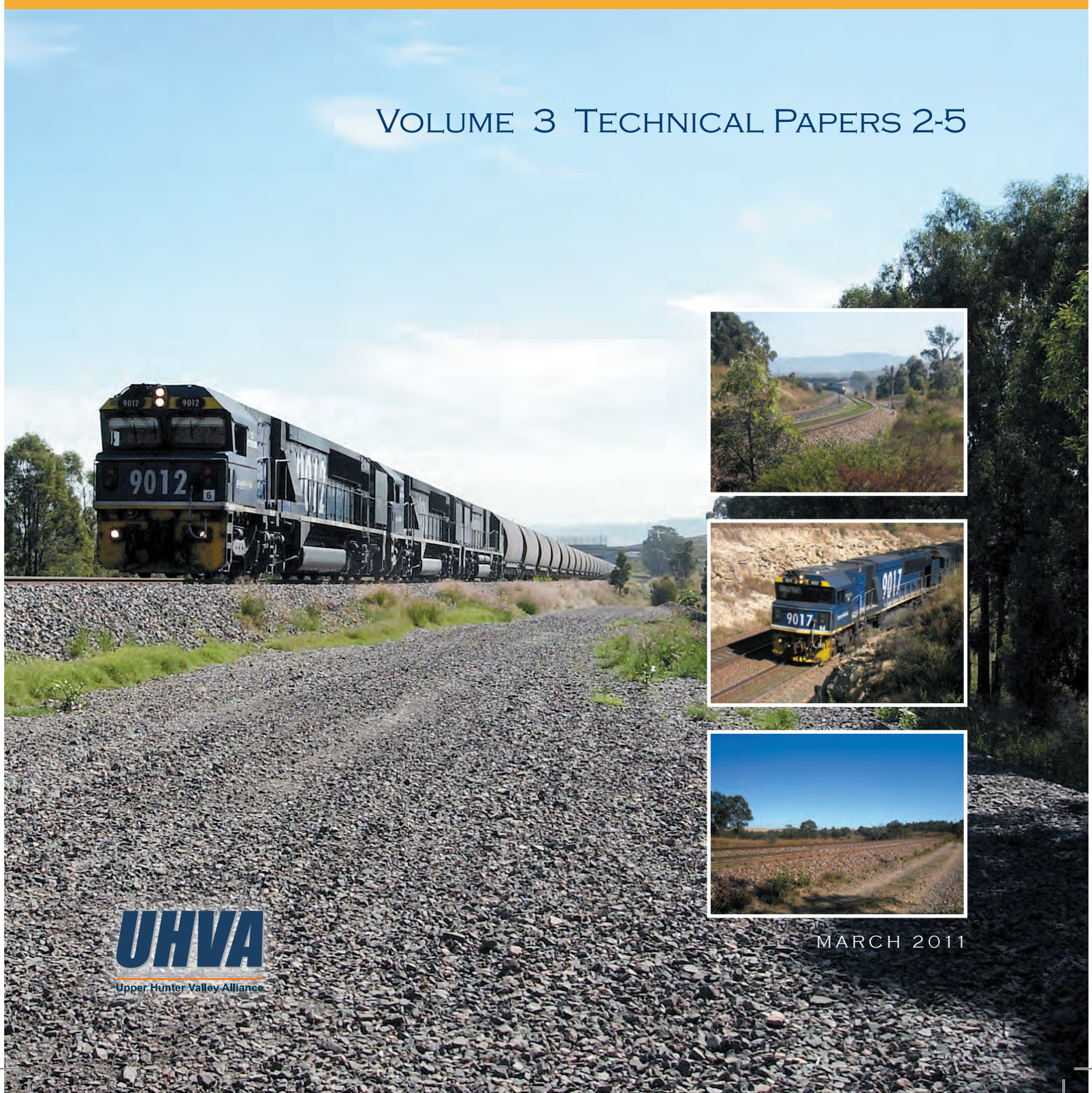
NUNDAH BANK THIRD TRACK

Environmental Assessment

Volume 3 Technical Papers 2-5



UHVA
Upper Hunter Valley Alliance

MARCH 2011

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Ecology

Proposed New Rail Track at Nundah Bank Ecological Assessment

March 2011

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	Original	20 September 2010	
A	Includes vegetation calculations (100927)	5 October 2010	S. Harrington
B	Addresses comments provided on draft report	8 December 2010	S. Harrington
C	Addresses adequacy comments and revised area of impact	15 February 2011	A. Cockerill
D	Revision D	16 February 2011	A. Cockerill
E	Revision E	15 March 2011	A. Cockerill

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Signed: .....

Date: .....15 March 2011

Distribution: .....

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Glossary

Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: ▪ genetic diversity — the variety of genes (or units of heredity) in any population ▪ species diversity — the variety of species ▪ ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. For this study this is the Sydney Basin bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & Cresswell 1995).
Critical Habitat	The whole or any part or parts of an area or areas of land comprising the habitat of an Endangered species, an Endangered population or an Endangered ecological community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation 2004). Critical habitat is listed under either the TSC Act or the EPBC Act and both the state (Department of Environment, Climate Change and Water) and Federal (Department of the Environment, Water, Heritage and the Arts) Directors-General maintain a register of this habitat. Capitalisation of the term 'Critical Habitat' in this report refers to the habitat listed specifically under the relevant state and Commonwealth legislation.
Department of Environment and Conservation (DEC)	The former name for the NSW Department of Environment, Climate Change and Water.
Department of Environment, Climate Change and Water (DECCW)	Broadly, the NSW Department of Environment, Climate Change and Water works towards a healthy environment cared for and enjoyed by the whole NSW community; manages the state's natural resources, including biodiversity, soils and natural vegetation; manages natural and cultural heritage across the state's land and waters; acts to minimise the impacts of climate change; promotes sustainable consumption, resource use and waste management; regulates activities to protect the environment; and conducts biodiversity, plant, environmental and cultural heritage research to improve decision making.
Department of the Environment and Heritage (DEH)	A former name (July 2004–January 2007) for the Department of Sustainability, Environment, Water, Population and Communities.
Department of the Environment and Water Resources (DEWR)	A former name (January 2007–December 2007) for the Commonwealth Department of the Environment, Water, Heritage and the Arts.
Department of the Environment, Water, Heritage and the Arts (DEWHA)	A former name (December 2007–September 2010) for the Commonwealth Department of Sustainability, Environment, Water, Population and Communities.

Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)	The Commonwealth department responsible for the protection and conservation of Australia's natural environment and cultural heritage (September 2010–). The department develops and implements national policy, programs and legislation including administering the EPBC Act.
Industry and Investment NSW	Formerly the NSW Department of Primary Industries.
Ecological community	An assemblage of species occupying a particular area.
Environmental weed	Any plant that is not native to a local area that has invaded native vegetation.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
GPS	Global Positioning System - a navigational tool that uses radio receivers to pick up signals from four or more special satellites to provide precise determination of location.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
Key Threatening Processes	A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Conservation 2004). Key threatening processes are listed under the TSC Act, the FM Act and the EPBC Act. Capitalisation of the term 'Key Threatening Processes' in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.
Likely	Taken to be a real chance or possibility (Department of Environment and Conservation 2004).
Local population	The population that occurs within the site, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary can be demonstrated as defined by Department of Environment and Climate Change (2007b).
Locality	The area within a 10 km of the project site.
Migratory species	Species listed as Migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the EPBC Act.
Noxious weed	An introduced species listed under the *Noxious Weeds Act 1993*. Under the Act, noxious weeds have specific control measure and reporting requirements.
NSW	New South Wales

Priorities Action Statements (PAS)	Priorities Action Statements outline the broad strategies and detailed priority actions to be undertaken in NSW to promote the recovery of Threatened species, population and ecological communities and manage key threatening processes (Department of Environment and Climate Change 2007a).
Protected species	Those species defined as protected under the *National Parks and Wildlife Act 1974*. Includes all native animals, as well as all native plants listed on Schedule 13 of the *National Parks and Wildlife Act 1974*.
Recovery plan	A plan prepared under the TSC Act, FM Act or the EPBC Act to assist the recovery of a Threatened species, population or ecological community.
Significant	Important, weighty or more than ordinary as defined by Department of Environment, Climate Change and Water (2007b).
Stag	A dead tree
Study Area	The extent of indirect impacts, which may occur outside of the subject site as consequence of impacts within the subject site.
Subject Site	The extent of direct impacts that will be affected as a consequence of the project. This includes the footprint of the project, associated with proposed infrastructure and potential construction work sites.
Threatened biodiversity	Threatened species, populations or ecological communities as listed under the TSC Act, FM Act or the EPBC Act.
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as Threatened) under the TSC Act, FM Act or the EPBC Act. Capitalisation of the terms 'Threatened', 'Vulnerable', 'Endangered' or 'Critically Endangered' in this report refers to listing under the relevant state and/or Commonwealth legislation.
TSC Act	NSW *Threatened Species Conservation Act 1995*
Viable local population	A population that has the capacity to live, develop and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (Department of Environment and Climate Change 2007b).

Executive summary

This report outlines the ecological assessment of the proposed new rail track at Nundah Bank, in the Hunter Valley NSW. The project consists of the construction of approximately 4.26 km of third track parallel (up side) to the existing Main Northern Railway line.

This report supports the environmental assessment for the project under Part 3A of the *Environmental Planning and Assessment Act 1979*. It provides a worst case scenario for impacts of the project on biodiversity as it provides a broad corridor assessment. The area of vegetation and habitats to be cleared would be reduced as a result of ongoing detailed design.

Field surveys were undertaken between 16 and 20 August 2010 and included:

- quadrat and random meander surveys
- small mammal trapping (arboreal and terrestrial)
- microbat surveys using anabat bat detector and harp traps
- spotlighting and call playback
- diurnal bird surveys
- active herpetofauna searches
- hollow tree survey
- general habitat assessment.

The majority of the vegetation within the site has been previously cleared and extensively modified as a result of: historic and current grazing; rail construction in the current and former locations; open cut coal mining and associated works.

Where the landscape and soil profile haven't been significantly modified the original vegetation is regenerating from a soil stored seed bank. There is some regeneration in areas where the soil profile has been disturbed/removed through dispersal of seeds from isolated mature trees and colonising species (such as Acacia spp.) as well as planting undertaken by the landowners. The subject site contains five distinct vegetation types:

- Central Hunter Spotted Gum – Ironbark – Grey Box:
  - Forest – covering approximately 8.755 ha.
  - Derived grassland (native grassland formed as a result of clearing and/or ongoing grazing – covering approximately 13.37 ha.
- Aquatic vegetation along drainage lines and dams- covering approximately 0.26 ha.
- Weed dominated areas – covering 40.99 ha.
- Plantation (rehabilitation following mining) covering 0.64 ha.

The proposal will include the removal of 22.12 ha of native vegetation, including 8.75 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest, which is listed as a Threatened ecological community under the TSC Act.

No Threatened ecological community listed under the EPBC Act was recorded in the study area. No Endangered Population listed under the TSC Act and/or the EPBC Act was identified or was considered likely to occur in the study area.

No Threatened species of plant listed under the TSC Act or the EPBC Act was identified in the study area. However, significance assessments were completed on two Threatened plant species, *Diuris tricolor* (Vulnerable under the TSC Act) and *Bothriochloa biloba* (Vulnerable under the EPBC Act), based on the presence of potential habitat. These assessments concluded that the proposal was unlikely to have a significant impact on these species due to the small area (22.12 ha) of potential habitat likely to be affected, its disturbed and fragmented nature and ongoing disturbance.

Four Threatened species of animal listed under the TSC Act and/or the EPBC Act were recorded in the study area including, Squirrel Glider, Grey-crowned Babbler, Little Lorikeet and Grey-headed Flying-fox. Significance assessments were also completed on a further 36 Threatened species of animal, based on the presence of suitable habitat. Significance assessments completed for these species concluded that the proposal was not likely to have a significant impact for one or more of the following reasons:

- The subject site essentially followed disturbed easements with no preferred habitat recorded therein.
- The study area existed as highly fragmented and isolated regrowth/remnant vegetation.
- The subject site lacked important microhabitat elements such as roosting and breeding habitat (i.e. large tree hollows).
- The species' were highly mobile and while the subject site potentially occurred as part of a larger home range, the species would use larger tracts of vegetation/habitat in the locality and not the study area exclusively.

Although the impacts to threatened biodiversity are not considered to be significant, given that the Project would result in clearing of native vegetation, including an Endangered Ecological Community and habitat for Threatened species, it would be necessary to develop offset strategies to fulfil the Director General's and DECCW's requirements for the Part 3A assessment, particularly the principle of and the 'maintain and improve'. The offset strategy will also be developed in accordance with *The Principles for the Use of Biodiversity Offsets in NSW* (Department of Environment and Climate Change 2008b).

