinned Honeyeater (*Melithreptus gularis gularis*) - Vulnerable
- Painted Honeyeater (*Grantiella picta*) - Vulnerable
- Hooded Robin (*Melanodryas cucullata cucullata*) – Vulnerable.
- Flame Robin (*Petrocia phoenicea*) – Vulnerable (Preliminary Determination 8 May 2009)
- Scarlet Robin (*Petroica multicolour*) – Vulnerable (Preliminary Determination 8 May 2009)
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) – Vulnerable
- Varied Sittella (*Daphoenositta chrysoptera*) – Vulnerable (Preliminary Determination 8 May 2009)
- Diamond Firetail (*Stagonopleura guttata*) - Vulnerable

The grey-crowned babbler and varied sittella were recorded during field surveys. The speckled warbler, black-chinned honeyeater, painted honeyeater, hooded robin, flame robin, scarlet robin and diamond firetail were not recorded during field surveys, however suitable habitat is present for each species. The above nine bird species forage and nest in woodland areas. The loss of potential foraging and nesting trees during clearing activities is unlikely to affect the lifecycles of the above hollow dependent bird species due to the small areas of vegetation to be removed from the woodland remnants along the investigation area. The life cycles of non-hollow dependent woodland bird species would be unlikely to be significantly affected by the Project.

Migratory Blossom Feeding Woodland Bird Species

- Regent Honeyeater (*Xanthomyza Phrygia*) – Endangered
- Swift Parrot (*Lathamus discolour*) – Endangered

The regent honeyeater and swift parrot were not recorded during field surveys. No suitable breeding habitat occurs in the investigation area for the swift parrot. The regent honeyeater may breed in the investigation area during suitable conditions. Due to the nomadic and migratory nature of the two species, either may appear at any suitable flowering winter eucalypts in south eastern Australia. Given the migratory and nomadic nature of the regent honeyeater and swift parrot and the resulting potential foraging area across south-eastern Australia, the area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the regent honeyeater or swift parrot. The life cycles of migratory blossom feeding woodland bird species would be unlikely to be significantly affected by the Project.

- Spotted-tailed Quoll (*Dasyurus maculatus*) - Vulnerable

The spotted-tailed quoll was not recorded during field surveys, however suitable habitat is present and the species may occur. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the spotted-tailed quoll, as the species has extremely large home range areas that likely encompass entire or several woodland remnants within the study locality. The Project would be unlikely to have an adverse affect on the life cycle of the spotted-tailed quoll.

- Brush-tailed Phascogale (*Phascogale tapoatafa*) - Vulnerable

The brush-tailed phascogale was not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging and denning woodland habitat in the investigation area or study locality for the brush-tailed phascogale. There is the potential for individual brush-tailed phascogales to perish during the tree felling process (even if a tree felling protocol is implemented). The loss of some individuals may disrupt the life cycle and if a small population is present, may place it at the risk of extinction. If a large population is present and extends into the woodland areas in the study locality the life cycle of any population would be less likely to be negatively impacted by the removal of some woodland for the Project. The Project would be unlikely to have an adverse affect on the life cycle of the brush-tailed phascogale.

- Koala (*Phascolarctos cinereus*) – Vulnerable

No koalas scats were recorded from 20 searches at the base of trees, no koala sized scratches were identified on smooth barked trees, no koalas were heard calling on or nearby to the investigation area, no koalas responded to call playback, no koalas were identified during spotlighting and no koalas were opportunistically sighted on the investigation area during diurnal surveys. It is unlikely that the koala occurs in the study area. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the koala. Individual koalas may perish during the felling process if present, however given the likely large home range areas in the investigation area only a very small proportion of any possible local population would be affected. The Project would be unlikely to negatively affect the life cycle of the koala.

Further assessment of the potential impacts of the Project on the koala is undertaken in **Section 6.4.3** (SEPP 44) of this report.

- Squirrel Glider (*Petaurus norfolcensis*) - Vulnerable

The squirrel glider was recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging and denning woodland habitat in the investigation area or study locality for the squirrel glider. Suitably sized tree hollows occur in the investigation area for the squirrel glider and there is the potential for individual squirrel gliders to perish during the tree felling process (even if a tree felling protocol is implemented). The loss of some individuals may disrupt the life cycle, depending on the size of the local population. If a small population is present, the loss of some individuals may place it at the risk of extinction. If a more likely large population is present and extends into the woodland areas adjacent to the investigation area and further into the study locality, the life cycle is less likely

to be negatively affected by the potential loss of some individuals. The Project would be unlikely to negatively affect the life cycle of the squirrel glider.

- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable

The grey-headed flying-fox was not recorded during field surveys but is likely to occur. Grey-headed flying-foxes forage over large areas (up to 50 km from their roosts) and due to the relatively small areas of woodland that would be removed it is unlikely that the removal of such vegetation would significantly impact on the life cycle of the grey-headed flying-fox. No breeding or shelter habitat in the form of a fly-fox camp occurred in the study area. The Project would be unlikely to have an adverse affect on the life cycle of the grey-headed flying-fox.

Hollow-roosting Bats

- Yellow-bellied Sheathtailed-bat (*Saccolaimus flaviventris*) – Vulnerable
- Eastern freetail-bat (*Mormopterus norfolkensis*) – Vulnerable
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*) – Vulnerable
- Greater broad-nosed bat (*Scoteanax rueppellii*) - Vulnerable

The eastern freetail-bat was recorded during field surveys. The yellow-bellied sheathtailed-bat, eastern false pipistrelle and greater broad-nosed bat were not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging and roosting woodland habitat in the investigation area or study locality for hollow-roosting bats. Suitably sized tree hollows occur in the investigation area for hollow-roosting bats and there is the potential for individuals to perish during the tree felling process (even if a tree felling protocol is implemented). The loss of some individuals may disrupt life cycles if small populations are present and may place them at the risk of extinction. If more likely large populations are present and extend into the woodland areas in the study area and study locality the life cycles of the species would be unlikely to be negatively affected. The Project would be unlikely to have an adverse affect on the life cycles of hollow-roosting bats.

Cave-roosting Bats

- Little bentwing-bat (*Miniopterus australis*) – Vulnerable
- Eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) – Vulnerable
- Large-eared pied bat (*Chalinolobus dwyeri*) - Vulnerable
- Eastern cave bat (*Vespadelus troughtoni*) – Vulnerable

The little bentwing-bat and eastern bentwing-bat were recorded during field surveys. The large-eared pied bat and eastern cave bat were not recorded during field surveys but may occur. No roosting or breeding habitat in the form of tunnels or caves occurred in the investigation area. Possible short-term roosting sites occur within culverts and bridges under the railway line. The investigation area provides potential foraging habitat for cave-roosting bats. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the study area or study locality for cave-roosting bats. There is some potential that possible roost sites within culverts and bridges may be disturbed during construction. The Project would be unlikely to have an adverse affect on the life cycle of cave-roosting bats.

- Large-footed Myotis (*Myotis macropus*) - Vulnerable

The large-footed myotis was recorded during field surveys. An area of approximately 2.25 hectares of farm dams would be removed for the Project and would be unlikely to significantly reduce the amount of potentially suitable foraging habitat in the study area or study locality for the southern myotis. Suitably sized tree hollows occur in the investigation area for the southern myotis and there is the potential for individuals to perish during the tree felling process. The species also roosts in caves, mines, bridges and abandoned fairy martin nests. The potential loss of some individuals may disrupt the life cycle and if a small population is present, may place it at the risk of extinction. If more likely large populations are present and extend into the study area and study locality the life cycles of the species would be unlikely to be negatively affected. The Project would be unlikely to have an adverse affect on the life cycle of the large-footed myotis.

b) How is the proposal likely to affect the habitat of a threatened species, endangered population or endangered ecological community?

The Project would result in the removal or modification of areas of woodland vegetation from the investigation area. **Table 15** above lists the area of each vegetation community that would be removed or modified by the Project. The Project would also result in the removal of 2.25 hectares of farm dams and the re-alignment of approximately 100 metres of Sawyers Creek.

The loss of the areas of woodland is unlikely to affect species' ability to move within the landscape due to the presence of woodland areas adjacent to most areas of woodland to be removed from the investigation area. The ecological integrity/security of surrounding habitat would be unlikely to be affected by the removal of the areas of areas of woodland from the investigation area.

Except for the green and golden bell frog, due to the availability of similar farm dam and grazing paddock habitat within the study locality, the areas of farm dam and grazing paddock habitat within the investigation area that would be removed are of low importance to the long-term survival of the threatened species, populations and ecological communities in the locality. If the green and golden bell frog occurs at farm dams in the investigation area that would be removed, the removal of those farm dams could remove the suitable habitat for the species in the study area.

c) Does the proposal affect any threatened species or endangered population that are at the limit of its known distribution?

None of the threatened species in this assessment are at the limit of their known distribution in the investigation area or study locality.

d) How is the proposal likely to affect current disturbance regimes?

Current disturbance regimes within the study area include:

- Stock grazing
- Railway traffic (trains and service vehicles)
- Land clearing
- Fire
- Weed invasion
- Human presence

The level of stock grazing adjacent to the existing two tracks would not be expected to change if the third track is constructed.

The addition of the third track would increase the number and frequency of trains and service vehicles within the railway corridor and would likely result in an increase number of collisions between trains and fauna species. Increases in railway traffic would also likely increase the potential impacts from increases in noise and vibration from passing trains. Such impacts would be likely to be minor on fauna species.

The construction of the third track would result in further land clearing within the study locality but at the same time result in the protection of other areas of woodland within the region through the implementation of a Compensatory Habitat Policy by ARTC.

The prevalence of wild fire would be unlikely to change significantly during the construction or operation of the Project, however the increased movements of people and vehicles within the investigation area during the construction phase could see a rise in the number of accidental fires.

The area and level of weed invasion would be unlikely to change due to the continuation of weed management and control strategies within the rail corridor by the Proponent.

An increased level of human activity across the investigation area would see a resulting increased level of wildlife disturbance.

e) How is the proposal likely to affect habitat connectivity?

The removal of areas of woodland from the investigation area would result in a minor increase in the degree of fragmentation, edge effects and isolation of surrounding woodland, as the remaining woodland area within the study locality reduces slightly, the ratio of edge to remaining woodland increases and remaining woodland areas become isolated from each other by a slightly larger distance. The removal of farm dams from the investigation area would result in an increase in the degree of fragmentation and isolation of surrounding farm dams as the remaining area of farm dams within the study locality reduces and remaining farm dams become isolated from each other by a larger distance.

f) How is the proposal likely to affect critical habitat?

No critical habitat is currently listed on the NSW TSC Act for the threatened species within the study locality.

6.4.1.3 Conclusion to Part 3A Assessment for Threatened Fauna

Following an assessment of the potential impacts of the Project (**Section 6.4**) it was found that the Project would be unlikely to significantly impact upon the 39 threatened species identified with potential habitat in the investigation area and listed on the TSC Act.

