# 10. Ecology

*This chapter provides a summary of the Ecological Impact Assessment undertaken for the Project. A full copy of the assessment report is included in Appendix E.*

## 10.1 Methodology

### 10.1.1 Approach to Ecological Impact Assessment

The assessment of ecological impacts was based on the following key tasks:

- Literature (desktop) review and assessment of threatened biota likely to occur within the locality of the pipeline corridor;
- Field surveys and compilation of survey results;
- preparation of vegetation and habitat maps using GIS;
- Determination of subject species, defined as those threatened species, populations or ecological communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that could be affected by the Project;
- Assessment of impacts on native flora and fauna and subject species, as well as on other biodiversity values; and
- Development of measures to avoid, mitigate and offset impacts on biodiversity values associated with the Project.

### 10.1.2 Director-General's Requirements

The Director-General's requirements (DGRs), state that the EA must include a '*flora and fauna impact assessment in accordance with the NSW Department of Environment and Climate Change (DECC) Guidelines for Threatened Species Assessment (DEC, 2005*)'. Accordingly, GHD prepared an Ecological Impact Assessment, which is attached in Appendix E. The report assesses the ecological impacts of the proposed construction and operation of the Project, with due consideration of relevant Commonwealth and State legislation, as well as relevant guidelines, including:

- *Guidelines for Threatened Species Assessment* (DEC, 2005), with regard to the nature and content of this report; and
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC 2004). The field surveys completed for this assessment have been designed and implemented to comply with the minimum requirements recommended in these guidelines.

The DGRs include a list of requirements for the assessment of ecological impacts. These requirements and how they are addressed are detailed in Appendix E.

### 10.1.3 Literature review and assessment

A desktop literature review was undertaken by GHD to identify the representative spectrum of flora and fauna, threatened species, populations and ecological communities listed under the TSC Act and the EPBC Act that could be expected to occur within the survey corridor, based on habitats present. The following documentation was reviewed prior to conducting field investigations:

- Wildlife Atlas database, involving retrieval of threatened species records within a 10 km radius for TSC Act listed flora and fauna, centred on the survey corridor;
- Protected Matters Database, involving retrieval of matters of national environmental significance listed under the EPBC Act within a 10 km radius of the site;
- NSW Fisheries online database;
- GHD (2009) Preliminary Environmental Assessment for the Highlands Source Project; and
- Ecological Australia (2009) Wingecarribee to Goulburn Pipeline- Preliminary Environmental Assessment.

### 10.1.4 Field surveys

Field surveys were undertaken along the length of the pipeline from 16 to 20 November 2009, 7 to 11 December 2009 and 11-15 January 2010, to confirm the ecological value of key locations indentified in the literature review and previous reports for the site. Identification of additional terrestrial and aquatic habitats that warranted targeted surveys based on the quality and quantity of vegetation communities and fauna habitats present, were also included. A targeted survey was undertaken in key survey locations from 7 to 11 December 2009 to focus on areas considered likely to support threatened flora and fauna and Endangered Ecological Communities (EEC's) identified in the PEA (GHD 2009).

A corridor of 400 m width was surveyed, centred on the centreline of the proposed pipeline easement. This area of land is referred to in this Chapter and in the accompanying report (Appendix E) as the 'survey corridor'. A summary of the field surveys and effort is provided in Table 10.1.

**Table 10.1 Summary of Survey Effort**

| Task | Technique | Person Hours / Number |
|---|---|---|
| ***Flora*** | | |
| Flora Inventory | Quadrats | 61 Quadrats |
| Targeted Searches for Threatened Flora | Random Meander | All areas accessed containing suitable habitat for targeted species within proposed footprint and adjacent areas of vegetation |
| ***Fauna*** | | |
| Bird Survey | Diurnal Bird Counts | 30 minutes x 26 sites |
| Reptiles and Amphibians | Active Searches | 4 sites for total of 3 hours |
| Bats | Anabat | 15 nights (approximately 150 hours) |
| Forest owls and threatened arboreal fauna | Call Play Back | 7 locations |
| Arboreal and other nocturnal fauna | Spotlighting | 13 locations, covering approximately 6 km. Time expended 13 hours |
| Nocturnal mammals | Camera Traps | 4 camera locations |

### 10.1.5 Conservation significance

The conservation status of species and communities recorded within the survey corridor was determined with reference to the following:

- TSC Act for State significance of terrestrial species, populations and ecological communities and their habitats;
- FM Act for State significance of aquatic species, populations and ecological communities and their habitats; and
- EPBC Act for national significance of terrestrial and aquatic threatened species and threatened ecological communities, wetlands and migratory species.

### 10.1.6 Survey limitations

The factors that limited the scope of survey effort undertaken as part of this investigation included:

- Restricted access to land along the pipeline route;
- Timing of surveys was sub-optimal for the detection of some species; and

- Unfavourable weather conditions (e.g. high fire danger, windy and wet weather) impeding survey efforts whilst mobilised for field surveys.

Certain survey techniques required by the DGRs were not utilised, as they were not suitable for long linear developments such as the Project (e.g. cage trapping, stag watching, pitfalls). Alternate survey techniques were employed to target subject species listed in the DGRs and ensure adequate survey coverage for the pipeline corridor. For example, trapping for small mammals, microbats and reptiles was not undertaken due to timing constraints. Survey effort for these fauna groups focused on call identification for microbats (Anabat), and the identification of suitable foraging and roosting habitat for other species within the survey corridor. Active searches were also undertaken for mammals, reptiles and amphibians.

Given the level of survey completed and the conservative approach to the assessment undertaken, it is considered that the flora and fauna species of relevance to the survey corridor have been identified and that ecological value, conservation significance and likely impacts on threatened species (and their habitats) have been appropriately assessed. Notwithstanding, it has been agreed with DECCW that further surveys and assessment will be conducted prior to construction, and detailed in a Biodiversity Management Strategy (refer Section 10.5).

## 10.2 Existing environment

### 10.2.1 Overview

The proposed pipeline route passes through a number of vegetation community types, including large sections of cleared agricultural and grazing land, small isolated stands of remnant native vegetation, larger stands of remnant native vegetation, riparian vegetation, native sedgelands, fragmented and regrowth native vegetation, and exotic plantations and crops.