1. Introduction

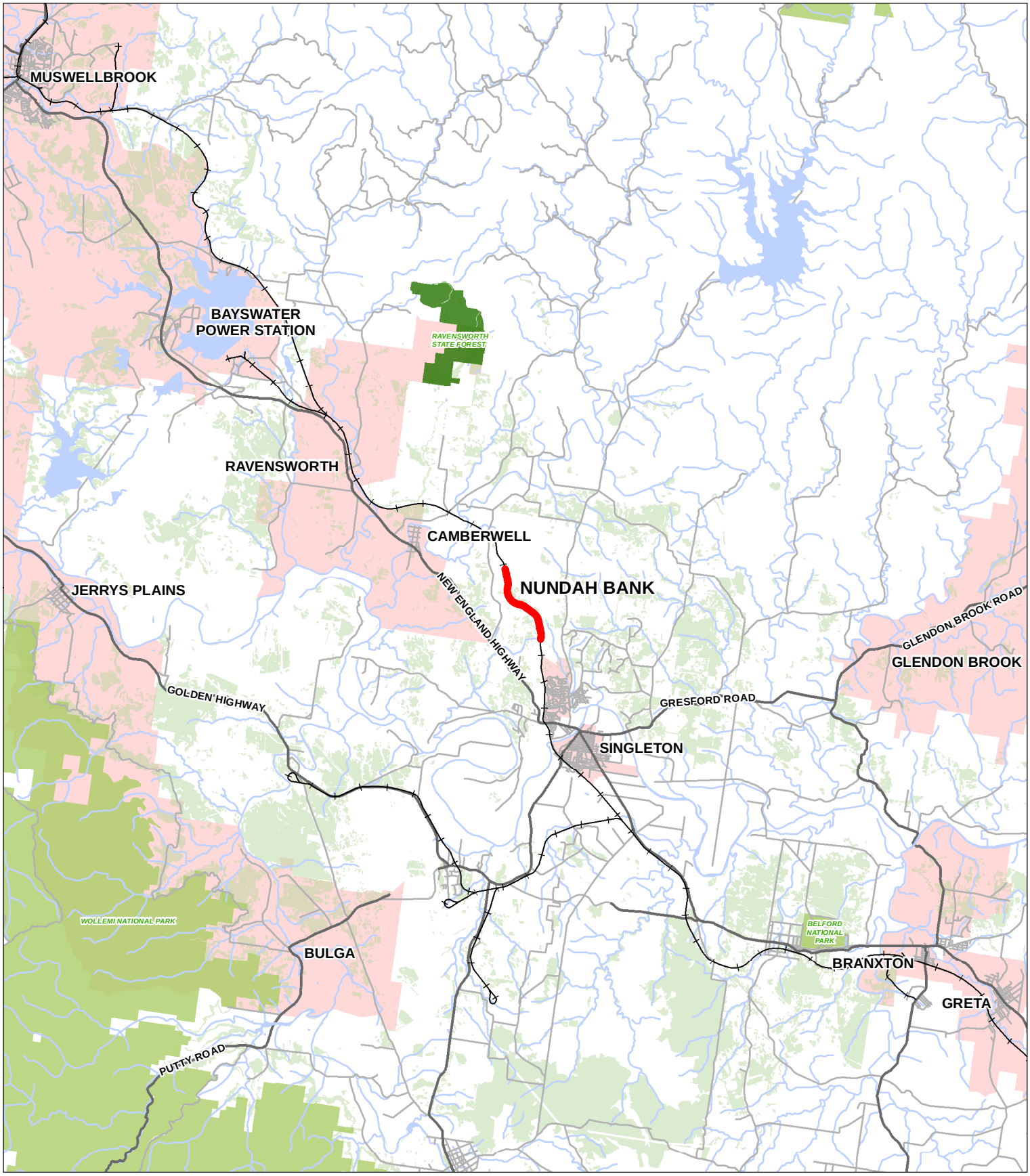
This report outlines the ecological assessment of the proposed new rail track at Nundah Bank, in the Hunter Valley NSW. This report supports the environmental assessment for the project under Part 3A of the *Environmental Planning and Assessment Act 1979*.

1.1 Proposed works

The project consists of the construction of approximately 4.26 km of third track parallel (up side) to the existing Main Northern Railway line (Figure 1-1). Further details are provided in the main Environmental Assessment report. Associated works include:

- Approximately 4.26 km of single track at grade on the up side of the existing up main between 245.240 km and 249.500 km including two new turnouts and return curves.
- Reconditioning of the existing up main to cater for load sharing between the new up relief and up mains.
- Upgrades to Camberwell Junction to provide two new crossovers and two new turnouts to the existing balloon loop.
- New vehicular maintenance access tracks adjacent to the proposed third track on both the up and down sides.
- Widening of the formation beneath the existing Rixs Creek Mine Haul Road overbridge to provide width for the third track and access roads to both sides.
- Decommissioning of the existing signalling system and installation of new signals spaced at 500 m with 400 m overlaps.
- Construction of temporary ancillary infrastructure such as construction compounds, haul roads, sedimentation basins and stockpile sites.
- Services and utilities adjustments.
- The acquisition of land.
- Earthworks for track formation, drainage and minor structures.

This report provides a worst case scenario for impacts to biodiversity as it provides a broad corridor assessment. The area of vegetation and habitats to be cleared would be reduced as a result of ongoing detailed design.



Third Track
Main Roads
Major Roads
Rail Lines
National Park
State Forest
Forest or Shrub
Water course
Watercourse Areas
Built Up Areas

A4 Original

0 2.5 5 10

Kilometres

GDA 1994 MGA Zone 56

N

ARTC
Nundah Bank

Job Number	2110501B
Revision	A1
Date	09.02.2011
Scale	1:250,000

Location Plan

Figure 1.1

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1.2 Director-General's requirements

A summary of the Director-General's requirements, guidelines to be followed and requirements provided by Department of Environment Climate Change and Water (DECCW) are provided in Table 1-1 including the relevant section of this report where these requirements are addressed.