The implementation of mitigation measures recommended in this report and the development of a Compensatory Habitat Policy, in consultation with DECCW, would further reduce the level of potential impact on threatened fauna species and their habitats.

6.4.2 Assessment of Significance under Part 3A of the EP&A Act

While DECCW submissions to the DoP DGRs are not strict requirements for assessment, they have been addressed here satisfy DECCW recommendations. Of the two assessment tools identified in the DECCW submission that can be used by proponents for the purpose of assessment under Part 3A of the EP&A Act, the factors identified in the *Threatened Species Assessment Guidelines – The Assessment of Significance* (DECC 2007 and NSW DPI 2008) have been used to assess the level of impact on threatened fauna species. The factors combined are commonly referred to as a 7-part test.

Seven threatened fauna species were recorded within the investigation area during the field habitat assessment and targeted fauna survey. Based on a comparison of the habitat types present (**Section 0**) with the habitat requirements of other threatened species identified during the literature and database searches (**Section 2**), 32 other threatened fauna species on the TSC Act were identified with some potential to occur (**Section 6.1**). The potential impact of the Project on the 39 threatened species listed on the TSC Act is assessed below via 7-part tests. Species sharing similar habitat requirements have been grouped together.

(a) ***In the case of a threatened species, whether the action proposed is likely to have an adverse affect 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.***

- Green and Golden Bell Frog (*Litoria aurea*) - Endangered

The green and golden bell frog was not recorded during field surveys of seven farm dams. Seven records on the Atlas of NSW Wildlife occur within 10 kilometres of the investigation area. Farm dams within the investigation area may provide suitable habitat for the species, particularly those with beds of tall reeds. The seven farm dams surveyed sampled the most likely habitat areas for the species (farm dams with tall reed beds). Surveys were undertaken during the DECC (2009) recommended survey period of August to February. While the species may occur at other farm dams due to its ability to turn up at unexpected locations, the probability of such an occurrence is considered unlikely. If the green and golden bell frog does occur on one or more of the dams within the investigation area and the dam(s) is/are isolated from other nearby occupied dams then the removal of the dam(s) would likely negatively affect the lifecycle of the population occurring at that/those dam(s). However given the species was not recorded during surveys of suitable habitat areas and is considered unlikely to occur at non-sampled dams, the removal of some farm dams would be unlikely to have an adverse affect 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.

- Blue-billed Duck (*Oxyura australis*) - Vulnerable

The blue-billed duck was not recorded during field surveys however, limited habitat occurs in the form of farm dams along the investigation area. Farm dams may provide opportunistic foraging habitat for the species. Some farm dams within the investigation area will be removed (2.25 hectares). A large number of farm dams occur in the surrounding landscape and provide similar potential foraging locations for the blue-billed duck in the study locality The removal of some farm dams would be unlikely to have an adverse affect 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.

- Black-necked Stork (*Ephippiorhynchus asiaticus*) – Vulnerable

The black-necked stork was not recorded during field surveys, however the black-necked stork may occasionally forage at the farm dams on the site during rare visits to the region. A large number of farm dams occur in the surrounding landscape and provide adequate foraging locations for the black-necked stork in the study locality. The Project is unlikely to have an adverse affect on the life cycle of the black-necked stork such that a viable local population of the black-necked stork would be likely to be placed at the risk of extinction.

- Square-tailed Kite (*Lophoictinia isura*) - Vulnerable

The square-tailed kite was not recorded during field surveys. The area of woodland habitat to be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the square-tailed kite. The Project would be unlikely to have an adverse affect on the life cycle of the square-tailed kite such that a viable population of the species would be likely to be placed at risk of extinction.

- Spotted Harrier (*Circus assimilis*) – Vulnerable (Preliminary Determination 8 May 2009)

The spotted harrier was not recorded during field surveys.The spotted harrier may occasionally forage across the grazing land in the investigation area during rare visits to the study locality. A large area of grazing land occurs in the surrounding landscape and provides adequate foraging locations for the spotted harrier within the study locality. The Project would be unlikely to have an adverse affect on the life cycle of the spotted harrier such that a viable local population of the spotted harrier would be likely to be placed at the risk of extinction.

- Little Eagle (*Hieraeetus morphnoides*) – Vulnerable (Preliminary Determination 8 May 2009)

The little eagle was not recorded during field surveys. The area of woodland habitat to be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the little eagle. The Project is unlikely to have an adverse affect on the life cycle of the little eagle such that a viable population of the species would be likely to be placed at risk of extinction.

- Glossy-black Cockatoo (*Calyptorhynchus lathami*) - Vulnerable

The glossy-black cockatoo was not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging habitat in the investigation area or study locality for the glossy-black cockatoo. A very low density of suitably sized tree hollows occurs in the investigation site for the glossy-black cockatoo, however the species is unlikely to nest in open areas and disturbed areas such as along a busy railway line. The Project is unlikely to have an adverse affect on the life cycle of the glossy-black cockatoo such that a viable population of the species would be likely to be placed at risk of extinction.

- Gang-gang Cockatoo (*Callocephalon fimbriatum*) - Vulnerable

The gang-gang cockatoo was not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging habitat in the investigation area or study locality for the gang-gang cockatoo. A very low density of suitably sized tree hollows occurs in the investigation site for gang-gang cockatoo, however the species is unlikely to nest in open areas and disturbed areas such as along a busy railway line. The Project would be unlikely to have an adverse affect on the life cycle of the gang-gang cockatoo such that a viable population of the species would be likely to be placed at the risk of extinction.

- Little Lorikeet (*Glossopsitta pusilla*) – Vulnerable

The little lorikeet was not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the study area or study locality for the little lorikeet. The Project would be unlikely to have an adverse affect on the life cycle of the little lorikeet such that a viable population of the species would be likely to be placed at the risk of extinction.

- Turquoise Parrot (*Neophema pulchella*) - Vulnerable

The turquoise parrot was not recorded during field surveys. The area of woodland and grassland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the study area or study locality for the turquoise parrot. The Project would be unlikely to have an adverse affect on the life cycle of the turquoise parrot such that a viable population of the species would be likely to be placed at the risk of extinction.

- Swift Parrot (*Lathamus discolor*) – Endangered

The swift parrot was not recorded during field surveys. Due to the nomadic and migratory nature of the species, the swift parrot may appear at any suitable flowering winter eucalypts in south eastern Australia (reaching as far north as southern Queensland). Given the migratory and nomadic nature of the swift parrot and the resulting potential foraging area across south-eastern Australia, the area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the swift parrot. The Project would be unlikely to have an adverse affect on the life cycle of the swift parrot such that a viable population of the swift parrot would be likely to be placed at the risk of extinction.

Forest Owls

- Masked owl (*Tyto novaehollandiae*) - Vulnerable
- Powerful owl (*Ninox strenua*) – Vulnerable
- Barking owl (*Ninox connivens*) – Vulnerable

No forest owls were recorded during the field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging and breeding woodland habitat in the investigation area or study locality for threatened forest owls, nor would it be likely to significantly impact on the prey species of the threatened forest owls. A low density of suitable denning hollows for the owls occurs within the investigation area and there is the potential for individual owls to perish during the tree felling process (even with a tree felling

protocol). The loss of some individuals may disrupt the life cycle and if a small population is present, may place it at the risk of extinction. If a large population is present and extends into the woodland areas in the study locality the population is unlikely to be placed at the risk of extinction by the potential loss of some individuals. As no forest owls were recorded and they only potentially occur, the Project would be unlikely to have an adverse affect on the life cycle of threatened forest owls such that viable populations of their species would be likely to be placed at risk of extinction.

- Brown Treecreeper (Climacteris picumnus) - Vulnerable

The brown treecreeper was not recorded during the field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the brown treecreeper. The Project is unlikely to have an adverse affect on the life cycle of the brown treecreeper such that a viable population of the species would be likely to be placed at risk of extinction.

- Speckled Warbler (*Pyrrholaemus saggitatus*) - Vulnerable

The speckled warbler was not recorded during the field surveys. The area of woodland habitat to be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the speckled warbler. The Project is unlikely to have an adverse affect on the life cycle of the speckled warbler such that a viable population of the species would be likely to be placed at risk of extinction.

- Black-chinned Honeyeater (*Melithreptus gularis gularis*) - Vulnerable

The black-chinned honeyeater was not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the black-chinned honeyeater. The Project would be unlikely to have an adverse affect on the life cycle of the black-chinned honeyeater such that a viable population of the species would be likely to be placed at risk of extinction.

- Regent Honeyeater (*Xanthomyza Phrygia*) – Endangered

The regent honeyeater was not recorded during the field surveys. Due to the nomadic and migratory nature of the species, the regent honeyeater may appear at any suitable flowering winter eucalypts in south eastern Australia. Given the migratory and nomadic nature of the regent honeyeater and the resulting potential foraging area across south-eastern Australia, the area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the regent honeyeater. The Project would be unlikely to have an adverse affect on the life cycle of the regent honeyeater such that a viable population of the regent honeyeater would be likely to be placed at risk of extinction.

- Painted Honeyeater (*Grantiella picta*) - Vulnerable

The painted honeyeater was not recorded during field surveys. The area of woodland habitat (containing a low to moderate density of mistletoe infestation) that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the painted honeyeater. The Project would be unlikely to have an adverse affect on the life cycle of the painted honeyeater such that a viable population of the painted honeyeater would be likely to be placed at risk of extinction.

- Hooded Robin (*Melanodryas cucullata cucullata*) – Vulnerable.

The hooded robin was not recorded during field surveys. The area of woodland and grassland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland and grassland habitat in the investigation area or study locality for the hooded robin. The Project would be unlikely to have an adverse affect on the life cycle of the hooded robin such that a viable population of the species would be likely to be placed at risk of extinction.

- Flame Robin (*Petrocia phoenicea*) – Vulnerable (Preliminary Determination 8 May 2009)

The flame robin was not recorded during field surveys. The flame robin may occur in the investigation area during northern winter migration movements from southern breeding areas in Victoria and southern NSW. The areas of woodland and grassland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland and grassland habitat in the investigation area or study locality for the flame robin. The Project would be unlikely to have an adverse affect on the life cycle of the flame robin such that a viable population of the flame robin would be likely to be placed at risk of extinction.

- Scarlet Robin (*Petroica multicolour*) – Vulnerable (Preliminary Determination 8 May 2009)

The scarlet robin was not recorded during field surveys. The scarlet robin may occur in the investigation area during northern winter migration movements from southern breeding areas in Victoria and southern NSW. The areas of woodland and grassland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland and grassland habitat in the investigation area or study locality for the scarlet robin. The Project would be unlikely to have an adverse affect on the life cycle of the scarlet robin such that a viable population of the scarlet robin would be likely to be placed at risk of extinction.

- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) – Vulnerable

The grey-crowned babbler was recorded at all field survey sites and a number of nests were also recorded at each site. The grey-crowned babbler and its nest likely also occur at many of the smaller woodland remnants within the investigation area. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of woodland habitat in the study area or study locality for the grey-crowned babbler, however a large number of nests would be destroyed. As abandoned nests persist in trees for extended periods only a small proportion of nests within the investigation areas are likely to be active roosting or breeding nests. If clearing activities are undertaken during the breeding season of the grey-crowned babbler, individuals may perish during the clearing process. Even if clearing is undertaken during the breeding season the loss of a small number of individuals would be unlikely to affect the life cycle of the grey-crowned babbler

such that a viable population of the grey-crowned babbler would be likely to be placed at risk of extinction.

- Varied Sittella (*Daphoenositta chrysoptera*) – Vulnerable (Preliminary Determination 8 May 2009)

The varied sittella was recorded at one site during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the varied sittella. The Project would be unlikely to have an adverse affect on the life cycle of the varied sittella such that a viable population of the varied sittella would be likely to be placed at risk of extinction.

- Diamond Firetail (*Stagonopleura guttata*) - Vulnerable

The diamond firetail was not recorded during field surveys. The area of woodland and grassland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland and grassland habitat in the investigation area or study locality for the diamond firetail. The Project is unlikely to have an adverse affect on the life cycle of the diamond firetail such that a viable population of the diamond firetail would be likely to be placed at risk of extinction.

- Spotted-tailed Quoll (*Dasyurus maculatus*) - Vulnerable

The spotted-tailed quoll was not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the spotted-tailed quoll. The Project would be unlikely to have an adverse affect on the life cycle of the spotted-tailed quoll such that a viable population of the spotted-tailed quoll would be likely to be placed at risk of extinction.

- Brush-tailed Phascogale (*Phascogale tapoatafa*) - Vulnerable

The brush-tailed phascogale was not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging and denning woodland habitat in the investigation area or study locality for the brush-tailed phascogale. There is the potential for individual brush-tailed phascogales to perish during the tree felling process. The loss of some individuals may disrupt the life cycle and if a small population is present, may place it at the risk of extinction. If a large population is present and extends into the woodland areas in the study locality, the population is less likely to placed at the risk of extinction by the potential loss of some individuals. The Project would be unlikely to have an adverse affect on the life cycle of the brush-tailed phascogale such that a viable population of the brush-tailed phascogale would be likely to be placed at risk of extinction.

- Koala (*Phascolarctos cinereus*) – Vulnerable

The koala was not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the investigation area or study locality for the koala. Individual koalas may perish during the felling process however given the likely large home range areas in the investigation area only a very small proportion of any possible local population would be affected. The Project would be unlikely to have an adverse affect on the life cycle of the koala such that a viable population of the koala would be likely to be placed at risk of extinction.

Further assessment of the potential impacts of the Project on the koala is undertaken in **Section 6.4.3** (SEPP 44) of this report.

- Squirrel Glider (*Petaurus norfolcensis*) - Vulnerable

The squirrel was recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging and denning woodland habitat in the investigation area or study locality for the squirrel glider. Suitably sized tree hollows occur in the investigation area for the squirrel glider and there is the potential for individual squirrel gliders to perish during the tree felling process. The loss of some individuals may disrupt the life cycle and if a small population is present, may place it at the risk of extinction. If a more likely large population is present and extends into the woodland areas in the study locality the population is unlikely to be placed at the risk of extinction by the potential loss of some individuals.

- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable

The grey-headed flying-fox was not recorded during field surveys but is likely to occur. Grey-headed flying-foxes forage over large areas (up to 50 km from their roosts) and due to the relatively small areas of woodland and isolated farm trees that would be removed it is unlikely that the removal of such vegetation would significantly impact on the life cycle of the grey-headed flying-fox. No breeding or shelter habitat in the form of a fly-fox camp occurred in the study area. The Project would be unlikely to have an adverse affect on the life cycle of the grey-headed flying-fox such that a viable local population of the grey-headed flying-fox would be likely to be placed at the risk of extinction.

Cave-roosting Bats

- Little bentwing-bat (*Miniopterus australis*) – Vulnerable
- Eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) – Vulnerable
- Large-eared pied bat (*Chalinolobus dwyeri*) - Vulnerable
- Eastern cave bat (*Vespadelus troughtoni*) – Vulnerable

The little bentwing-bat and eastern bentwing-bat were recorded during field surveys. The large-eared pied bat and eastern cave bat were not recorded during field surveys but may occur. No roosting or breeding habitat in the form of tunnels or caves occurred in the investigation area. Possible short-term roosting sites occur within culverts under the railway line in culverts and bridges. The investigation area provides potential foraging habitat for cave-roosting bats. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable woodland habitat in the study area or study locality for cave-roosting

bats. The Project would be unlikely to have an adverse affect on the life cycle of cave-roosting bats such that viable populations of cave-roosting bats would be likely to be placed at risk of extinction.

Hollow-roosting Bats

- Yellow-bellied Sheathtailed-bat (*Saccolaimus flaviventris*) – Vulnerable
- Eastern freetail-bat (*Mormopterus norfolkensis*) – Vulnerable
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*) – Vulnerable
- Greater broad-nosed bat (*Scoteanax rueppellii*) - Vulnerable

The eastern freetail-bat was recorded during field surveys. The yellow-bellied sheathtailed-bat, eastern false pipistrelle and greater broad-nosed bat were not recorded during field surveys. The area of woodland habitat that would be removed for the Project would not significantly reduce the amount of potentially suitable foraging and roosting woodland habitat in the investigation area or study locality for hollow-roosting bats. Suitably sized tree hollows occur in the investigation area for hollow-roosting bats and there is the potential for individuals to perish during the tree felling process. The loss of some individuals may disrupt life cycles if small populations are present and may place them at the risk of extinction. If more likely large populations are present and extend into the woodland areas in the study locality the populations are less likely to placed at the risk of extinction by the potential loss of some individuals. The Project would be unlikely to have an adverse affect on the life cycle of hollow-roosting bats such that viable populations of hollow-roosting bats would be likely to be placed at risk of extinction.

- Large-footed Myotis (*Myotis macropus*) - Vulnerable

The area of water bodies (farm dams, 2.25 hectares) and woodland habitat that would be removed or modified for the Project would not significantly reduce the amount of potentially suitable foraging and roosting habitat in the study area or study locality for the large-footed myotis. Suitably sized tree hollows occur in the investigation area for the southern myotis and there is the potential for individuals to perish during the tree felling process. The species also roosts in caves, mines, bridges and abandoned fairy martin nests. The potential loss of some individuals may disrupt the life cycle and if a small population is present, may place it at the risk of extinction. If a large population is present and extends into the study locality the population is less likely to be placed at the risk of extinction by the potential loss of some individuals. The Project would be unlikely to have an adverse affect on the life cycle of the large-footed myotis such that viable populations of the large-footed myotis would be likely to 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 likely to be placed at risk of extinction.***

Not applicable, no endangered populations are known or likely to occur in the study locality.

(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.

Endangered ecological communities and critically endangered ecological communities have been investigated as part of a separate flora assessment for the investigation area prepared by the Hunter 8 Alliance.

(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

(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

(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.

- Green and golden bell frog
- Blue-billed duck
- Black-necked stork
- Square-tailed kite
- Spotted harrier
- Little eagle
- Glossy black-cockatoo
- Gang-gang cockatoo
- Little lorikeet
- Turquoise parrot
- Swift parrot
- Masked owl
- Powerful owl
- Barking owl
- Brown treecreeper
- Speckled warbler
- Black-chinned honeyeater
- Regent honeyeater
- Painted honeyeater
- Hooded robin
- Flame robin
- Scarlet robin
- Grey-crowned babbler
- Varied sittella
- Diamond firetail
- Spotted-tailed quoll
- Brush-tailed phascogale
- Koala
- Squirrel glider
- Grey-headed flying-fox
- Yellow-bellied sheathtailed-bat
- Eastern freetail-bat
- Eastern bentwing-bat
- Little bentwing-bat
- Large-eared pied bat
- Eastern false pipistrelle
- Southern myotis
- Greater broad-nosed bat
- Eastern cave bat

(i) The Project would result in the removal or modification of areas of vegetation from the investigation area. **Table 15** above lists the area of each vegetation community that would be removed or modified by the Project. The Project would also result in the removal of several farm dams and the re-alignment of approximately 100 metres of Sawyers Creek.

(ii) The removal of areas of woodland from the investigation area would result in a minor increase in the degree of fragmentation and isolation of surrounding woodland as the remaining woodland area within the study locality reduces slightly and remaining woodland areas become isolated from each other by a slightly larger distance. The removal of farm dams (2.25 hectares) from the study area would result in an increase in the degree of

fragmentation and isolation of farm dam habitat. The degree of fragmentation and isolation would increase as the remaining area of farm dams within the study locality reduces and remaining farm dams become isolated from each other by a larger distance.

(iii) The loss of the areas of woodland is unlikely to affect species' ability to move within the landscape due to the presence of woodland areas adjacent to most areas of woodland to be removed from the investigation area. The ecological integrity/security of surrounding habitat would be unlikely to be affected by the removal of areas of woodland from the investigation area. However the area of habitat that would be removed has a high level of long term importance for most species in the study locality as current and future developments within the study locality and region result in a cumulative regional decline in the amount of available woodland habitat for fauna species.

Due to the availability of similar farm dam and grazing paddock habitat within the study locality, the areas of farm dam and grazing paddock habitat within the investigation area that would be removed is of low importance to the long-term survival of the species, populations and ecological communities in the locality.

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

No areas of designated critical habitat identified under the provisions of the *Threatened Species Conservation Act* 1995 apply to the study area (see **Section 3.1.5**).

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

- Blue-billed duck
- Black-necked stork
- Square-tailed kite
- Spotted harrier
- Little eagle
- Glossy black-cockatoo
- Gang-gang cockatoo
- Little lorikeet
- Turquoise parrot
- Swift parrot
- Brown treecreeper
- Speckled warbler
- Black-chinned honeyeater
- Regent honeyeater
- Painted honeyeater
- Hooded robin
- Flame robin
- Scarlet robin
- Grey-crowned babbler
- Varied sittella
- Diamond firetail
- Spotted-tailed quoll
- Brush-tailed phascogale
- Squirrel glider
- Grey-headed flying-fox
- Yellow-bellied sheathtail-bat
- Eastern freetail-bat
- Eastern bentwing-bat
- Little bentwing-bat
- Large-eared pied bat
- Eastern false pipistrelle
- Southern myotis
- Greater broad-nosed bat
- Eastern cave bat

No draft or final recovery plans or threat abatement plans or threatened species priorities action statements are listed on the Department of Environment, Climate Change and Water website (DECCW 2009) for the above species.