Areas of cleared agricultural land dominated the Glenquarry, Moss Vale – Werai, Sutton Forest – Exeter, and Murray's Flat – Goulburn sections of the proposed route. These areas were dominated by a mixture of native and introduced pasture grasses and weeds and were subject to extensive and heavy grazing of cattle and other livestock. These areas contained isolated paddock trees and small stands of remnant vegetation often in a degraded state lacking a shrub layer. Creek lines occurring within these sectors are mostly in a degraded state, with little to no remnant vegetation occurring along much of the waterbodies, and are typically colonised by willow (*Salix* species), regrowth *Acacia* (wattle) species and exotic weeds.

Large stands of native vegetation dominated sections of the proposed pipeline route in the Paddy's River, Marulan, and Towrang areas. The condition of this vegetation varied in levels of condition and age classes, ranging from: maturing regrowth to older remnant stands; disturbed woodland showing signs of under-scrubbing and grazing pressure; through to predominantly undisturbed large remnant stands in good condition.

### 10.2.2 Vegetation communities

Vegetation communities identified and mapped within the survey corridor are described in detail in Appendix E and their distributions shown in Figure 10.1. A total of 15 vegetation communities

were identified and mapped, of which 9 are native vegetation types. Two endangered ecological communities (EECs) listed under the TSC Act were recorded, including Southern Highlands Shale Woodlands and Robertson Basalt Tall Open Forest. Further details of these communities are provided below.

Estimates of the total mapped area of each vegetation community within the 400 m survey corridor (as calculated in GIS) are shown in Table 10.2. A total of 2686 ha of vegetation has been mapped within the survey corridor for the raw water transfer corridor, with 2400 ha within the shorter treated water pipeline. The key difference between the two pipeline options is the area of Disturbed Agricultural and Grazing Land, which occupies the majority of the western end of the survey corridor (near Goulburn), with approximately 1958 ha mapped for the raw water pipeline and 1638 ha for the treated water pipeline.

A substantial portion of the mapped area (up to 550 ha for the raw water pipeline) is classified as Mixed Dwelling/Patchy Vegetation (Table 10.2). These areas contain a mix of planted trees, landscaped areas and small patches of native vegetation within rural and residential areas and along roadsides.

The mapped areas of native vegetation are the same for both pipeline options (see Table 10.2), with the majority of the vegetation occurring within central sectors of the pipeline route (e.g. Paddys River, Towrang and Marulan), as shown in Figure 10.1. The most widespread native vegetation communities are Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges of the north east South Eastern Highlands (231 ha), Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands (141 ha) and Sydney Peppermint – Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin (129 ha) (see Table 10.2).

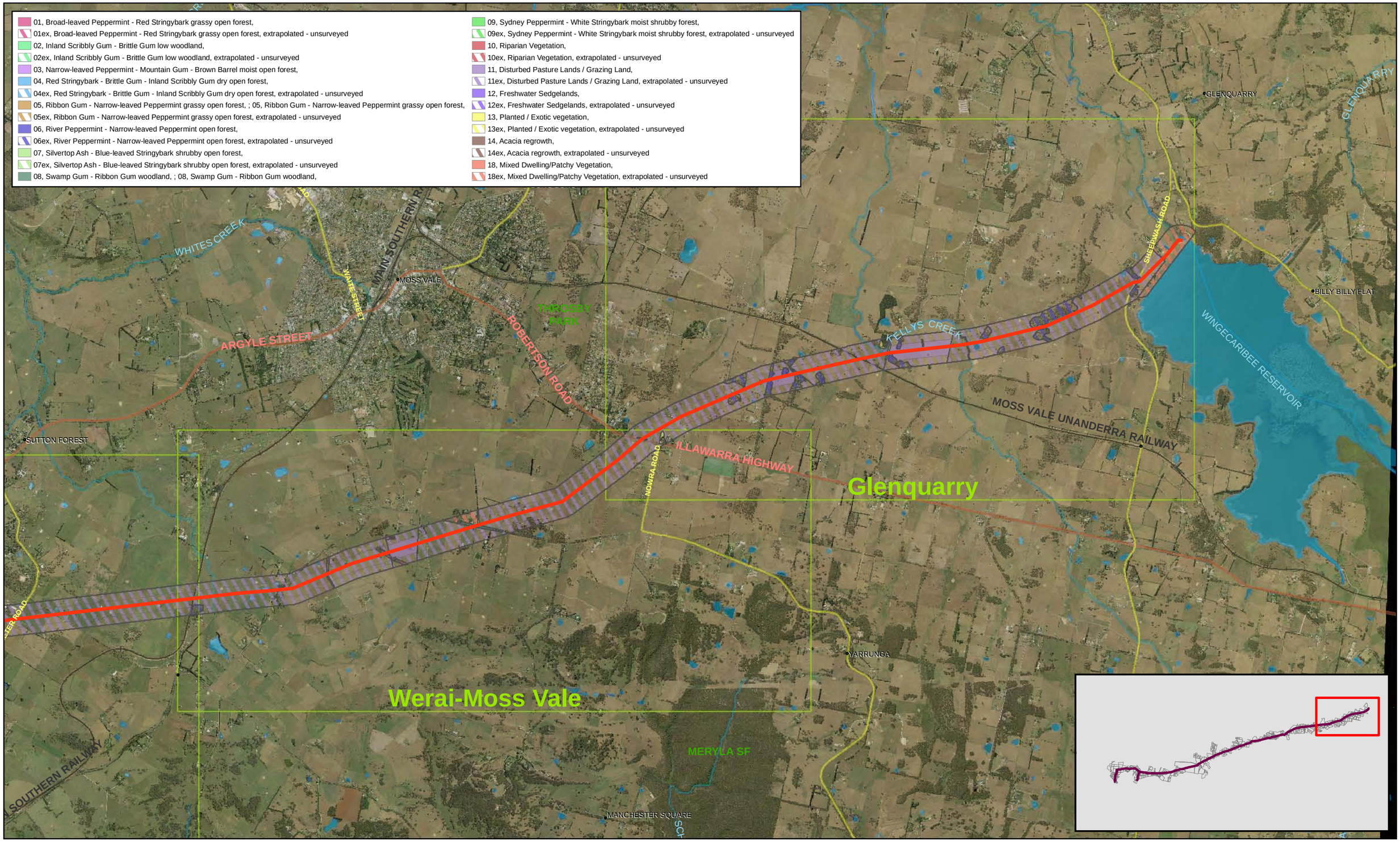
Small areas of Degraded Riparian Creeklines (6 ha for raw water and 12 ha for treated water) were recorded along waterways within the survey corridor. Elsewhere, small scattered patches of Acacia Regrowth, Planted / Exotic Vegetation and Freshwater Swamps were recorded

### 10.2.3 Flora species

Field surveys identified at total of 307 species of plants from 62 families occurring within the survey corridor. Fifty (50) of these species (approximately 16%) were exotic species, including noxious weeds such as Blackberry (**Rubus fruticosus* aggregate species) and African Lovegrass (**Eragrostis curvula*). Two threatened species, one listed as vulnerable under the TSC Act and one as endangered under the EPBC Act, were also identified as a result of these surveys (see Section 10.2.8).