Table 1-1 Ecological assessment requirements

Assessment requirements	Addressed in report
Director General's	
Assessment of flora, fauna and habitat with specific consideration of Endangered ecological communities, Threatened flora, fauna and populations	Sections 3, 4 and 5
Assessment of vegetation clearing (and resultant foraging, roosting habitat loss, fragmentation, connectivity and edge effects) and operational impacts (such as increase in rail movements)	Section 5
Consideration of *The Draft Guidelines for Threatened species assessment* (Department of Environment and Conservation & Department of Primary Industries 2005)	Section 2.6, Section 7
Consideration of *Threatened biodiversity survey and assessment: Guidelines for developments and activities* (Department of Environment and Conservation 2004)	Section 2.4
Consideration of Principles for the use of biodiversity offsets in NSW (Department of Environment and Climate Change 2008b)	Section 8
Department of Environment Climate Change and Water (DECCW)	
Document all 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)	Section 4, Appendix C and D
Provide details of the survey methodologies and/or techniques utilised	Section 2, Appendix F
Provide a detailed assessment of the impacts on such species, habitats, populations and ecological communities	Section 5, Appendix E
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 habitats	Section 6
The project should be assessed in accordance with the following legislative requirements and guidelines:	
Threatened biodiversity survey and assessment: Guidelines for developments and activities (Department of Environment and Conservation 2004)	Section 2.4
Threatened species survey and assessment guidelines: field survey methods for fauna- Amphibians {Department of Environment Climate Change, 2009 #3150}	Section 2.4.2
Threatened species assessment guidelines. The assessment of significance {Department of Environment and Climate Change, 2007 #1880; Department of Primary Industries, 2008 #3213}	Section 2.6, Section 7
The Draft Guidelines for Threatened species assessment (Department of Environment and Conservation & Department of Primary Industries 2005)	Section 2.6, Section 7

Assessment requirements	Addressed in report
Principles for the use of biodiversity offsets in NSW (Department of Environment and Climate Change 2008b)	Section 8
The BioBanking assessment methodology {Department of Environment and Climate Change, 2008 #3212}	Section 2.4.1 and 8
Consideration for assessment of the proposal through the NSW Government's Biodiversity Banking and Offset Scheme (BioBanking)	Section 8

1.3 Aims

The objectives of this ecological assessment, considering the requirements listed in Section 1.2, were to:

- Describe the existing environment, including vegetation communities, flora and fauna habitats.
- Describe constraints for the study area associated with the proposal, with particular reference to species, populations and communities, listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or *Fisheries Management Act 1994* (FM Act).
- Prepare significance assessments for the project's potential impacts, where required, on locally occurring Threatened species, populations and ecological communities listed under the TSC Act, the EPBC Act and/or the FM Act.
- Develop mitigation measures appropriate for the proposal relating to biodiversity.

2. Methods

This ecological assessment included both desk-based assessment of the literature and relevant databases, as well as field survey of the study area and surrounding landscape.

2.1 Personnel

The contributors to the preparation of this report, their qualifications and roles are listed in Table 2-1.

Table 2-1 Contributors and their roles

Name	Qualification	Role
Alex Cockerill	BSc (Hons)	Senior ecologist – project manager
Selga Harrington	BSc (Hons)	Senior ecologist – flora assessment
Nathan Cooper	BEnvSc	Ecologist – fauna assessment
Lukas Clews	BSc	Ecologist – fauna assessment
Martin Predavec	PhD, BSc (Hons)	Technical executive ecology – technical review

All work was carried out under the appropriate licences, including a scientific licence as required under Clause 22 of the National Parks and Wildlife Regulations 2002 and Section 132C of the *National Parks and Wildlife Act 1974,* and an Animal Research Authority issued by the Department of Industries and Investment NSW (Agriculture).

2.2 Nomenclature

Names of plants used in this document follow Harden (Harden 1992, 1993, 2000, 2002) with updates from PlantNet (Royal Botanic Gardens 2010). Scientific names are used in this report for species of plant followed by the common names in brackets. Scientific and common names of plants are listed in Appendices A and C. Introduced species are identified within the text with an asterisk following the name, for example *Lantana camara**.

Names of vertebrates follow the Census of Australian Vertebrates (CAVS) database maintained by the Department of the Environment, Water, Heritage and the Arts (Department of the Environment Water Heritage and the Arts 2009a). Common names are used in the report for species of animal. Scientific names are included in species lists found in Appendix C.

2.3 Database searches

Records of Threatened species known or predicted to occur within the project locality were obtained from a range of databases as detailed in Table 2-2. Available literature was reviewed including regional assessments as well as ecological studies undertaken within the study area, such as:

- *Nundah Bank concept assessment report* (SKM 2009a).

- *Integra underground coal project: flora and fauna assessment* (ERM 2009).
- *Nundah project preliminary environmental assessment* (SKM 2009b).
- *Integra open cut project: biodiversity assessment* (URS 2009).

Table 2-2 Database searches

Database	Search date	Area searched	Reference
Threatened species, populations and communities database	2 August 2010	Hunter/Central Rivers CMA Hunter Sub-catchment	Department of Environment and Climate Change (2010b)
Atlas of NSW Wildlife	2 August 2010	10 km radius centred on the subject site	Department of Environment Climate Change and Water (2010a)
Threatened & protected species – records viewer	20 September 2010	Hunter/Central Rivers CMA; Singleton LGA	Department of Industry and Investment {, 2010 #3209}
EPBC Protected Matters Search	14 February 2011	10 km radius centred on the subject site	Department of Sustainability, Environment, Water, Population and Communities

Note: This tool was repaired in February 2011 and as such updated database search has been conducted and is included in this report. Flora and Fauna database searches were completed as a radius (10 km) around the following co-ordinates: UTM, 56 325137 6402587.