- Green and Golden Bell Frog (*Litoria aurea*) - Endangered

While it is considered unlikely that the green and golden bell frog occurs within the investigation area, if it does occur at one or more farm dams within the investigation area and those farms dams were to be removed or modified the Project would be inconsistent with the first three specific objectives of the draft recovery plan for the green and golden bell frog (DEC 2005). The three objectives are:

- Increase the security of key green and golden bell frog populations by way of preventing the further loss of green and golden bell frog habitat at key populations across the species range and where possible secure opportunities for increasing protection of habitat areas (Section 10 of draft recovery plan).
- Ensure extant green and golden bell frog populations are managed to eliminate or attenuate the operation of factors that are known or discovered to be detrimentally affecting the species (Section 11 of draft recovery plan).
- Implement habitat management initiatives that are informed by data obtained through investigations into the general biology and ecology of the green and golden bell frog through a systematic and coordinated monitoring program (Section 12 of the draft recovery plan)

- Powerful Owl (*Ninox strenua*) – Vulnerable
- Masked owl (*Tyto novaehollandiae*) - Vulnerable

As the investigation area is potential habitat for the powerful owl and masked owl, the proposed removal of some woodland habitat as part of the Project is inconsistent with objective 5 (minimise loss and fragmentation of owl habitat areas) of the large forest owl recovery plan.

- Barking Owl (*Ninox connivens*) – Vulnerable

If barking owls use the investigation area the Project would be inconsistent with actions 3a (protect known barking owl nest sites and surrounding habitat) and 3.2 (assist with the protection of barking owl habitat from disturbance due to developments and activities) of the Recovery Plan for the barking owl (DECC 2003). The development of a Compensatory Habitat Policy may be consistent with actions 3a and 3.2 if known barking owl habitat is included within the potential offset area(s).

- Koala (*Phascolarctos cinereus*) – Vulnerable

As no koalas were identified or are likely to occur in the investigation area the Project is consistent with the objectives of the Recovery Plan for the Koala (DECC 2008) and the National Koala Conservation Strategy (ANZECC 1998). However if koalas use the investigation area the Project would be inconsistent with objective 1a (identify and conserve habitat important for koala conservation) of the Recovery Plan for the Koala (DECC 2008) and objective 1.1 (identify and conserve habitat important for koala conservation) of the National Koala Conservation Strategy (ANZECC 1998). The development of a Compensatory Habitat Policy may be consistent with objectives 1a and 1.1 if known koala habitat is included within the potential offset area(s).

(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.*

To date, thirty-two (32) key threatening processes are listed on Schedule 3 of the TSC Act. Five are relevant to the Project and are discussed below.

1. Clearing of Native Vegetation

The Project would see the removal of woodland habitat. The removal of the woodland would increase the impact of the clearing of native vegetation key threatening process listed on Schedule 3 of the TSC Act.

2. Loss of Hollow-bearing Trees

The Project would result in the removal of hollow-bearing trees. The removal of hollow-bearing trees would increase the impact of the loss of hollow-bearing trees key threatening process listed on Schedule 3 of the TSC Act.

3. Removal of Dead Wood and Dead Trees

The Project would result in the removal of some dead standing trees and dead wood. Dead wood in the form of logs were uncommon but occurred in parts of the investigation area. The removal of dead wood and dead trees would increase the impact of the removal of dead wood and dead trees key threatening process listed on Schedule 3 of the TSC Act.

4. Human-caused Climate Change

The Project may result in an exacerbation of human-caused climate change through the facilitation of an increased vehicle and train traffic load. The Project may contribute to human-caused climate change.

5. Infection of Native Plants by Phytophthora cinnamomi

The potential introduction and/or spread of root rot fungus (*Phytophthora cinnamomi*) during earth works has the potential to significantly reduce the habitat quality of nearby existing and/or rehabilitated habitat areas. The Project may contribute to the infection of native plants by *Phytophthora cinnamomi*.

6. Infection of frogs by amphibian chytrid causing the disease chytridiomycosis

The movement of water, soil or plant matter from wet areas or onto the investigation area during construction has the potential to spread chytrid fungus. The level of chytrid fungus prevalence on the investigation area and in the surrounding area is unknown but should not be assumed to be absent.

6.4.2.1 Seven-part Test Conclusions

Following an assessment of the potential impacts of the Project (**Section 6.4**) it was found that the Project is unlikely to significantly impact upon the 39 threatened species identified with potential habitat in the investigation area and listed on the TSC Act. The implementation of mitigation measures recommended in this report and the development of a Compensatory Habitat Policy, in consultation with DECCW, would further reduce the level of potential impact on threatened fauna species and their habitats.

6.4.3 SEPP 44 – Koala Habitat Protection

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

a) identification of "potential Koala Habitats" within the proposed development area; if the total tree cover contains 15% or more of the koala food tree species listed in Schedule 2 of SEPP 44 then it is deemed to be "potential" koala habitat. Identification of 'potential koala habitat requires the determination of the presence of 'core koala habitat';
b) identification of "core Koala habitat" within the development area. "Core Koala habitat" is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;
c) identification of "core Koala habitat" will require that a plan of management must accompany the DA application;
d) if the rezoning of lands, other than to environmental protection, involves potential or core Koala habitat then the Director of planning may require a local environmental study be carried out.

Singleton, Cessnock and Maitland LGAs are listed on Schedule 1 of SEPP 44 and therefore the Project is subject to SEPP 44 assessment. Forest red gum (*Eucalyptus tereticornis*) a Schedule 2 listed food tree species on SEPP 44 was present at more than 15 percent of the canopy cover along various parts of the investigation area identifying the site as 'potential koala habitat'. However the site is highly unlikely to comprise 'core koala habitat'. No koalas scats were recorded from 20 searches at the base of trees, no koala sized scratches were identified on smooth barked trees, no koalas were heard calling on or nearby to the investigation area, no koalas responded to call playback, no koalas were identified during spotlighting and no koalas were opportunistically sighted on the investigation area during diurnal surveys. A resident population of koalas was not identified on the investigation area and as such the investigation area is unlikely to form 'core koala habitat'. No further assessment under SEPP 44 is required.

Assessment of the potential impact of the Project on the koala has also been undertaken in accordance with the TSC Act in **Section 6.4**.

6.5 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act was gazetted in 2000 and replaced several earlier Commonwealth statutes. This Act focuses Commonwealth interests on matters of national environmental significance (NES) including integrated biodiversity conservation and the management of important protected areas. The Act also establishes a streamlined environmental assessment and approvals process.

The matters of NES as identified in the Act which require assessment and approval to be addressed by the Commonwealth include:

- World Heritage properties
- National Heritage places
- RAMSAR wetlands
- Nationally threatened species and ecological communities (Part 13, Division 1, Subdivision A of the EPBC Act)
- Migratory species
- Commonwealth Marine areas
- Nuclear actions (including uranium mining)

The assessment and approval process applies to any action that has, will have or is likely to have a significant impact on a matter of NES. An 'action' is defined as a project, development, undertaking or an activity or series of activities.

With regard to fauna, the only matters of NES relevant to the study area are nationally listed threatened species and migratory species. Those species that occur or could potentially occur within the study area and are subject to assessment pursuant to the Act are as follows:

Endangered Species

- Swift parrot
- Spotted-tailed quoll
- Regent honeyeater

Vulnerable Species

- Green and golden bell frog
- Grey-headed flying-fox
- Large-eared pied bat

Migratory species

- Cattle egret
- Great egret
- White-throated needletail
- Fork-tailed swift
- Latham's snipe
- Rainbow bee-eater
- Regent honeyeater
- Rufous Fantail
- Satin flycatcher
- Wanderer butterfly

The relevant criteria given in the administrative guidelines for the Act to determine whether the action will or is likely to have a significant impact on nationally threatened species' are as follows:

Table 16. Assessment of Potential Impact on Species Listed Under the EPBC ACT 1999.

Significant Impact Criteria and Assessment	
Critically Endangered and Endangered Species Swift Parrot, Regent Honeyeater and Spotted-tailed Quoll	
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	*a) lead to a long-term decrease in the size of a population;* The swift parrot and regent honeyeater are only likely to visit the study area on an opportunistic, occasional or rare basis. If spotted-tailed quolls occur in the study area would only provide a small fraction of the daily habitat requirements of the species. Due to the small area of vegetation that would be removed the Project would be unlikely to lead to a long-term decrease in the size of any populations of the swift parrot, regent honeyeater or spotted-tailed quoll.
	b) reduce the area of occupancy of the species; Approximately 80.4 hectares of remnant woodland and potential foraging habitat for the swift parrot, regent honeyeater and spotted-tailed quoll would be lost as a result of the Project. The removal of such habitat would be unlikely to reduce the area of occupancy of the swift parrot, regent honeyeater or spotted-tailed quoll.
	c) fragment an existing population into two or more populations; The Project is highly unlikely to fragment an existing population of the swift parrot, regent honeyeater or spotted-tailed quoll into two or more populations.
	d) adversely affect habitat critical to the survival of a species; The Project would not adversely affect habitat critical to the survival of the swift parrot, regent honeyeater or spotted-tailed quoll.
	e) disrupt the breeding cycle of a population; No breeding habitat for the swift parrot or regent honeyeater has been recorded within the investigation area and none is likely to occur. Breeding habitat of the spotted-tailed quoll may occur in the investigation area but is more likely to occur in the study locality that adjacent to the railway line in the investigation area. The Project would not disrupt the breeding cycle of a population of the swift parrot, regent honeyeater or spotted-tailed quoll.
	f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; The Project would not affect the habitat of the swift parrot, regent honeyeater or spotted-tailed quoll to such an extent that one or more of these species would be likely to decline.
	g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;* The Project is highly unlikely to result in an invasive species harmful to the swift parrot, regent honeyeater or spotted-tailed quoll from becoming established within the investigation area.
	h) introduce disease that may cause the species to decline; or The Project is highly unlikely to result in the introduction of a disease that would cause the swift parrot, regent honeyeater or spotted-tailed quoll to decline.
	i) interfere with the recovery of the species. While the Project would result in the loss of some potential foraging habitat for the swift parrot, regent honeyeater and spotted-tailed quoll, this would not interfere significantly with the recovery of any of the species.

Vulnerable Species Green and Golden Bell Frog, Grey-headed Flying Fox and Large-eared Pied Bat	
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	*a) lead to a long-term decrease in the size of an important population*** *of a species;* No important populations of the green and golden bell frog, grey-headed flying-fox or large-eared pied bat were identified or are likely to occur in the investigation area. The loss of the small area of potential habitat is unlikely to lead to a long-term decrease in the size of an important population of the green and golden bell frog, grey-headed flying-fox or large-eared pied bat.
	b) reduce the area of occupancy of an important population; No important populations of the green and golden bell frog, grey-headed flying-fox or large-eared pied bat are likely to occur on the investigation area. Thus there is unlikely to be reduction in the area of occupancy of an important population of any of these species.
	c) fragment an existing important population into two or more populations; The Project would not fragment an existing important population of the green and golden bell frog, grey-headed flying-fox or large-eared pied bat into two or more populations. No green and golden bell frog, grey-headed flying-fox or large-eared pied bat important populations are likely to occur on or adjacent to the investigation area.
	d) adversely affect habitat critical to the survival of a species; The Project would not adversely affect habitat critical to the survival of the green and golden bell frog, grey-headed flying-fox or large-eared pied bat.
	e) disrupt the breeding cycle of an important population; No important populations of the green and golden bell frog, grey-headed flying-fox or large-eared pied bat are likely to occur on the investigation area. The Project would not disrupt the breeding cycle of an important population of the green and golden bell frog, grey-headed flying-fox or large-eared pied bat.
	f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; The small areas of potential woodland and farm dam habitat that would be lost as a result of the Project is unlikely to affect the green and golden bell frog, grey-headed flying-fox or large-eared pied bat to the extent that any of the species would be likely to decline.
	*g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***;* The Project is highly unlikely to result in an invasive species harmful to the green and golden bell frog, grey-headed flying-fox or large-eared pied bat becoming established within the investigation area.
	h) introduce disease that may cause the species to decline; or It is highly unlikely that the Project would result in the introduction of a disease that may cause the green and golden bell frog, grey-headed flying-fox or large-eared pied bat to decline.
	i) interfere substantially with the recovery of the species. The Project is highly unlikely to interfere substantially with recovery of the green and golden bell frog, grey-headed flying-fox or large-eared pied bat.