**Table 10.2 Mapped Area of Vegetation Communities recorded within the 400m Survey Corridor**

| Vegetation Community | Conservation Status | 400m Corridor (ha) (Treated) | 400m Corridor (ha) (Raw) |
|---|---|---|---|
| Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills of the South Eastern Highlands | EEC (SHSW) | 83.65 | 83.65 |
| Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands | | 140.54 | 101.63 |
| Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands | EEC (RBTO) | 0.49 | 0.49 |
| Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands of the South Eastern Highlands | | 43.11 | 43.11 |
| Ribbon Gum - Narrow-leaved Peppermint grassy open forest on basalt plateaux of the Sydney Basin and South Eastern Highlands | EEC (SHSW) | 12.68 | 12.68 |
| River Peppermint - Narrow-leaved Peppermint open forest on sheltered escarpment slopes, Sydney Basin and South East Corner | EEC (SHSW) | 83.34 | 83.34 |
| Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges of the north east South Eastern Highlands | | 230.72 | 230.72 |
| Swamp Gum - Ribbon Gum woodland on poorly-drained flats of the South Eastern Highlands | EEC (SHSW) | 4.99 | 4.99 |
| Sydney Peppermint – Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin | EEC (SHSW) | 129.37 | 129.37 |
| Degraded Riparian Creeklines | | 5.88 | 11.69 |
| Freshwater Swamps | | 0.48 | 0.63 |
| Disturbed Agricultural and Grazing Land | | 1638.13 | 1957.61 |
| Planted / Exotic Vegetation | | 22.86 | 22.86 |
| Acacia Regrowth | | 3.34 | 3.34 |
| Mixed Dwelling/Patchy Vegetation | | 530.45 | 550.23 |
| | **Total** | **2399.59** | **2686.12** |

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

GHD CLIENTS|PEOPLE|PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

| | |
|---|---|
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| Revision | 0 |
| Date | 14 JAN 2010 |

Vegetation Communities
Sector: Werai - Glenquarry

Figure10.1a

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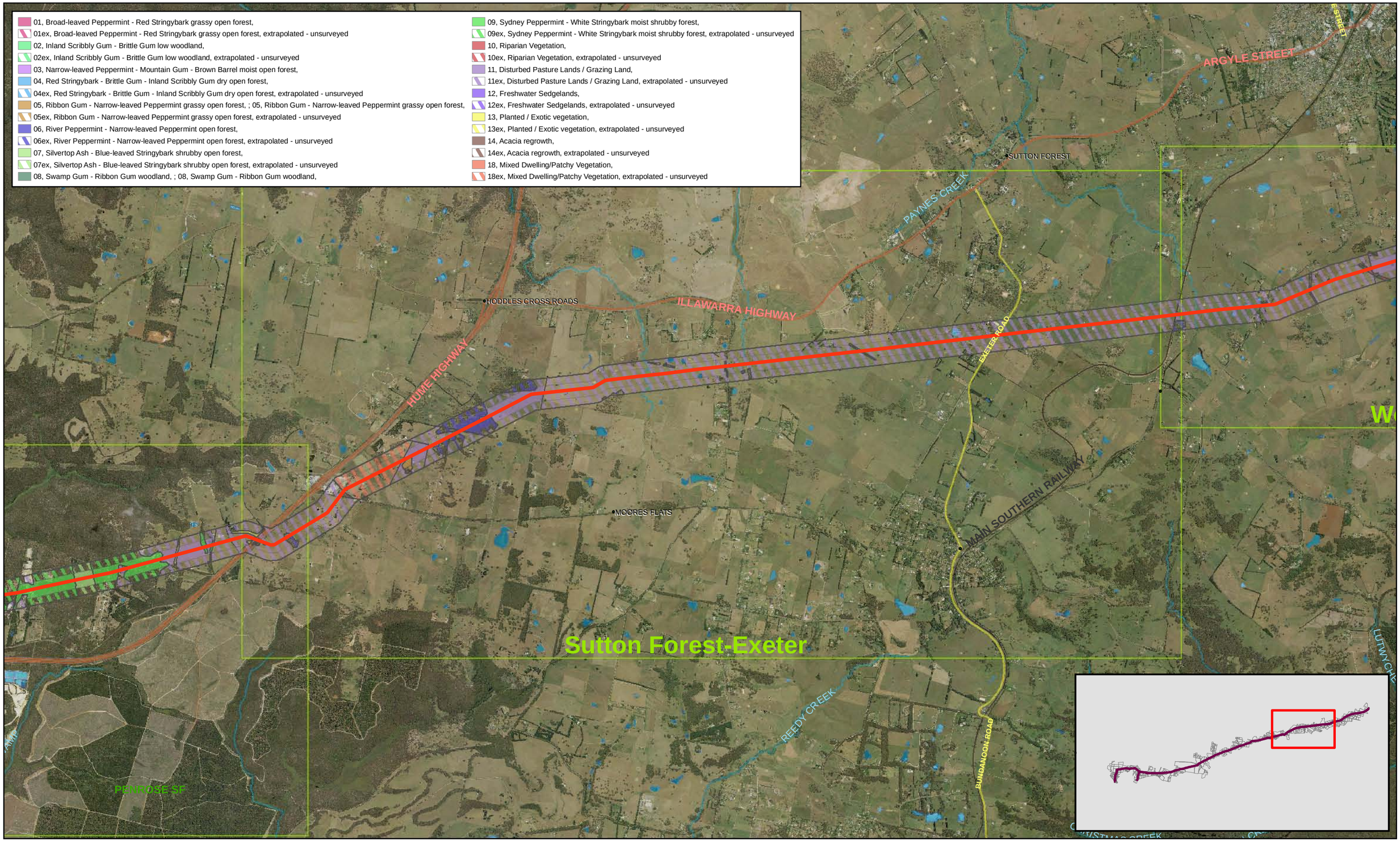