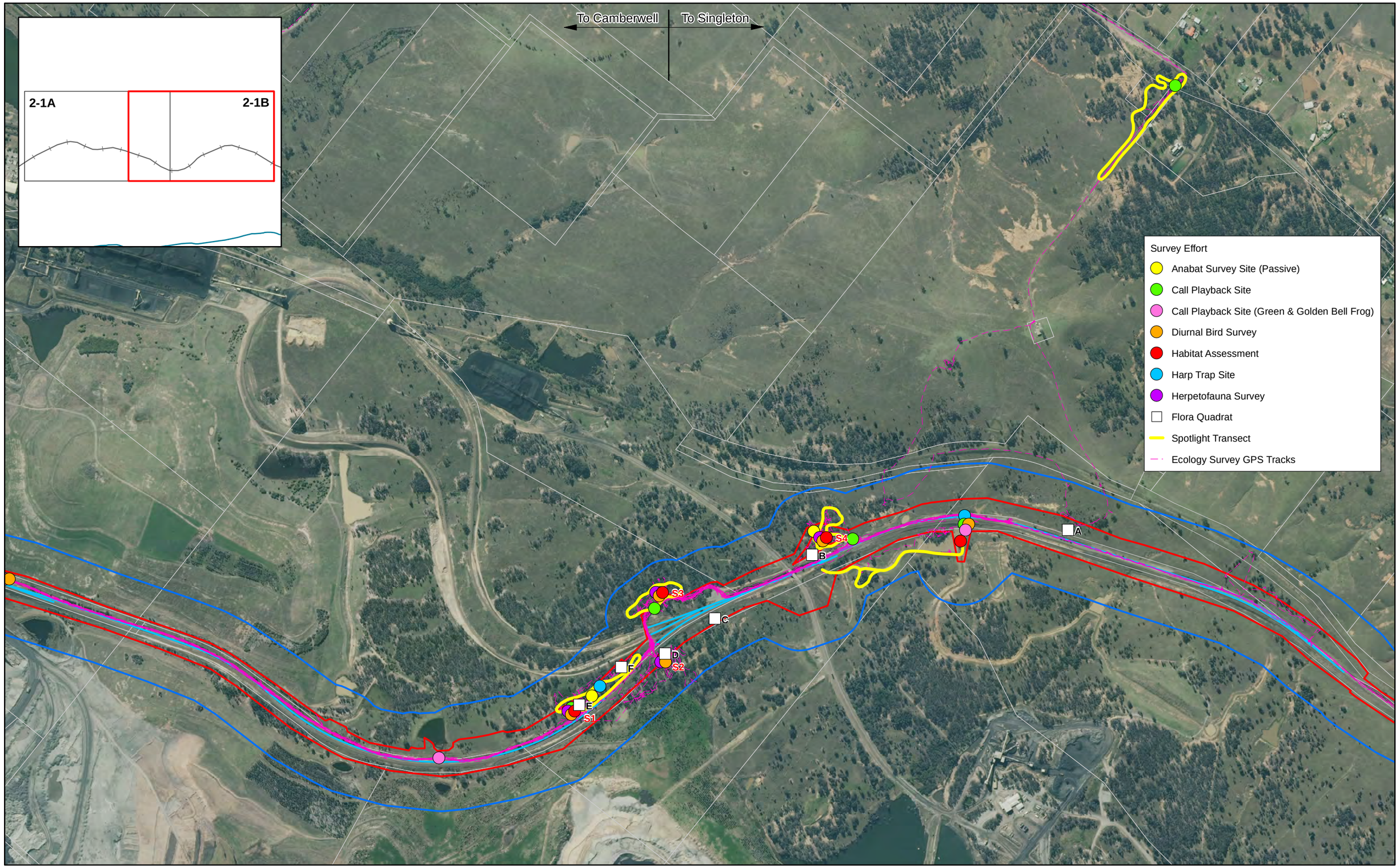
2.4 Field survey

Field surveys were undertaken between 16 and 20 August 2010. Survey effort is described below and mapped in Figures 2-1A and B.

2.4.1 Flora

The floristic diversity and possible presence of Threatened species was assessed using a combination of random meander and plot-based (quadrat) surveys in accordance with the NSW *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (Department of Environment and Conservation 2004).

Due to the linear nature of the project, random meander surveys were completed along the entire length of the project corridor. Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random manner throughout the site recording all species observed, boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.



A3 Original

0 125 250 500

Meters

GDA 1994 MGA Zone 56

N

Proposed Third Track Alignment
Study Area
Subject Site
Cadastre

ARTC
Nundah Bank
Proposed Third Track

Job Number	2110501A
Revision	A2
Date	16.02.2011
Scale	1:10,000

Survey Effort Map Figure 2-1B

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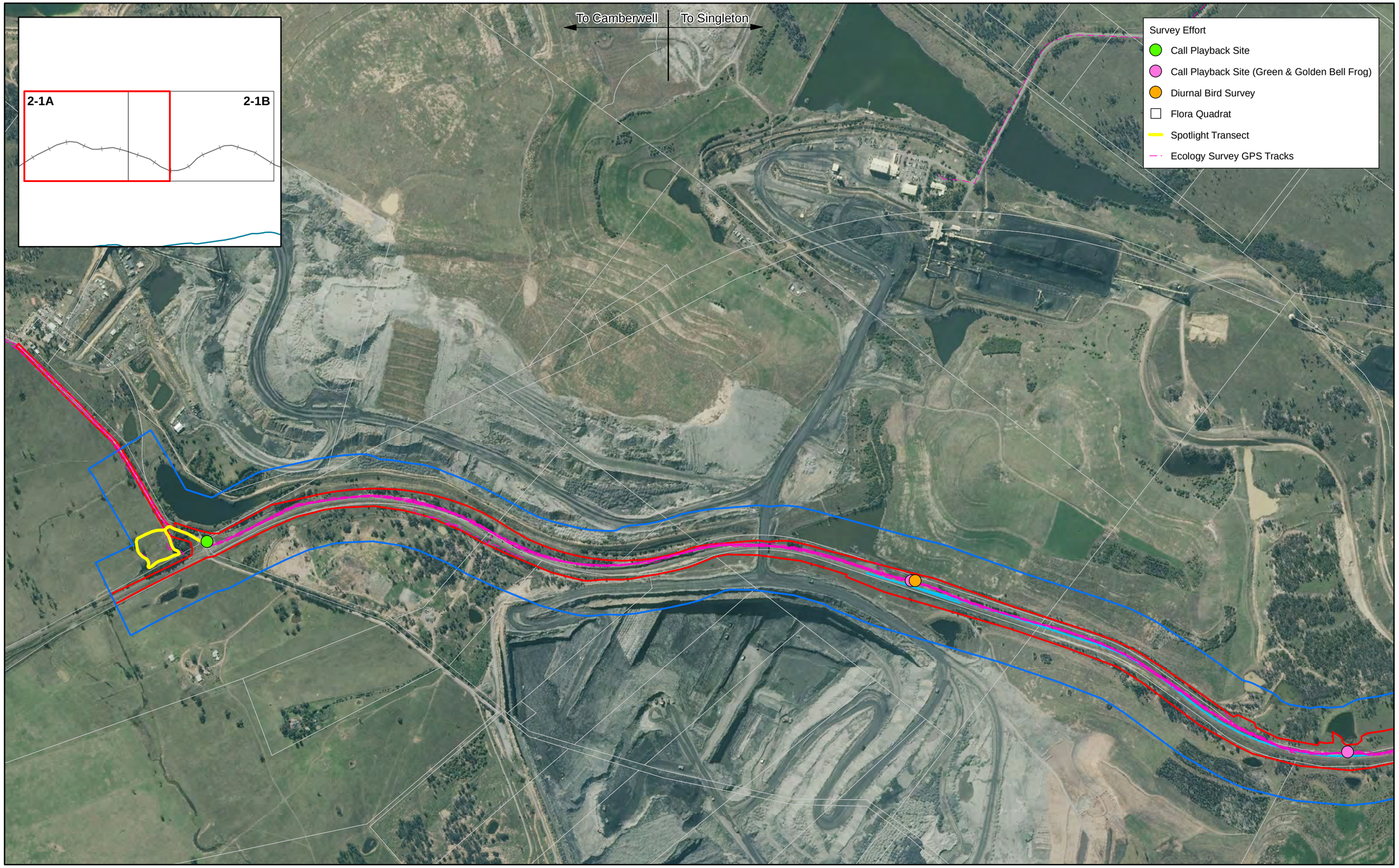

A3 Original

0 125 250 500

Meters

GDA 1994 MGA Zone 56

Proposed Third Track Alignment
Study Area
Subject Site
Cadastre

ARTC
Nundah Bank
Proposed Third Track

Job Number	2110501A
Revision	A2
Date	16.02.2011
Scale	1:10,000

Survey Effort Map Figure 2-1A

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2.4.1.1 Quadrats

Five quantitative (quadrat) site surveys (Table 2-3 and Figures 2-1A and B) were undertaken as outlined in the methodology contained within BioBanking Operation Manual (Seidel & Briggs 2008) and described below. Figure 2-4 illustrates the plot layout that was used at each site.