Migratory Species Cattle Egret, Great Egret, White-throated Needletail, Fork-tailed Swift, Latham's Snipe, Rainbow Bee-eater, Regent Honeyeater, Rufous Fantail, Satin Flycatcher and Wanderer Butterfly.	
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	*a) substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat[#] for a migratory species;*
	No important habitat for the any of the above listed migratory species occurs within the investigation area or would be substantially modified, destroyed or isolated as a result of the Project.
	b) result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or It is highly unlikely that an invasive species that is harmful to any of the above listed migratory species would become established within the investigation area as a result of the Project.
	c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion[##] of the population[###] of a migratory species. The Project is highly unlikely to seriously disrupt the lifecycle of any of the above listed migratory species.

^ *'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:*

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

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

A 'population of a species' is defined under the EPBC Act as an occurrence of the species ina particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- *a geographically distinct regional population, or collection of local populations or*
- *a population, or collection of local populations, that occurs within a particular bioregion.*

** Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

[**]An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

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

****Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.*

[#]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.*

[##]Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

[###] *'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.*

6.5.1 Key Threatening Processes

Seventeen key threatening processes have been finally determined under the EPBC Act. Those that could be potentially relevant to the Project are discussed below:

1) Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*): Infection of some species of native plants by this plant pathogen could occur in the investigation area if contaminated soil was inadvertently imported in fill or on machinery, tools, boots or clothing. Protocols should be established to prevent this from occurring.
2) Land Clearance: The clearing of woodland and grassland areas for the Project would contribute towards the key threatening process of land clearance.
3) Infection of amphibians with chytrid fungus resulting in chytridiomycosis: The movement of water, soil or plant matter from wet areas or onto the investigation area during construction has the potential to spread chytrid fungus. The level of chytrid fungus prevalence on the investigation area and in the surrounding area is unknown but should not be assumed to be absent.
4) Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases: As with any industrial activity, the Project during both its construction and operational phases is likely to result in an incremental contribution to the anthropogenic global emissions of greenhouse gases thus contributing to the overall loss of terrestrial climatic habitat for some threatened species on a global scale.

6.5.2 EPBC Significance Test Conclusion

The following 16 EPBC Act listed threatened and/or migratory species were identified with potential habitat on the investigation area (**Section 6.1**).

Endangered Species

- Swift parrot
- Spotted-tailed quoll
- Regent honeyeater

Vulnerable Species

- Green and golden bell frog
- Grey-headed flying-fox
- Large-eared pied bat

Migratory species

- Cattle egret
- Great egret
- White-throated needletail
- Fork-tailed swift
- Latham's snipe
- Rainbow bee-eater
- Regent honeyeater
- Rufous fantail
- Satin flycatcher
- Wanderer butterfly

Following an assessment of the potential impacts of the Project (**Section 6.4**) it was found that the Project is unlikely to significantly impact upon any local population of the 16 above threatened and/or migratory species listed on the EPBC Act. The implementation of mitigation measures recommended in this report and the development of a Compensatory Habitat Policy, in consultation with DECCW, would further reduce the level of potential impact on threatened and migratory fauna species and their habitats.

6.6 Impacts on Non-Listed Species and Communities

The removal of vegetation within the investigation area would result in a decreased potential foraging area and a reduction in potential roosting and nesting sites for woodland, grassland, wetland and farm dam species. The removal of vegetation would also increase the level of local habitat fragmentation by a small degree and increase the potential impacts of edge effects by a similar degree. Where vegetation will be removed, remaining woodland remnants would decrease in size by a small degree and the resulting change in ratio of edge to area of remnant would increase edge effects.

The loss of some areas of vegetation associated with the Project would decrease the extent of fauna habitat available within the investigation area. However given the relatively small area of habitat to be removed within a long investigation area and the availability of nearby similar or better quality habitat it is not expected that the removal of vegetation would greatly impact any of the non-listed fauna species.

In addition to vegetation removal, during the construction of the Project construction activities and associated vehicle/machinery movements would be likely to result in an increase in the degree of noise, dust and vibration impacts on local species. The impact of potential increases in noise, dust and vibration on fauna species is likely to be secondary to the potential impacts associated with the removal of vegetation. However potential increases in noise, dust and vibration may cause some individuals to move out of the local area or to abandon nesting attempts.

The completion of the Project would result in an effective doubling of the rail traffic within the investigation area. The increase in the number of trains would be likely to result in an increased number of collisions with fauna species. A small number of grey kangaroo carcasses were recorded within the investigation area. The number of fauna species hit by trains would be likely to increase in a proportional manner to the increase in train movements.

While the project would result in the removal of some vegetation, increases in fragmentation and isolation, increased train/fauna collisions, increased levels of noise, dust and vibration during construction, and increased levels of noise and vibration during operation, none of these impacts are likely to significantly impact on local fauna species or local biodiversity. The implementation of mitigation measures recommended in this report and the development of a Compensatory Habitat Policy, in consultation with DECCW, would further reduce the level of potential impact on fauna species and biodiversity.

7. MITIGATION MEASURES

The Draft Guidelines for Threatened Species Assessment (DECC and DPI, 2005) require a description and justification of measures to avoid, mitigate and if necessary offset, any adverse effects of the Project on threatened species.

7.1 Avoid

As the proposed third track must follow the same or a similar path to the existing two tracks, the ability to position the third track to avoid fauna habitat areas was significantly reduced. In at least one area an option existed where the third track would be positioned away from the existing two tracks in order to reduce the altitudinal climb for trains. However, the selected location of the third track adjacent to the existing two tracks is preferred to minimise the area of vegetation to be removed for the Project (and avoid additional vegetation clearing). Positioning the third track adjacent to the existing two tracks would require the widening of the rail corridor by only the width of the track and associated cuts and batters. Whereas a separate third track would require the removal of vegetation to allow for the width of the track and associated cuts and batters, service tracks and rail corridor buffer (all within the new rail corridor).

In an attempt to minimise the potential impacts on fauna species (and flora species) the Design team was advised (verbally) that they should avoid all woodland areas were possible.

Detailed field surveys during the concept design and environmental assessment phase helped to determine the potential impacts of the Project. This facilitated the amendment of the concept design to minimise potential impacts on threatened fauna species and their habitats.

However, there was little scope for further avoidance of ecological impacts for the Project. The Project alignment location is constrained by the location of the existing rail corridor. Therefore there is little scope for locating the Project away from some of the sensitive environmental receptors identified in this assessment. Further mitigation and offset measures are described below in the aim to overcome these constraints.

7.2 Mitigate

The Project would involve some clearing of native vegetation and disturbance to fauna habitat, including threatened fauna species within the investigation area. The following measures are recommended to ameliorate the potential impacts that may occur to fauna species and their habitats as a result of the Project.

1. A tree felling protocol should be developed to minimize harm to all fauna species during the clearing of trees for the Project. The tree felling protocol should be developed by a suitably qualified and licensed ecologist with previous experience supervising the felling of trees. The tree felling protocol should involve as a minimum the following key steps of:
    - Establishment of the best time of the year for felling (depends on the likely species to be affected) where possible.
    - Pre-felling marking of habitat trees.
    - Inspections of trees on the day of felling.
    - The felling of non-habitat trees at least two days before habitat trees.

- The inspection of non-habitat trees for koalas on the day of felling non-habitat trees (not necessarily by an ecologist).
- The shaking of habitat trees the day before felling is planned.
- Procedures for the safe removal of fauna species from trees prior to and post felling.
- A stop work procedure for in the event that a threatened species is recorded in or leaving a tree hollow during tree felling. Such a stop work procedure should require as a minimum, the tree to be left standing overnight.
- A relocation/release protocol (including the holding of nocturnal species until dusk).
- Where possible, leaving the tree where it falls, overnight.
- Arrangements for the treatment of injured fauna.
- A protocol for the salvaging of tree hollows for rehabilitation works (unless nest boxes are to be used).

Where possible, tree felling should be undertaken during the best time of year as identified in the tree felling protocol. All tree felling should be supervised by a suitably qualified and licensed ecologist with previous experience supervising the felling of habitat trees.

2. A suitable number of nest boxes required to compensate for the loss of tree hollows from cleared vegetation was determined as ten percent of the measured density of tiny to medium tree hollows and 20 percent of large tree hollows. The rate of tree hollow compensation was determined after consideration of the following factors:

   - Not all tree hollows recorded would be suitable for use by fauna.
   - Some tree hollows recorded may not be hollows on closer inspection (after felling).
   - Adjacent woodland areas are likely to contain an already existing similar level of tree hollow provision.
   - Not all woodland areas contained hollows or hollows at the densities recorded at the four survey sites (selected for their high habitat quality compared to the other potential woodland sites).
   - An unknown number of tree hollows not viewable from the ground are likely to have been missed during assessment.
   - A larger proportion of large tree hollows showed signs of use than tiny to medium hollows.

No nest boxes have been recommended to compensate for the loss of very large tree hollows (>300 millimetres) as the species that use such hollows also use large sized hollows.

Table 17. Number of Nest Boxes Required to Compensate for the Loss of Tree Hollows

Hollow Size Class (millimeters)	Hollow Density (per hectare)		Nest Boxes Required (per hectare)	
	Open Woodland	Riparian Woodland	Open Woodland	Riparian Woodland
10-25	42	56	4 micro-bat	6 micro-bat
26 to 50	39	33	3 squirrel glider 1 owlet nightjar	2 squirrel glider 1 owlet nightjar
51 to 100	28	17	1.5 ringtail possum 1.5 rosella	0.85 ringtail possum 0.85 rosella
101 to 300	5	0	0.4 brushtail possum 0.3 cockatoo 0.3 kookaburra	0
300 and larger	2	0	0	0
Total			*12.0*	*10.7*

3. All nest boxes should be established one month prior to felling operations in nearby woodland areas identified by an experienced and qualified ecologist. Nest boxes should be established at the heights recommended in Franks (2003). All nest boxes with entrance hollows between 50 and 80 millimetres should be fitted with rigid (timber or metal) Indian Myna baffles. Nest boxes should be established in trees using the Habisure method of attaching the next box to the tree. The Habisure system involves:
   - The use of 3.15mm plastic coated (usually green) soft fencing wire.
   - A length of wire passes through the nest box and around the tree trunk.
   - At the sides of the nest box the wire is folded (using long-nosed pliers) into at least four folds about 60 millimetres tall and 15 millimetres apart. As the tree grows the folds are slowly pulled apart and the nest box remains in the tree. Other methods that nail or screw the nest box to the tree typically fail within two to five years as the tree grows and either pushes the strapping/wire off the nail/screw or pulls the nest box apart as the trunk expands.
   - Where the wire passes around the back of the tree trunk, the wire is threaded through a length of garden hose to protect the tree.
   - Where possible the wire around the tree should pass over a branch behind the trunk. However a properly fitted nest box using the Habisure system can be installed on straight stemmed smooth barked trees.