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Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

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Vegetation Communities
Sector: Sutton Forest-Exeter

Figure10.1b

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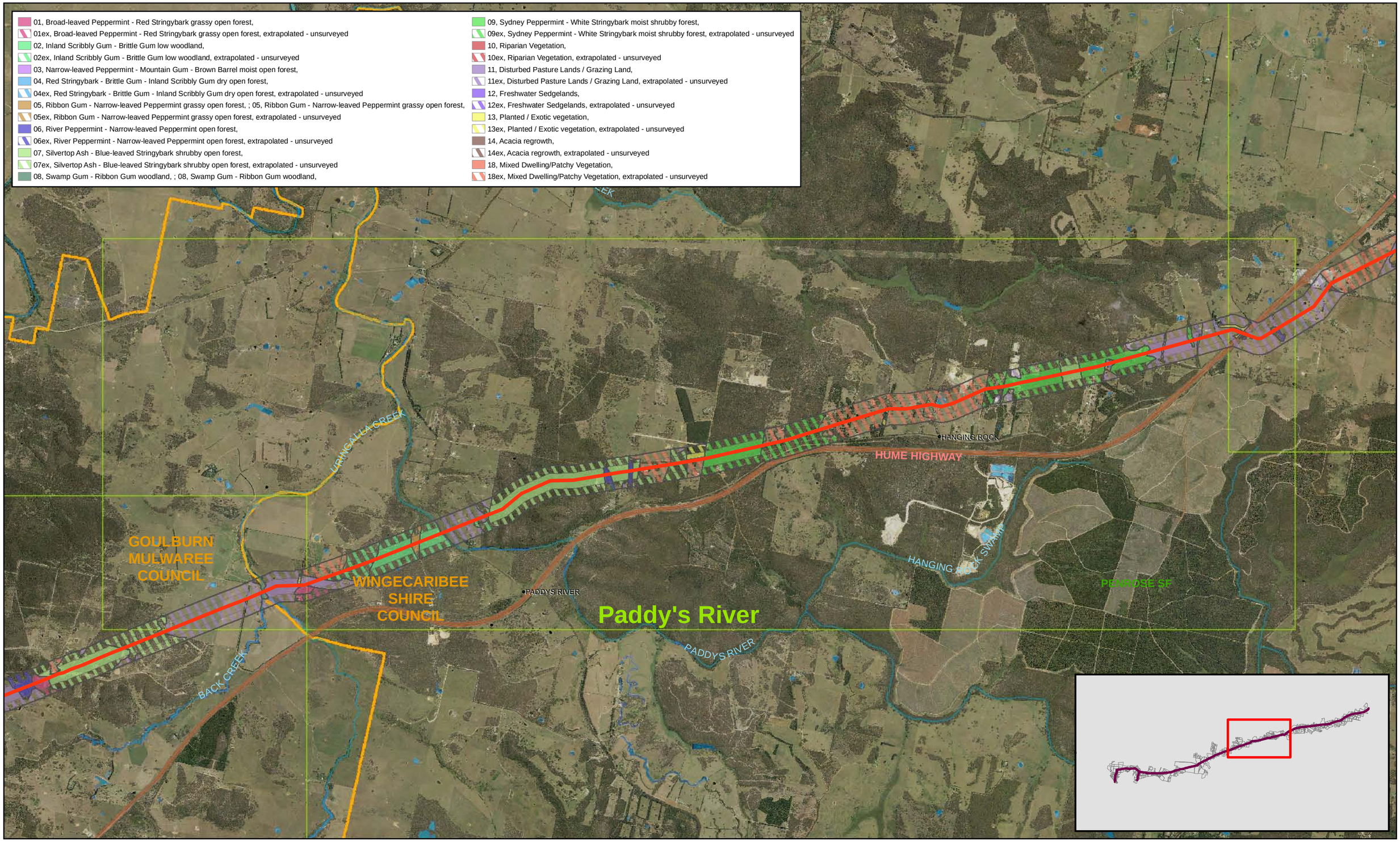


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Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

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Vegetation Communities
Sector: Paddys River