Table 2-3 Location of flora quadrats

Site name	Easting	Northing
A	326536	6401437
B	326137	6402057
C	325777	6402109
D	325655	6402257
E	325406	6402396
F	325559	6402346

Notes: MGA 94; Zone 56

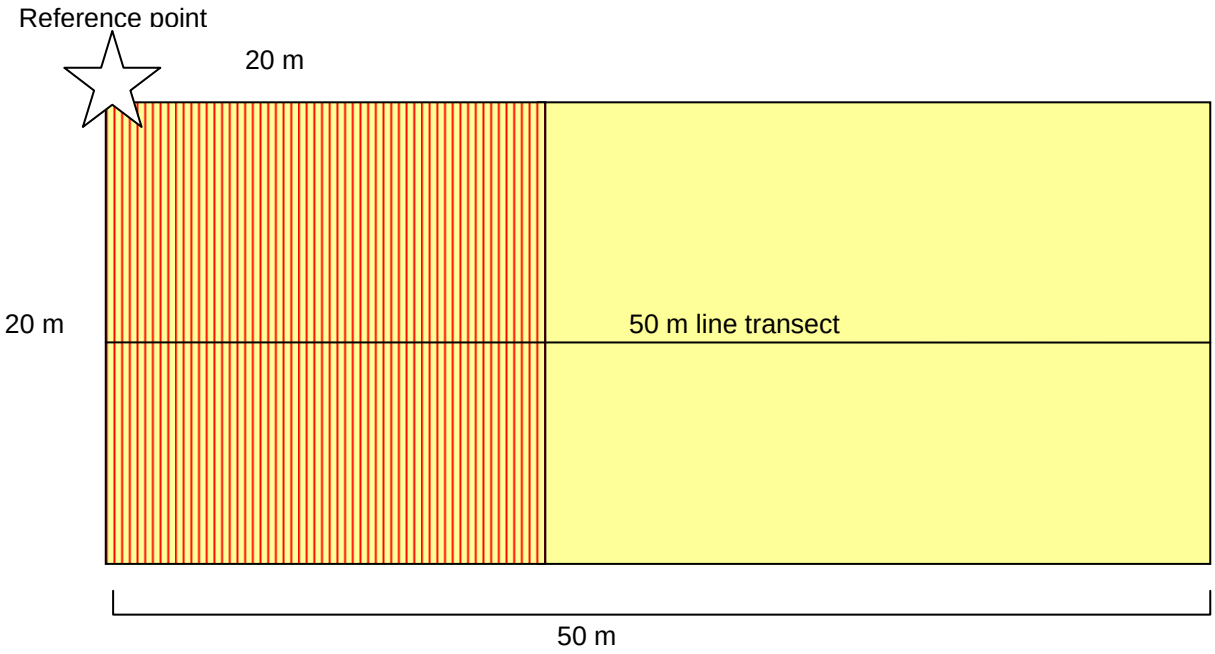

Figure 2-2 Schematic diagram illustrating the layout of the nested 20 x 50 m and 20 x 20 m quadrats used for the assessment of condition attributes at each site

Key: 20 x 20 m quadrat 20 x 50 m quadrat

The following site attributes were recorded at each site:

- **Location** (easting – northing grid type MGA 94, Zone 56).
- **Vegetation structure and dominant species and vegetation condition.**
- **Native and exotic species richness** (within a 400 m^2 quadrat): This consisted of recording all species by systematically walking through each 20 x 20 m quadrat. The cover abundance of each species was estimated.
- **Number of trees with hollows** (1,000 m^2 quadrat): This was the frequency of hollows within living and dead trees within each 50 x 20 m quadrat. A hollow was only recorded if (a) the entrance could be seen; (b) the estimated entrance width was at least 5 cm across; (c) the hollow appeared to have depth; (d) the hollow was at least 1 m above the ground and the (e) the centre of the tree was located within the sampled quadrat.
- **Total length of fallen logs** (1,000 m^2 quadrat): This was the cumulative total of logs within each 50 x 20 m quadrat with a diameter of at least 10 cm and a length of at least 0.5 m.
- **Native overstorey cover**: This consisted of estimating the percentage cover of the tallest woody stratum present (>1 m and including emergents). The woody stratum included species that were native to New South Wales and not necessarily those that were locally endemic.
- **Native mid-storey cover**: This involved estimating the cover of vegetation between the overstorey stratum and a height of 1 m (i.e. tall shrubs, under-storey trees and tree regeneration).
- **Ground cover**: This comprised estimating the cover of plants below 1 m in height. The following categories of plants were recorded:
  - **Native ground cover (grasses):** native grasses (Poaceae family native to NSW).
  - **Native ground cover (shrubs)**: all woody vegetation below 1 m in height and native to New South Wales.
  - **Native ground cover (other)**: non-woody vegetation (i.e. vascular plants – ferns and herbs) below 1 m in height and native to New South Wales.
  - **Exotic plant cover**: vascular plants not native to Australia.
- **Evaluation of regeneration**: This was estimated as the proportion of overstorey species present at the site that was regenerating (i.e. saplings with a diameter at breast height ≤5 cm). The maximum value for this measure was 1.

2.4.1.2 Condition and quality assessment of vegetation communities

The condition of vegetation was assessed through general observation and comparison against this benchmark data as well as using parameters such as intactness, diversity, history of disturbance, weed invasion and health.

Three categories were used to describe the condition of vegetation communities:

- **Good**: Vegetation still retains the species complement and structural characteristics of the pre-European equivalent. Such vegetation has usually changed very little over time and displays resilience to weed invasion due to intact groundcover, shrub and canopy layers.

- **Moderate:** Vegetation generally still retains its structural integrity, but has been disturbed and has lost some component of its original species complement. Weed invasion can be significant in such remnants.