4. Nest boxes function should be monitored annually during the construction phase of the project (two to three years). Such inspections could be undertaken from the ground with a pair of binoculars and do not require the internal inspection of nest boxes. Monitoring inspections should document the status of the tree attachment method (is the nest box still attached and hanging correctly), the condition of the box (are there gaps in the joins or has the box been damaged beyond functional use by chewing) and the presence or absence of feral bees. Where feral bees have invaded nest boxes a bee keeper should be contacted to remove the bee hive. Damaged nest boxes should be replaced as soon as practical.

5. Where bridges and culverts are to be removed or modified, on the first day of removal/modification an ecologist should inspect the bridge/culvert for roosting bats, and fairy martin and welcome swallow nests. If roosting bats are present they should be left undisturbed until dusk. At dusk roosting bats can be captured and released nearby. Following removal or departure of all roosting bats the culvert should be removed or blocked off (for example cover the entrance with shade cloth) prior to dawn the following morning. If more than 10 bats or any number of bats with babies/juveniles are identified, advice from a specialist bat expert will be required to determine if, how and when the bats can be removed.
6. The Compensatory Habitat Policy developed by the Hunter8 Alliance and in consultation with DECCW should be implemented.
7. Where culverts are to be replaced or constructed, they should not restrict the use of those culverts as movement corridors for fauna species through the rail corridor.
8. Runoff/ sedimentation from the proposed surface impact areas should be managed during both the construction and operation phases using current best practice sediment and erosion control measures. In particular, management of runoff into and protection of the water quality of creeks and watercourses should be implemented.
9. A weed management strategy should be implemented, possibly as part of a vegetation management plan, for any retained or rehabilitated natural vegetation within the investigation area and any offset areas. All noxious weeds within the land should be treated in accordance with their weed Class as per the *Noxious Weeds Act 1993*.
10. Rehabilitation of highly disturbed and bare areas following completion of operations in the area should use locally-occurring species (trees, shrubs and ground cover) characteristic of the local vegetation communities.
11. During construction, ensure that protocols are in place to minimise the risk of importation of root-rot fungus (*Phytophthora cinnamomi*) via the transport of soil on machinery or footwear, or the importation of soil. Where possible, machinery and footwear should be free of soil or washed clean before arriving on site. Any soil imported onto the site should be sourced from root-rot fungus free areas.

Following is an assessment of the likely effectiveness level of the six key mitigation measures (measures 1 to 6) recommended for inclusion in the draft Statement of Commitments for the Project.

Tree Felling Protocol (*see Mitigation Measure 1 above*)

The supervision of tree felling by an experienced and qualified ecologist should result in a reduction in the risk of death or injury to individuals of threatened and non-threatened species during the tree felling process. While not all tree hollows can be checked for species after felling (often hollows extend out of sight further down the branch or trunk than can be seen with a torch) leaving the tree where it falls over the following night should allow remaining individuals to escape into nearby habitat. A high level of confidence can be associated with the implementation of a tree felling protocol and a resulting reduction in the potential level of impact on hollow-dependent threatened and non-threatened fauna species.

Nest Boxes to Compensate for the Loss of Tree Hollows (*see Mitigation Measures 2 and 3 above*)

The level of confidence in the effectiveness of nest boxes to provide roost and denning sites for fauna species varies according to the species. A high level of confidence can be associated with the use of nest boxes by non-threatened arboreal mammal and parrot species, particularly common brushtail possums (*Trichosurus vulpecula*), common ringtail possums (*Pseudocheirus peregrinus*) and eastern rosellas (*Platycercus eximius*). While squirrel gliders are generally known to use nest boxes, local experience suggests that only a medium to high level of confidence can be associated with the use of nest boxes to provide denning sites for squirrel gliders. Local experience suggests that only a low level of confidence can be associated with the use of nest boxes to provide roosting sites for micro-bat species.

Annual Nest Box Condition Monitoring (*see Mitigation Measure 4 above*)

Annual monitoring and subsequent maintenance of nest box condition (including the removal of feral bees) over a two to three year period provides a high level of confidence that nest boxes would be available to provide potential roosting/denning/nesting sites for threatened and non-threatened fauna species for at least two to three years.

Bridge and Culvert Inspections for Fauna (*see Mitigation Measure 5 above*)

Inspections of bridges and culverts at the start of works provides a high level of confidence that roosting and nesting individuals (threatened and non-threatened) would not be lost during the removal or modification of bridges and culverts.

Establishment of Offsets to Compensate for Cleared Areas (*see Mitigation Measure 6 above*)

The Proponent has committed to developing a Compensatory Habitat Strategy to offset the loss of habitat areas. While offsets do not reduce the level of impact on fauna species within the potential vegetation clearance or disturbance areas, they can potentially provide secure conserved areas for the species that occur within the offset areas. Within the region, appropriately located offset areas provide a medium level of confidence that a portion of the regional population will be conserved into the future. Offset areas established into perpetuity may begin to address the regional cumulative impacts of vegetation clearance within the region and thus begin to promote and conserve threatened species within the region.

7.3 Offset

The Hunter 8 Alliance has committed to developing a Compensatory Habitat Strategy to offset the loss of habitat areas. See the Flora and Aquatic Ecological Assessment prepared by the Hunter 8 Alliance for further details.

To address the potential impacts of the project, ARTC would implement a Compensatory Habitat Strategy that would contribute to the long term conservation of biodiversity. This would be developed in consultation with DECCW with the aim to set aside known habitat for threatened flora species, EECs and fauna species. The policy may include a combination of compensatory measures:

- Provision of land for conservation purposes.
- Additional biodiversity management measures.
- Funding of management or research initiatives.

The Compensatory Habitat Strategy would include offsetting for the impacts involved in the construction of the Station Lane and Hermitage Road overpasses, and replacement of the Nelson Street overpass associated with the Project. This approach involves consideration of the total impact of a number of projects within a given section of the rail corridor and agreement on an appropriate offset area on a regional basis. It aims to provide greater regional biodiversity conservation outcomes by providing larger areas of land of greatest interest to the relevant land management agencies and potentially better links to existing conserved lands. It is considered that greater regional biodiversity benefits can be achieved by adopting this approach in preference to a project by project approach.

The Compensatory Habitat Strategy would complement the specific mitigation measures incorporated into the Project design and which would be implemented during the construction and operational phases of the development to further mitigate impacts and contribute to the maintenance and improvement of local and regional biodiversity values.

8. CONCLUSIONS

8.1 Key Findings

Seven threatened species on the TSC Act (squirrel glider, grey-crowned babbler, varied sittella [preliminary determination], eastern freetail-bat, eastern bent-wing bat, little bent-wing bat and large-footed myotis) and four migratory species listed on the EPBC Act (Latham's snipe, rainbow bee-eater, rufous fantail and wanderer butterfly) were identified in the investigation area during field surveys. Potential habitat for a further 32 threatened species on the TSC Act and 16 threatened and/or migratory species on the EPBC Act was identified within the investigation area.

Following an assessment of the potential impacts of the Project (**Section 6.4**) via the Part 3A guidelines, it was found that the Project would be unlikely to significantly impact upon the 39 threatened species identified with potential habitat in the investigation area and listed on the TSC Act.

Following an assessment of the potential impacts of the Project (**Section 6.5**) via the EPBC assessment guidelines, it was found that the Project would be unlikely to significantly impact upon the 16 threatened and/or migratory species identified with potential habitat in the investigation area and listed on the EPBC Act.

The koala was not recorded in the investigation area and was considered unlikely to occur. Assessment under SEPP 44 found that koala no core koala habitat was present, and no further assessment under SEPP 44 was required.

8.2 Key Thresholds

Pursuant to the Draft Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC and DPI 2005), development applications being assessed under Part 3A must address the following key thresholds.

- ***Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.***

Impacts of the Project on fauna species and their habitats have been avoided or minimised where possible through the planning and design process. The preservation of areas of high conservation significance, such as threatened species habitat areas, has been considered during the selection process for compound and spoil areas required for construction of the Project. Further detailed field surveys during the concept design and environmental assessment phase helped to determine the potential impacts of the Project. This facilitated the amendment of the concept design to minimise potential impacts on threatened fauna species and their habitats.

The Project alignment location is constrained by the location of the existing rail corridor. Therefore there is little scope for locating the Project away from some of the sensitive environmental receptors identified in this assessment. Environmental management measures to further minimise impacts have been recommended in an aim to overcome these constraints.

The development of a Compensatory Habitat Strategy, in consultation with DECCW, would aim to offset the loss of threatened species and communities and further aim to contribute to the maintenance and improvement of biodiversity values.

- ***Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.***

Assessments of the likelihood of significance of the impacts on threatened species and their habitats have concluded it is unlikely that threatened fauna species and their habitats would be significantly impacted. Implementation of the recommended mitigation measures and the development of a Compensatory Habitat Policy, in consultation with DECCW, would likely further contribute in maintaining local populations within the locality.

- ***Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.***

The Project would be unlikely to accelerate the extinction of or place any species, population or ecological community at risk of extinction. Implementation of the recommended mitigation measures and the development of a Compensatory Habitat Policy, in consultation with DECCW, would further decrease the probability of any fauna species becoming extinct due to the Project.

- ***Whether or not the proposal will adversely affect critical habitat.***

Critical habitats are listed under both the NSW TSC Act and the Commonwealth EPBC Act. No listed critical habitat occurs within the study area and no critical habitat would be removed or adversely affected as a result of the Proposal.

8.3 Conclusion

This Terrestrial Fauna Ecological Assessment has been undertaken by Ecotone Ecological Consultants Pty Ltd, for the Hunter 8 Alliance on behalf of ARTC, as part of the Environmental Assessment, for the Maitland to Minimbah Third Track Project. This report has been prepared to assess the existing terrestrial fauna ecology of the study area, impacts of the Project, and to develop mitigation measures to minimise impacts of the Project.

The terrestrial fauna ecology survey and assessment has been prepared with consideration of the Draft Guidelines for Threatened Species Assessment under Part 3A of the Environmental Planning and Assessment Act 1979 (DEC and DPI, 2005) and the Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (DEC 2004).