Figure10.1c

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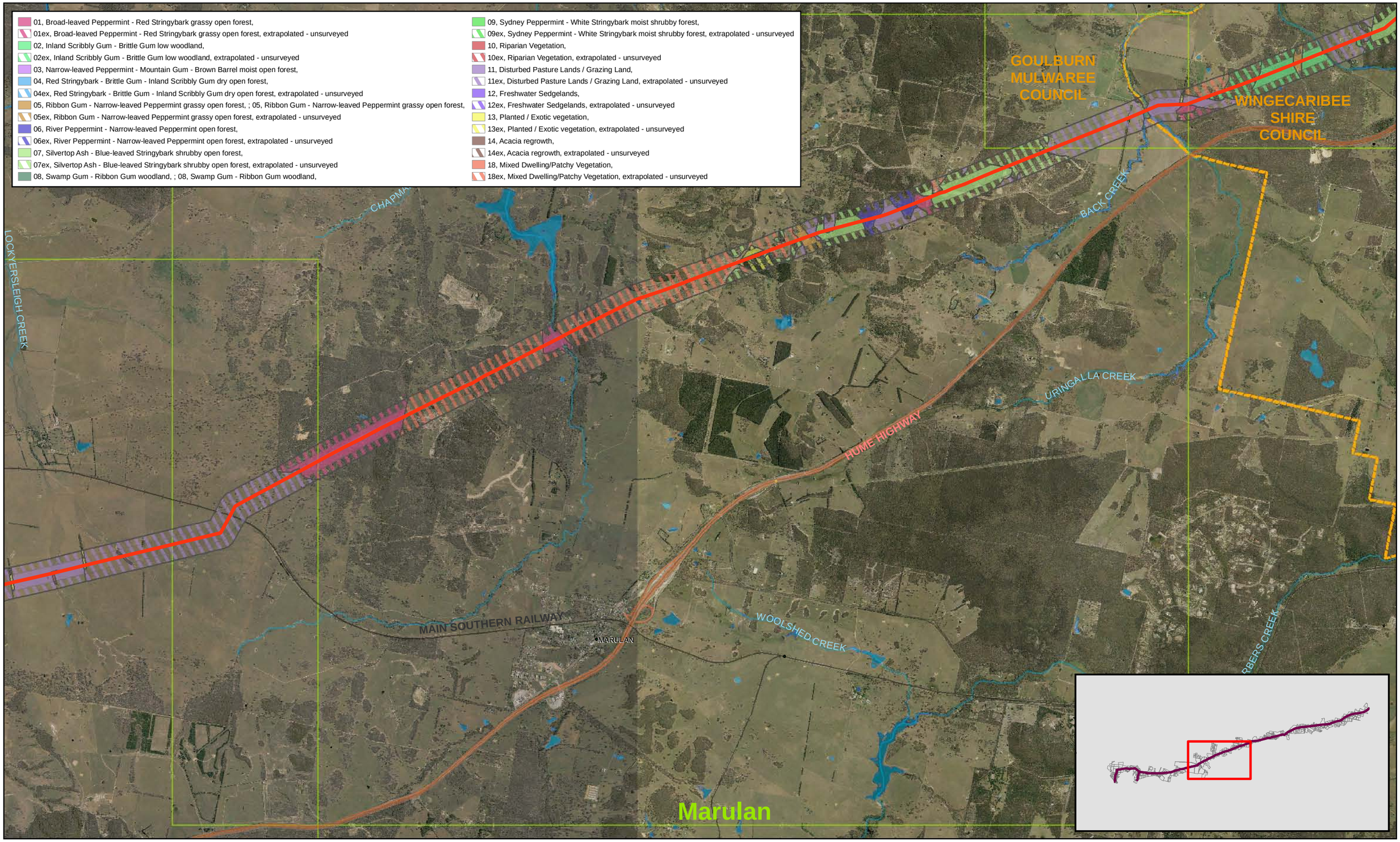


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Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

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Vegetation Communities
Sector: Marulan

Figure10.1d

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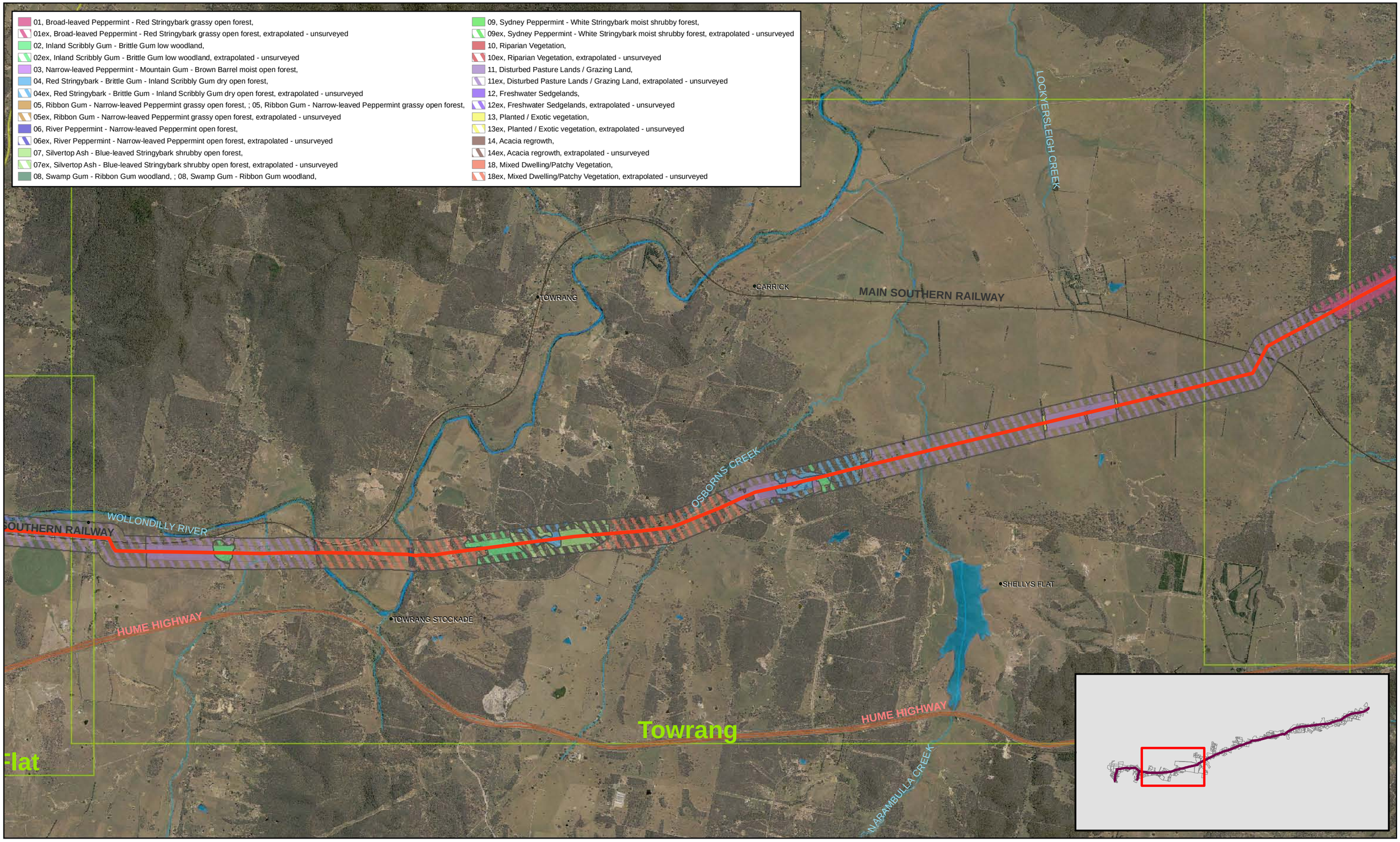


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Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

GHD CLIENTS|PEOPLE|PERFORMANCE

Goulburn Mulwaree Council

Goulburn Mulwaree Council
Highlands Source Project

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| Revision | 0 |
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Vegetation Communities
Sector: Towrang