- **Low:** Vegetation that has lost most of its species and is significantly modified structurally. Often such areas have a discontinuous canopy of the original tree cover, with very few shrubs. Exotic species, such as introduced pasture grasses or weeds, replace much of the indigenous ground cover. Environmental weeds are often co-dominant with the original indigenous species.

Following the biometric methodology (NSW Department of Environment and Conservation 2007), woody vegetation, is in low condition vegetation when:

- Overstorey percent foliage cover is <25% of the lower values of the overstorey per cent foliage cover benchmark for that vegetation type, AND either:

  - less than 50% of vegetation in the ground layer is indigenous species, OR

  - greater than 90% is ploughed or fallow.

2.4.2 Fauna

Survey effort considered the methodology detailed in the *NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (Department of Environment and Conservation 2004) and the *Threatened Species survey and assessment guidelines: field survey and methods for fauna- Amphibians* (NSW Department of Environment 2009).

Surveys included fauna habitat assessments including tree hollow survey as well as targeted surveys including mammal trapping, microchiropteran bat surveys (trapping and anabat recordings), spotlighting and call playback, diurnal bird surveys and active herpetofauna searches. The methods used are described below.

All fauna species observed during the fauna surveys were documented and combined into a total species list (Appendix B).

2.4.2.1 Fauna habitats

Fauna habitat assessments were completed to assess the likelihood of Threatened species of animal occurring in the study area. Habitat assessments included the assessment and identification of habitat features, hollow tree surveys and random meander surveys.

During habitat assessments and random meander surveys, opportunistic recordings of species were made through incidental sightings, aural recognition of calls and observations of indirect evidence of species' presence (i.e. Yellow-bellied Glider chews, Glossy-black

Cockatoo chew cones, nests/dreys, whitewash, burrows and scats). This provided supplementary information on faunal species presence.

Fauna habitats were assessed generally by examining characteristics such as the structure and floristics of the canopy, understorey and ground vegetation, the structure and composition of the litter layer, and other habitat attributes important for feeding, roosting and breeding. The following criteria were used to evaluate habitat values:

- **Good:** A full range of fauna habitat components are usually present (for example, old-growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- **Moderate:** Some fauna habitat components are missing (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- **Poor:** Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive past clearing.

Specific fauna habitat features were assessed at five locations (Figures 2-1A and B) in the study area. Features measured and assessed at each site are shown in (Table 2-4).

Table 2-4 Fauna habitat features assessed

General features	Overstorey features	Other features	Fauna tracks/signs	If water body present
Site number	Dominant vegetation	Artificial habitat features	Fauna scats	Waterbody type
Location (easting, northing)	Dominant overstorey species	Significant flowering events	Squirrel/Sugar Glider chews	Level of permanence
Evidence of disturbance	Senescence in canopy (%)	Midstorey (>2 m) cover	Scratches and worn areas on trees	Fringing composition
Evidence of clearing	Hollows high trunk	Significant species for fauna (e.g. food)	Potential Large Forest Owl roost trees	Riparian vegetation
Erosion	Hollows mid trunk	Understorey (<2 m) cover	Miscellaneous fauna traces	Condition of water body
Evidence of fire	Hollows low trunk	Groundcover vegetation (%)		
Epicormic growth	Fire scar hollows	Groundcover leaf litter (%)		
Other disturbance	Limb hollows	Fallen logs		
	Stags	Size of hollows in fallen logs (if any)		
		Rocks		

2.4.2.2 Small mammal trapping

Small to medium sized mammals were surveyed using a number of live trapping methods. Live capture/release methods included Elliott type A for small ground-dwelling mammals and Elliott type B traps for small arboreal mammals.

Elliott type A traps were placed at 10 m intervals along each of five transect lines at survey sites S1-S4 (five Elliott per transect). Traps were baited with standard bait mixture (rolled oats, peanut butter and honey) and were operated over a four-night period at each site (Figures 2-1A and B). A total of 100 trap nights were recorded at each of the four standard survey sites (Appendix F).

Elliott type B traps were secured on tree-mounted brackets and set approximately 3 m above ground level in suitable habitat/hollow-bearing trees (as far as practicable). Six tree-mounted traps were set in survey sites S1-S4 (Figures 2-1A and B). Each trap was baited with a standard bait mixture, while a mixture of honey and water was sprayed onto the trunk of the tree above the Elliott trap as a lure. Elliott traps were operated over a three-night period at each site, with 18 trap nights recorded at each survey site (S1-S4).

All traps were checked each morning with captured animals identified to species level and released at the site of capture. All live trapping followed guidelines and policies for wildlife research as set by the Animal Research Review Panel (Australian Government 2004).

2.4.2.3 Microchiropteran bat surveys

Ultrasonic Anabat Bat detection (Anabat SD1 CF Bat Detector – Titley Electronics, Ballina) was used to record and identify the echolocation calls of microchiropterans foraging at eight locations in the study area (Figures 2-1A and B). Six survey locations were surveyed using active monitoring methods, while two survey sites were surveyed using passive monitoring methods. Passive monitoring of survey sites was achieved by setting Anabat bat detectors to record throughout the night. Active monitoring of survey sites was completed during spotlight events at nominated sites across the study area, whereby an Anabat detector was used to track the animals and record their calls while actively spotlighting. Bat call analysis was undertaken by Nathan Cooper of Parsons Brinckerhoff, with the presentation of data following guidelines of the Australasian Bat Society (see Appendix H). Bat calls of New South Wales Sydney Basin (Pennay *et al.* 2004) was used as a reference collection for bat call identification.

Harp traps were used to trap foraging microchiropterans. Harp traps were located at sites within the study area that had the potential to be used as fly-ways by foraging microchiropterans. Two locations within the study area were targeted with harp traps set in each location for two consecutive nights (Figures 2-1A and B). Harp traps were checked each evening following spotlighting events and again the following day during morning hours. Microchiropteran species caught by harp traps, were identified to species level, sexed, weighed and forearm measurement recorded. Microchiropterans caught before evening harp trap checks were released the same night, while those caught after the evening check were contained until the following evening for release. Where possible, reference calls were collected for captured bats for use in analysis of bat calls.

2.4.2.4 Spotlighting

Spotlighting was used to target arboreal, flying and large ground-dwelling mammals, as well as nocturnal birds, reptiles and amphibians. Spotlighting was done after dusk at seven locations in the study area (Figures 2-1A and B). At least one person hour of survey effort was undertaken at six survey locations (survey sites S1, S3, S4 and three supplementary sites) on foot using two 100 watt vari-beam spotlights (see Appendix F). The speed of the spotlight surveys was approximately 1 km per hour. Surveys concentrated on areas that contained suitable habitat for nocturnal species, with sighted animals identified to the species level.