There is the potential for direct and indirect ecological impacts to occur as a result of the Project. While many of these impacts can be minimised through avoidance or management, there are some impacts that cannot be adequately mitigated on site. To address these impacts, ARTC would implement a Compensatory Habitat Policy, in consultation with DECCW, to further mitigate impacts and contribute to the maintenance and improvement of local and regional biodiversity values.

An assessment of the significance of impacts on threatened and/or migratory fauna species has been prepared in accordance with the assessment criteria identified in the Draft Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC and DPI, 2005) and the Significant Impact Guidelines 1.1: Significant Impact Guidelines Matters of NES (DEH 2006). Based on the assessments, it is considered unlikely that the Project would result in impacts that would cause a local population of threatened fauna to become extinct. The implementation of mitigation measures recommended in this report and the development of a Compensatory Habitat Policy, in consultation with DECCW, would further reduce the level of potential impact on threatened fauna species and their habitats.

9. REFERENCES

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

Barrett, G. S. (2003). *The New Atlas of Australian Birds.* Victoria, Australia: Royal Australasian Ornithologisats Union .

Churchill, S. (1998). *Australian Bats.* Sydney: Reed New Holland.

Cogger, H. (1995). *Reptiles and Amphibians of Australia.* Sydney: Reed Books.

CSIRO. (2006). *CSIRO list of Australian Vertebrates: a Reference with Conservation Status.* Collingwood, VIC: CSIRO Publishing.

CSIRO. (2004). *The Complete Field Guide to Butterflies of Australia.* Collingwood Vic: CSIRO Publishing.

DEC (2003). *Draft Recovery Plan for the Barking Owl*. New South Wales National Parks and Wildlife Service, Hurstville, NSW

DEC. (2004). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft.* Hurstville, NSW: Department of Environment and Conservation.

DECC. (2008). *Approved Recovery Plan for the Koala (Phascolarctos cinereus).* Sydney: Department of Environment and Climate Change.

DECC. (2009). *Threatened Biodiversity Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians.* Department of Environment and Climate Change NSW.

DECCW. (2009, March 17). *Recovery plans.* Retrieved September 1, 2009, from Department of Environment, Climate Change and Water: http://www.environment.nsw.gov.au/threatenedspecies/RecoveryPlans.htm

DEC (2005). *Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea).* Hurstville, NSW: Department of Environment and Conservation NSW.

DoP, DECC & DPI. (2008). *Guidelines for Threatened Species Assessment under Part 3A of the Environmental Planning and Assessment Act 1979.* Department of Planning.

Ecotone. (2009a). *Draft Fauna Impact Assessment for Hermitage Road Railway Bridge as Part of the Maitland to Minimbah Third Track Project.* Waratah, NSW: Ecotone Ecological Consultants Pty Ltd.

Ecotone. (2009b). *Draft Fauna Impact Assessment for Nelson Street Railway Bridge as Part of the Maitland to Minimbah Third Track Project.* Waratah, NSW: Ecotone Ecological Consultants Pty Ltd.

Ecotone. (2009c). *Draft Fauna Impact Assessment for Station Lane Railway Bridge as Part of the Maitland to Minimbah Third Track Project.* Waratah, NSW: Ecotone Ecological Consultants Pty Ltd.

Ecotone. (2008). *Flora and Fauna Impact Assessment - Proposed Third Rail Track for the Minimbah Bank near Belford.* Waratah NSW: Ecotone Ecological Consultants Pty Ltd.

Franks, A. &. (2003). *Nest Boxes for Wildlife - A Practical Guide.* Melbourne: Blooming Books.

Garnett, S. &. (2000). *The Action Plan for Australian Birds.* Canberra: Enviroment Australia.

GHD. (2009). *Flora and Aquatic Assessment of the Minimbah Third Track from Maitland to Minimbah.* Newcastle: GHD.

LHCCREMS. (2002). *Flora and Fauna Survey Guidelines for the Lower Hunter and Central Coast Region. Volumes 1 and 2.* Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy.

Morcombe, M. (2004). *Field Guide to Australian Birds.* Archerfield, Qld: Steve Parish Publishing.

Strahan, R. (2002). *The Mammals of Australia.* Sydney, NSW: Reed Books and the Australian Museum.

APPENDIX 1. FAUNA RECORDED WITHIN THE MINIMBAH THIRD TRACK STUDY AREA

Notes:
Species listed as ordered on the CSIRO List of Australian Vertebrates (CSIRO 2006).
Survey Areas:
1- Lochinvar open woodland
2- Anvil Creek riparian woodland
3 – Greta open woodland
4 – Belford open woodland
5 – Belford farm dams
6 – Combined REF areas.

Bold indicates a threatened species
V – Vulnerable species (TSC or EPBC Act)
E – Endangered species (TSC or EPBC Act)
M – Migratory (EPBC Act)
PD – Preliminary Determination (TSC Act)
* indicates introduced species (not native to Australia)

Observation types:

X	Observed or heard	Z	In scat or pellet	H	Hair tube sample
F	Tracks/scratches	S	Scat	N	Nest/roost
E	Bat echolocation call	Y	Skeletal remains	D	Definite identification
P	Probable identification				

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Survey Area					
				1	2	3	4	5	6
FROGS									
Family: *MYOBATRACHIDAE*									
Crinia signifera	Common eastern froglet			X	X	X	X	X	X
Uperoleia fusca	Dusky toadlet							X	
Uperoleia laevigata	Red-groined toadlet				X	X	X	X	X
Family: *HYLIDAE*									
Litoria caerulea	Green tree frog			X					
Litoria fallax	Eastern dwarf tree frog			X	X	X	X	X	X
Litoria latopalmata	Broad-palmed frog					X	X	X	
Litoria peronii	Peron's tree frog			X			X	X	
REPTILES									
Family: *CHELIDAE*									
Chelodina longicollis	Eastern snake-necked turtle			X					X
Family: *AGAMIDAE*									
Physignathus lesueurii	Eastern water dragon				X				
Family: *SCINCIDAE*									
Carlia tetradactyla	Southern rainbow-skink				X				
Cryptoblepharus virgatus	Wall skink			X					
Ctenotus robustus	Robust ctenotus								X
Egernia striolata	Tree skink						X		
Eulamprus quoyii	Eastern water skink				X				
Family: *ELAPIDAE*									
Pseudechis porphyriacus	Red-bellied black snake						X		

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Survey Area					
				1	2	3	4	5	6
BIRDS									
Family: *ANATIDAE*									
Chenonetta jubata	Australian wood duck					X	X		X
Anas superciliosa	Pacific black duck						X		X
Family: *PODICIPEDIDAE*									
Tachybaptus novaehollandiae	Australasian grebe						X		
Family: *PHALACROCORACIDAE*									
Phalacrocorax melanoleucos	Little pied cormorant								X
Phalacrocorax sulcirostris	Little black cormorant						X		
Family: *ARDEIDAE*									
Egretta novaehollandiae	White-faced heron								X
Egretta garzetta	Little egret								X
Family: *THRESKIORNITHIDAE*									
Threskiornis spinicollis	Straw-necked ibis			X					X
Family: *ACCIPITRIDAE*									
Aviceda subcristata	Pacific baza (crested hawk)				X				
Elanus axillaris	Black-shouldered kite					X			
Haliastur sphenurus	Whistling kite								X
Accipiter fasciatus	Brown goshawk			X	X		X		
Family: *FALCONIDAE*									
Falco longipennis	Australian hobby								X
Falco cenchroides	Nankeen kestrel								X
Family: *RALLIDAE*									
Porphyrio porphyrio	Purple swamphen						X		
Gallinula tenebrosa	Dusky moorhen						X		
Family: *SCOLOPACIDAE*									
Gallinago hardwickii	Latham's snipe		**M**				X		
Family: *CHARADRIIDAE*									
Vanellus miles	Masked lapwing			X			X		X
Family: *COLUMBIDAE*									
Phaps chalcoptera	Common bronzewing					X	X		X
Ocyphaps lophotes	Crested pigeon						X		X
Family: *PSITTACIDAE*									
Eolophus roseicapillus	Galah			X		X			X
Cacatua galerita	Sulphur-crested cockatoo			X	X	X			X
Trichoglossus haematodus	Rainbow lorikeet			X					X
Glossopsitta concinna	Musk lorikeet			X	X	X			X
Alisterus scapularis	Australian king parrot				X	X			X
Platycercus eximius	Eastern rosella			X		X	X		X
Psephotus haematonotus	Red-rumped parrot			X	X				X

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Survey Area					
				1	2	3	4	5	6
Family: *CUCULIDAE*									
Cacomantis variolosus	Brush cuckoo				X	X			
Cacomantis flabelliformis	Fan-tailed cuckoo				X	X			
Chalcites lucidus	Shining bronze-cuckoo								X
Eudynamys orientalis	Common (Pacific) koel			X					
Scythrops novaehollandiae	Channel-billed cuckoo				X				
Family: *PODARGIDAE*									
Podargus strigoides	Tawny frogmouth			X					
Family: *AEGOTHELIDAE*									
Aegotheles cristatus	Australian owlet-nightjar					X			
Family: *ALCEDINIDAE*									
Dacelo novaeguineae	Laughing kookaburra			X	X	X	X		X
Todiramphus sanctus	Sacred kingfisher				X	X			
Family: *MEROPIDAE*									
Merops ornatus	Rainbow bee-eater		**M**			X			
Family: *CORACIIDAE*									
Eurystomus orientalis	Dollarbird			X	X	X	X		
Family: *MALURIDAE*									
Malurus cyaneus	Superb fairy-wren				X	X			X
Family: *PARDALOTIDAE*									
Pardalotus punctatus	Spotted pardalote				X	X	X		X
Pardalotus striatus	Striated pardalote			X	X	X	X		X
Sericornis frontalis	White-browed scrubwren				X				X
Smicrornis brevirostris	Weebill			X	X	X	X		X
Gerygone olivacea	White-throated gerygone				X	X			X
Acanthiza pusilla	Brown thornbill				X				
Acanthiza reguloides	Buff-rumped thornbill			X					
Acanthiza chrysorrhoa	Yellow-rumped thornbill			X	X				X
Acanthiza nana	Yellow thornbill				X				X
Family: *MELIPHAGIDAE*									
Anthochaera carunculata	Red wattlebird								X
Plectorhyncha lanceolata	Striped honeyeater				X				
Philemon corniculatus	Noisy friarbird					X			X
Entomyzon cyanotis	Blue-faced honeyeater				X				X
Manorina melanocephala	Noisy miner			X	X	X	X		X
Lichenostomus chrysops	Yellow-faced honeyeater				X	X			X
Melithreptus brevirostris	Brown-headed honeyeater			X	X	X			
Melithrepus lunatus	White-naped honeyeater					X			
Acanthorhynchus tenuirostris	Eastern spinebill								X
Myzomela sanguinolenta	Scarlet honeyeater				X				
Family: *PETROICIDAE*									
Petroica rosea	Rose robin								X
Eopsaltria australis	Eastern yellow robin				X	X			X
Family: *POMATOSTOMIDAE*									
Pomatostomus temporalis	**Grey-crowned babbler**	**V**		**X**	**N**	**X**	**N**		**X**