Figure10.1e

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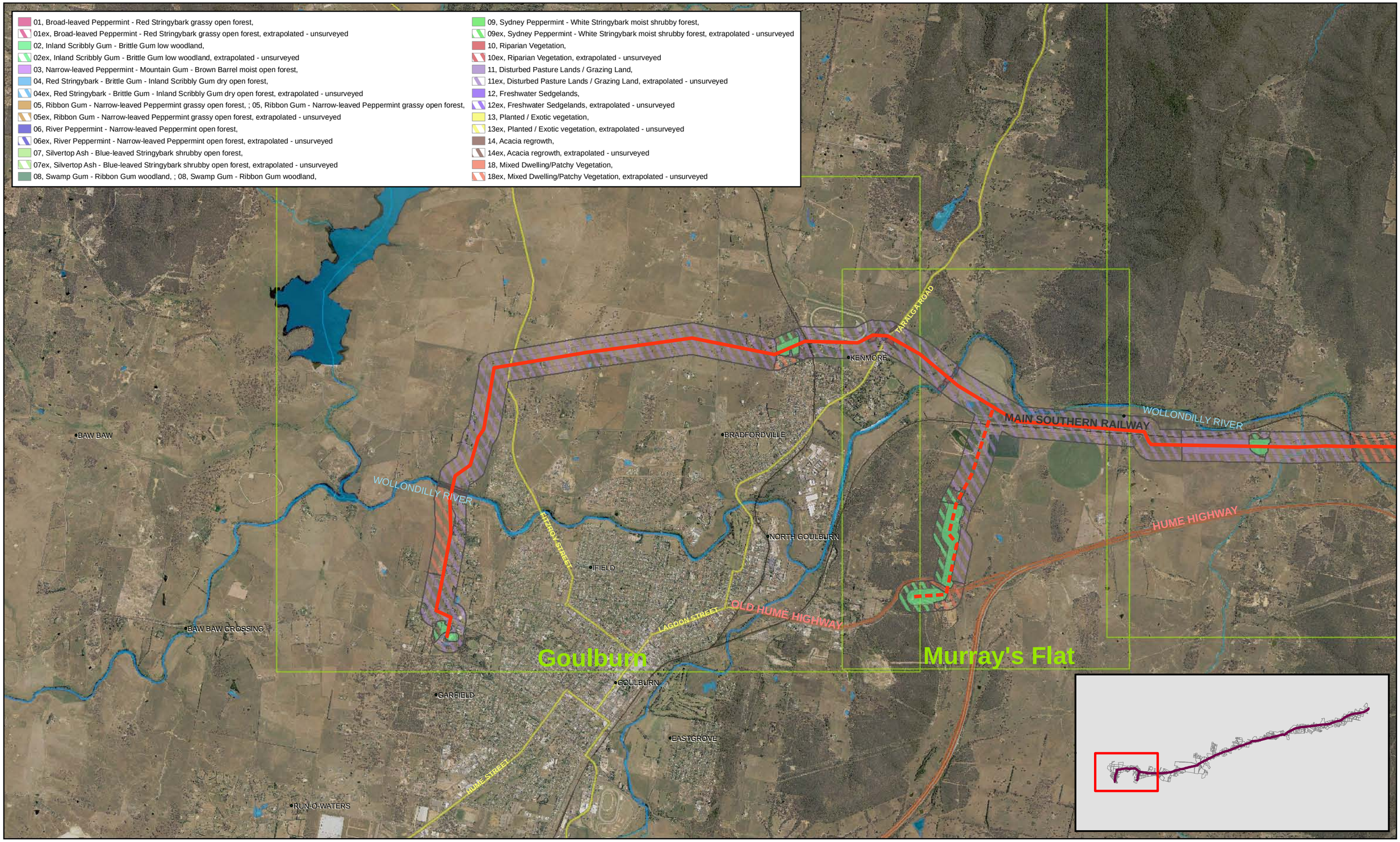


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Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

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| Date | 14 JAN 2010 |

Vegetation Communities
Sector: Goulburn-Murrays Flat

Figure10.1f

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### 10.2.4 Noxious Weeds

The NSW *Noxious Weeds Act 1993* provides for the declaration of noxious weeds in local government areas. Twelve noxious weeds listed under the *Noxious Weed Act* for the Goulburn-Mulwaree LGA were recorded within the survey corridor. These species were scattered widely throughout the survey corridor, with some areas containing higher densities than others. Blackberry and Willow are particularly prominent along creeks and rivers, with other weeds such as Paterson's Curse, St John's Wort and Fireweed occurring predominately in grazed pasture or along the existing easement. The most common and widespread noxious weed found within the survey corridor is Serrated Tussock, which is invading native bushland edges from surrounding paddocks and along the existing easement.