One other spotlight survey consist of a drive transect along the existing upside rail easement from chainage 246200 km to 251550 km. The vehicle was driven at approximately 5 km per hour. Two 100 watt vari-beam spotlights were used to survey habitat along the existing rail alignment, with sighted animals identified to the species level.

2.4.2.5 Call playback

Call playback was used to survey for the Barking Owl, Powerful Owl, Masked Owl and Squirrel Glider using standard methods (Debus 1995; Kavanagh & Debus 1994). Call playback was done after dusk at four locations in the study area (Figures 2-1A and B and Appendix F).

For each survey, an initial listening period of 10 to 15 minutes was undertaken, followed by a spotlight search for 10 minutes to detect any animals in the immediate vicinity. The calls of the target species were then played intermittently for five minutes (Squirrel Glider, Barking Owl, Powerful Owl and Masked Owl respectively) followed by a 10 minute listening period. After the calls were played, another 10 minutes of spotlighting was done in the vicinity to check for animals attracted by the calls, but not vocalising. Calls from Stewart (Pennay *et al.* 2004; Stewart 1998) were broadcast using an MP3 player and amplified through a megaphone.

Call playback was also used to target the Green and Golden Bell Frog at three supplementary locations in the study area. This method was used in an attempt to stimulate male frogs to call by broadcasting their call using an MP3 player and amplified through a megaphone. Calls were broadcast intermittently over a 20 minute period at each location.

2.4.2.6 Diurnal bird surveys

Bird surveys were completed at six locations in the study area (Figures 2-1A and B and Appendix F). Bird surveys conducted at survey sites S1-S4 were completed by actively walking through the nominated sites (transect) over a period of 20 minutes. All birds were identified to the species level, either through direct observation or identification of calls.

Two other bird surveys (supplementary sites) were completed near dams (Aquatic habitat) in the study area. Birds were observed from a stationary point on the periphery of the body of water for at least one person hour. All birds were identified to the species level, either through direct observation or identification of calls.

2.4.2.7 Herpetofauna active searches

Herpetofauna active searchers involved looking for active specimens and eye shine (frogs only); turning over suitable ground shelter, such as fallen timber, sheets of iron and exposed rocks; racking debris; and peeling decorticating bark. Specimens were either identified visually, by aural recognition of call (frogs only) or were collected and identified using nomenclature outlined in Swan *et al* (2004) (A Field Guide to Reptiles of New South Wales).

Herpetofauna surveys were completed by two persons over a 20 minute period and all ground shelter was returned to their original positions. Herpetofauna active searches were completed at standard trap sites (S1-S4) and at another 2 supplementary sites that showed potential habitat for this group (Figures 2-1A and B and Appendix F). Frogs and reptiles were also surveyed during spotlight events and opportunistically across the Study Area.

Frog surveys were conducted in accordance with frog survey guidelines (Department of the Environment Water Heritage and the Arts 2010b) and the hygiene protocol for the control of disease in frogs (NSW National Parks and Wildlife Service 2001).

2.4.2.8 Hollow tree survey

While a complete inventory of hollow trees was not completed in the study area, any hollow-bearing tree observed therein was recorded and provides a good indication of their abundance. The number of tree hollows and sizes recorded were based on visual estimates and categorised into the following size classes:

- <5 cm
- 6-15 cm
- 16-30 cm
- >30 cm.

2.5 Likelihood of occurrence

For this study, likelihood of occurrence of Threatened species within the study area for species recorded or predicted to occur in the locality is defined in Table 2-5.

Table 2-5 Likelihood of occurrence of threatened species

Likelihood	Description
Low	Species considered to have a **low likelihood of occurrence** include species not recorded during the field surveys that fit one or more of the following criteria: ▪ Have not been recorded previously in the study area and surrounds and for which the study area is beyond the current distribution range. ▪ Rely on specific habitat types or resources that are not present in the study area. ▪ Are considered locally extinct. ▪ Are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.

Likelihood	Description
Moderate	Species considered to have a **moderate likelihood of occurrence** include species not recorded during the field surveys that fit one or more of the following criteria: ▪ Have infrequently been recorded previously in the study area and surrounds. ▪ Use habitat types or resources that are present in the study area, although generally in a poor or modified condition. ▪ Are unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically during variable seasons or migration. ▪ Are cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
High	Species considered to have a **high likelihood of occurrence** include species not recorded that fit one or more of the following criteria: ▪ Have frequently been recorded previously in the study area and surrounds. ▪ Use habitat types or resources that are present in the study area that are abundant and/or in good condition within the study area. ▪ Are known or likely to maintain resident populations surrounding the study area. ▪ Are known or likely to visit the site during regular seasonal movements or migration.
Recorded	Any Threatened species recorded during field surveys.

2.6 Significance assessments

The impact assessments followed the methodologies outlined in Appendix E Section 1 and were based upon the proposal description provided in Section 1.1. Tests for significance were completed for Threatened species, populations or ecological communities considered to have a moderate or higher likelihood of occurrence.

For Threatened biodiversity listed under the TSC Act, this section details the heads of consideration for Threatened species assessment as suggested in the Department of Environment and Conservation/Department of Primary Industries draft Guidelines for Threatened Species Assessment (Department of Environment and Conservation & Department of Primary Industries 2005). The guidelines present methods to consider the impacts on biodiversity of Proposals assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*, including presenting heads of consideration for determining the significance of impacts.

For Threatened biodiversity listed under the EPBC Act significance assessment have been completed in accordance with the EPBC Act *Significant Impact Guidelines* (Department of the Environment and Heritage 2006).

For species, populations or communities listed under both Acts, both assessments were completed.

This report provides a worst case scenario for impacts to biodiversity as it provides a broad corridor assessment. The impacts would be reduced as a result of ongoing detailed design.

2.7 Limitations

On all sites, varying degrees of non-uniformity of flora and fauna habitats are encountered. Hence no sampling technique can entirely eliminate the possibility that a species is present on a site (e.g. species of plant present in the seed bank). The conclusions in this report are based upon data acquired for the site and the environmental field surveys and are, therefore, merely indicative of the environmental condition of the site at the time of survey, including the presence or otherwise of species. It should also be recognised that site conditions, including the presence of Threatened species, can change with time. However a precautionary approach was taken and assessments undertaken based on presence of potential habitat even if species wasn't recorded.

For species where the timing of surveys was not appropriate for detection, a precautionary approach was taken and surveys focussed on detection of areas of potential habitat for these species.