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Survey Area					
				1	2	3	4	5	6
Family: *NEOSITTIDAE*									
Daphoenositta chrysoptera	**Varied sitella**	**PD**				**X**			
Family: *PACHYCEPHALIDAE*									
Pachycephala pectoralis	Golden whistler				X				X
Pachycephala rufiventris	Rufous whistler				X	X			
Colluricincla harmonica	Grey shrike-thrush				X				X
Family: *DICRURIDAE*									
Myiagra rubecula	Leaden flycatcher					X			
Grallina cyanoleuca	Magpie-lark			X		X	X		X
Rhipidura rufifrons	Rufous fantail		**M**		X				
Rhipidura fuliginosa	Grey fantail				X	X			X
Rhipidura leucophrys	Willie wagtail					X	X		X
Family: *CAMPEPHAGIDAE*									
Coracina novaehollandiae	Black-faced cuckoo-shrike				X	X	X		X
Family: *ORIOLIDAE*									
Oriolus sagittatus	Olive-backed oriole					X			X
Sphecotheres viridis	Figbird				X				
Family: *ARTAMIDAE*									
Cracticus torquatus	Grey butcherbird			X	X	X	X		X
Cracticus nigrogularis	Pied butcherbird			X	X	X	X		X
Gymnorhina tibicen	Australian magpie			X	X	X	X		X
Strepera graculina	Pied currawong				X		X		X
Family: *CORVIDAE*									
Corvus coronoides	Australian raven			X	X	X	X		X
Family: *CORCORACIDAE*									
Corcorax melanorhamphos	White-winged chough			X	X	X	X		X
Family: *PASSERIDAE*									
Taeniopygia bichenovii	Double-barred finch								X
Neochmia temporalis	Red-browed firetail				X				X
Family: *DICAEIDAE*									
Dicaeum hirundinaceum	Mistletoebird				X	X	X		X
Family: *HIRUNDINIDAE*									
Hirundo neoxena	Welcome swallow						X		X
Hirundo ariel	Fairy martin				X				
Family: *SYLVIIDAE*									
Arcocephalus stentoreus	Clamourous reed-warbler						X		
Family: *ZOSTEROPIDAE*									
Zosterops lateralis	Silvereye				X				X
Family: *STURNIDAE*									
Sturnus vulgaris *	Common starling			X					
Acridotheres tristis *	Common myna			X					X

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Survey Area					
				1	2	3	4	5	6
MAMMALS									
Family: *TACHYGLOSSIDAE*									
Tachyglossus aculeatus	Short-beaked echidna					X	X		X
Family: *PETAURIDAE*									
Petaurus norfolcensis	**Squirrel glider**	**V**				**X**			
Family: *ACROBATIDAE*									
Acrobates pygmaeus	Feathertail glider					X			
Family: *PHALANGERIDAE*									
Trichosurus vulpecula	Common brushtail possum					X			X
Family: *MACROPODIDAE*									
Macropus giganteus	Eastern grey kangaroo			X		X	X		X
Macropus rufogriseus	Red-necked wallaby					X	X		
Wallabia bicolor	Swamp wallaby				X				
Family: *MOLOSSIDAE*									
Mormopterus sp. 2 (Adams et al)	A freetail-bat			P	P		P		
Mormopterus norfolkensis	**Eastern freetail-bat**	**V**		**D**	**D**				
Tadarida australis	White-striped freetail-bat			X	D				
Family: *VESPERTILIONIDAE*									
Miniopterus schreibersii oceanensis	**Eastern bent-wing bat**	**V**		**D**	**D**	**D**	**D**		
Miniopterus australis	**Little bent-wing bat**	**V**			**D**	**D**			
Nyctophilus spp.	Long-eared bat			D	D		D		
Chalinolobus gouldii	Gould's wattled bat			D	D	D	D		
Chalinolobus morio	Chocolate wattled bat			D					
Myotis macropus	**Large-footed myotis**	**V**		**P**				**X**	
Scoteanax rueppellii	**Greater broad-nosed bat**	**V**			**P**				
Scotorepens balstoni	Inland broad-nosed bat					P	D		
Vespadelus darlingtoni	Large forest bat			P	P		P		
Vespadelus vulturnus	Little forest bat			D		D			
Family: *CANIDAE*									
Vulpes vulpes *	Fox				F				
Family: *LEPORIDAE*									
Oryctolagus cuniculus *	Rabbit					X	X		X
INVERTEBRATES									
Family: *NYMPHALIDAE*									
Danaus plexipus	**Wanderer (monarch) butterfly**		**M**	**X**	**X**	**X**	**X**		**X**

APPENDIX 2. RISK ASSESSMENT

Consequence Table

Aspect	Insignificant	Minor	Moderate	Major	Catastrophic
Flora and fauna species (including EPBC protected species)	Population change not detectable	Detectable change in population without impact on population viability	Detectable change in population and impact on population viability that is significant at a local level	Detectable change in population and impact on population viability that is significant at a regional level	Detectable change in population and impact on population viability that is significant at a State or Commonwealth level

Likelihood Table

Likelihood	Description
Almost Certain	The event is expected to occur in most circumstances
Likely	The event will probably occur in most circumstances
Possible	The event could occur
Unlikely	The event could occur but not expected
Rare	The event occurs only in exceptional circumstances

Risk Matrix

Likelihood Level	Consequence Level				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Negligible	Low	Medium	High	High
Unlikely	Negligible	Low	Medium	Medium	High
Rare	Negligible	Negligible	Low	Medium	Medium

Environmental Risk Register – Fauna Ecology

Risk No	Risk Pathway Description (how the project interacts with assets, values and uses)	Description of Consequences	Planned Controls to Manage Risk (as per Project Description)	Risk Assessment (Control)			Additional Controls Recommended to Reduce Risk	Treated Risk Assessment		
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
1	Construction of the project results in an area of threatened and/or migratory fauna species habitat to be removed or modified.	Loss of habitat area or individuals	Pre-clearing survey by qualified and experienced ecologist Implementation of a Rehabilitation plan - replacing habitat losses as much as possible Minimise area to be removed where possible through design and construction activities (e.g. leave hollow bearing trees where possible) Preparation of an Offset Strategy consistent with DECC guidelines	Moderate	Unlikely	Medium	Nest boxes installed in trees for hollow dependent species (e.g. squirrel glider, bats ad birds) Implement Offset strategy including option such as funding of research or recovery projects, where appropriate Species specific rehabilitation features (e.g. dam design for green and golden bell frog)	Minor	Unlikely	Low
2	Construction of the Project impacts an area of fauna habitat to be removed or modified (protected but not threatened species)	Loss of habitat area for a species that may or may not significantly affect the local population. Loss of individuals during clearing process.	Pre-clearing survey by qualified and experienced ecologist Implementation of a Rehabilitation plan Minimise area to be removed where possible through design and construction activities (e.g. leave hollow bearing trees where possible)	Insignificant	Almost Certain	Low				
3	Construction of the project results in noise/dust/vibration reducing habitat quality for fauna species	May result in some individuals or species moving out of the area Possible loss of reproductive efforts (e.g. nests abandoned)	Noise, dust and vibration control measures and relevant management plans	Minor	Unlikely	Low				

Risk No	Risk Pathway Description (how the project interacts with assets, values and uses)	Description of Consequences	Planned Controls to Manage Risk (as per Project Description)	Risk Assessment (Control)			Additional Controls Recommended to Reduce Risk	Treated Risk Assessment		
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
4	Construction of the project resulting in Vehicle collisions with fauna	Loss of individuals	Limit Vehicle Speed on construction site, e.g. Vehicle access track is limited to 20km/h Control within the Environment Management Plan, in particular the traffic management plan	Insignificant	Possible	Negligible				
5	Operation of the project results in vehicle collisions with fauna on access tracks by service vehicles or on the track by trains.	Loss of individuals	Limit Vehicle Speed of service vehicles during track maintenance, e.g. Vehicle access track is limited to 20km/h	Insignificant	Almost Certain	Low				
6	General construction of the project results in increased level of general disturbance through human presence and vehicle use, reducing habitat quality for fauna in nearby areas	May result in some individuals or species moving out of the area Possible loss of reproductive efforts (e.g. nests abandoned) Reduced water quality for terrestrial species Increased siltation of waterways resulting in a reduced water supply (particularly during drought)	Control vehicle Speed limits (20km/h) on construction site Control within the Environment Management Plan including a dust management plan Implement Erosion and Sedimentation management plan, including the use of sedimentation fences/traps. This will include temporary structures within the EMP and permanent structures in the design	Insignificant	Possible	Negligible				

Risk No	Risk Pathway Description (how the project interacts with assets, values and uses)	Description of Consequences	Planned Controls to Manage Risk (as per Project Description)	Risk Assessment (Control)			Additional Controls Recommended to Reduce Risk	Treated Risk Assessment		
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
7	Construction of the project results in alteration of Sawyers Creek waterway path resulting in reduced habitat quality for fauna	Reduced access to water during construction Reduced water quality during works (increased sedimentation) Reduced amount of riparian habitat available during works and establishment of rehabilitation Erosion and sedimentation impacts on aquatic habitat and species. Loss of aquatic and riparian habitat.	Implement Erosion and Sedimentation management plan, including the use of sedimentation fences Implementation of a Rehabilitation Plan for realignment of waterways, replicate waterway area where possible and reinstate riparian vegetation and refuge - fish	Insignificant	Likely	Low				

APPENDIX 3. PROJECT PERSONNEL AND RELEVANT LICENCES

REPORT COMPONENT	STUDY TEAM MEMBERS	QUALIFICATIONS
Overall project management, fauna field surveys, habitat descriptions & impact assessment, report writing.	Steven Cox	B. Appl. Sci. (Hons)
Fauna field survey, Anabat file analysis.	Narawan Williams	TAFE Cert II (Conserv. & Land Mgt. Nat. Area Rest.)

Relevant licences held by Ecotone Ecological Consultants

TYPE	FOR	LICENCE NO	NAME	DATE VALID TO	ORGANISATION	LOCATION
Animal Research Authority	Vertebrate Fauna Surveys	08/8633	Brian Wilson	15-Nov-10	Animal care and ethics committee of the Director-General of NSW Agriculture	NSW
Certificate of Approval	Vertebrate Fauna Surveys	08/8633	Brian Wilson	15-Nov-11		
Licence to	Access NPWS Wildlife Atlas Data Base	CON93002	Brian Wilson	30-Jun-10	NSW Department of Environment and Climate Change	
Scientific Licence	Harm/ trap/ release: protected fauna; pick/ hold: native flora	S10555	Brian Wilson Stefan Rose Jenny Lewis Amy Williams Narawan Williams Anne Williams Steven Cox	30-Nov-09 Currently being renewed		
	As above plus bat banding	S10556	Ray Williams	31-Dec-09		