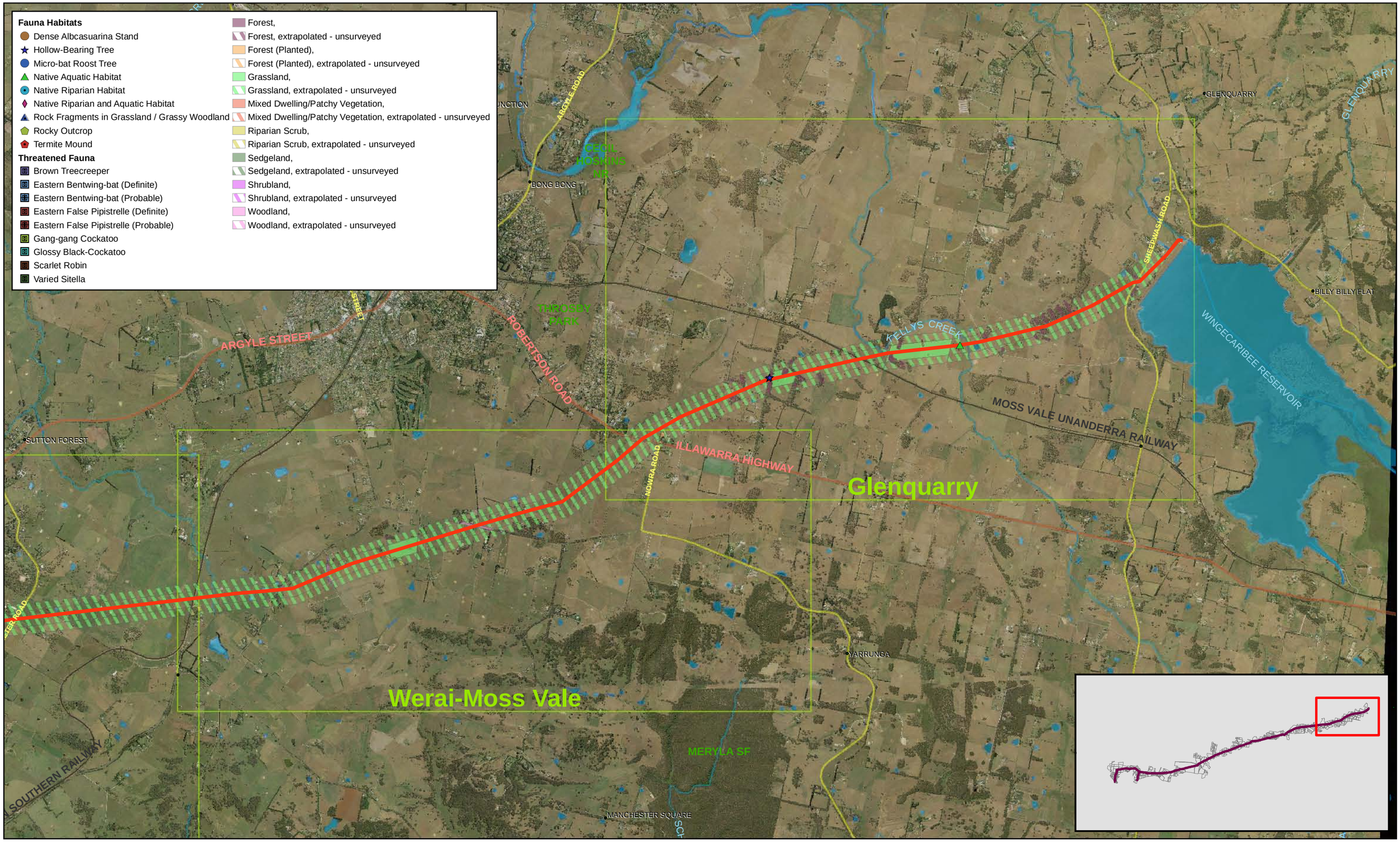
### 10.2.5 Fauna Habitats

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species previously recorded in the survey corridor. Important habitat resources are mapped in Figure 10.2.

The habitat assessment identified eight habitat types across the survey corridor. These are described in detail below. The extent of each habitat type in the survey corridor is mapped in Figure 10.2 and presented in Table 10.3.

**Table 10.3 Total Extent of Each Habitat Type within the 400m Survey Corridor**

| Habitat Type | 400m corridor (ha) (Treated Water Pipeline) | 400m corridor (ha) (Raw Water Pipeline) |
|---|---|---|
| Forest | 583.36 | 583.36 |
| Forest (Planted) | 22.86 | 22.86 |
| Grassland | 1638.13 | 1957.6 |
| Mixed Dwelling/Patchy Vegetation | 550.45 | 550.23 |
| Riparian Scrub | 5.88 | 11.05 |
| Sedgeland | 0.48 | 1.28 |
| Shrubland | 3.34 | 3.34 |
| Woodland | 145.53 | 106.62 |
| **Total** | **2930.03** | **3236.35** |

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

GHD CLIENTS|PEOPLE|PERFORMANCE

GOULBURN MULWAREE COUNCIL

Goulburn Mulwaree Council
Highlands Source Project

| | |
|---|---|
| Job Number | 23-13312-15 |
| Revision | 0 |
| Date | 05 FEB 2010 |

Fauna Habitat Types and Threatened Fauna Records
Sector: Werai - Glenquarry

Figure10.2a

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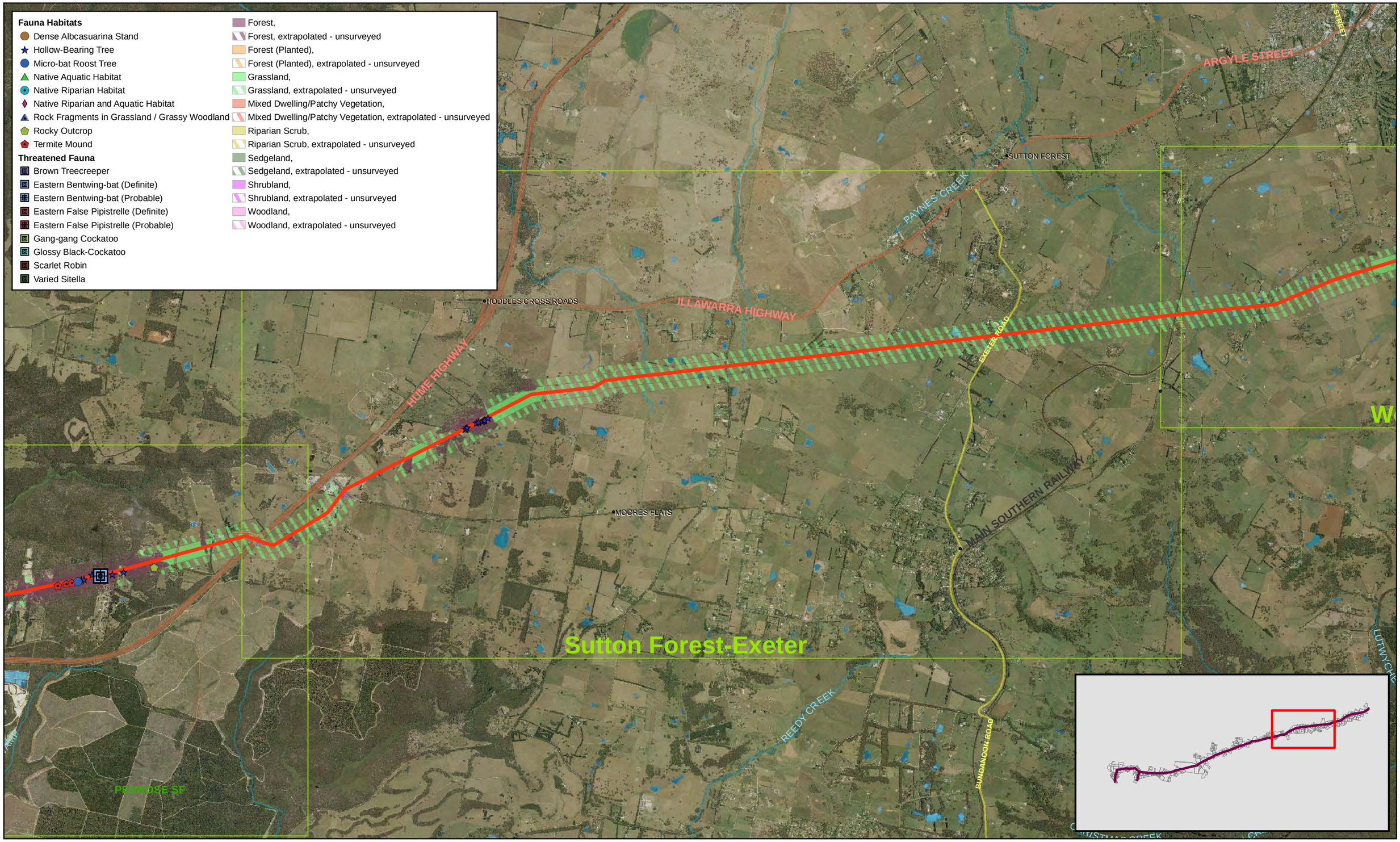
Data Source: NSW Lands Dept: crownlands,roadsegments,railways,hydroarea,hydroline,logalgovernmentarea,npwreserve,stateforest - 2007. Created by: ccharalambou, trbellwood, bahambly

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
- ArterialRoad
- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highlands Source Project

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|---|---|
| Job Number | 23-13312-15 |
| Revision | 0 |
| Date | 05 FEB 2010 |

Fauna Habitat Types and Threatened Fauna Records
Sector: Sutton Forest-Exeter

Figure10.2b

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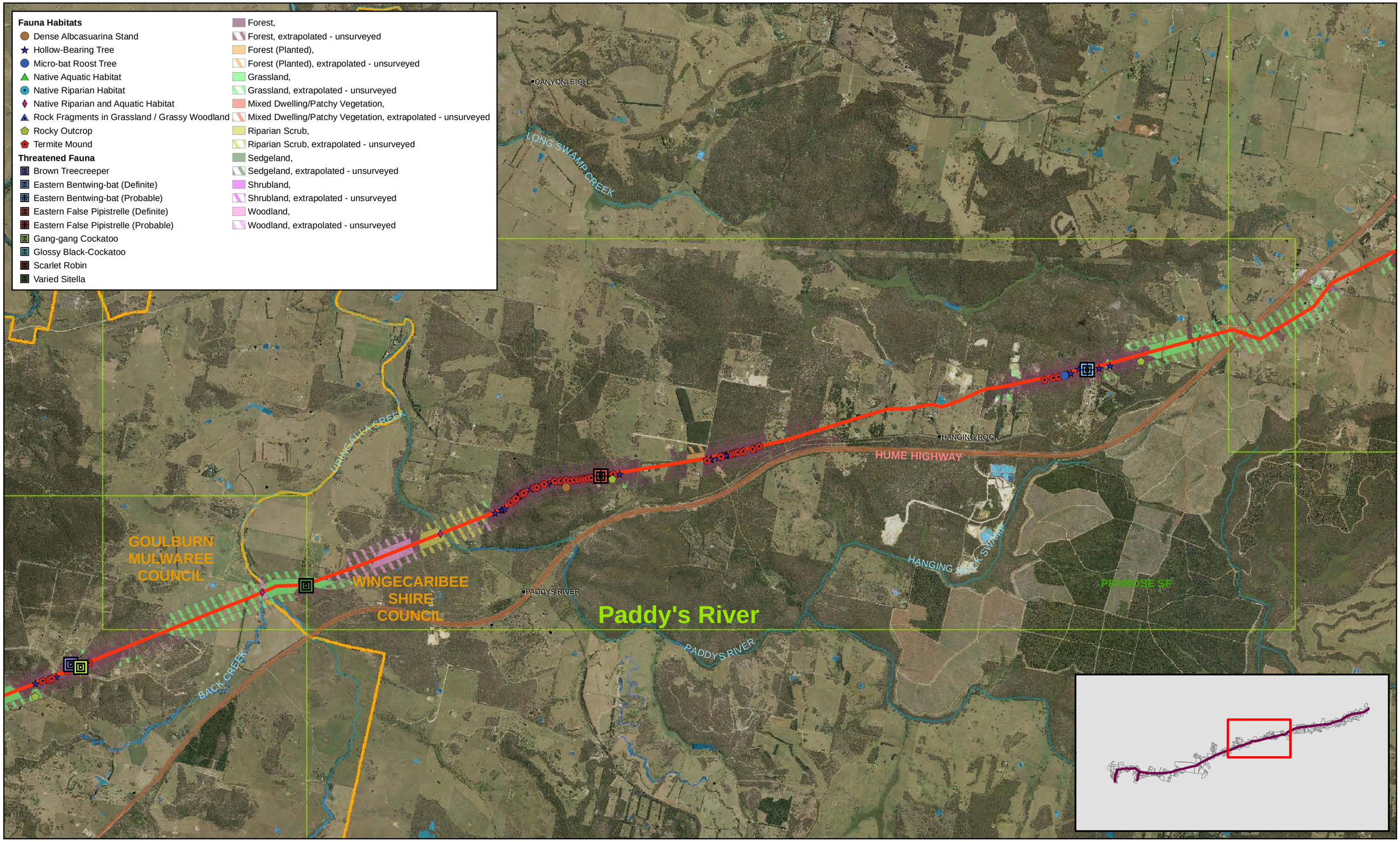


1:45,000 (at A3)

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
- (Treated Water)
- Sector boundary
- PrimaryRoad
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- Railway
- Lakes, Dams
- Rivers, Creeks
- Local Government Area

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| Job Number | 23-13312-15 |
| Revision | 0 |
| Date | 05 FEB 2010 |

Fauna Habitat Types and Threatened Fauna Records
Sector: Paddys River

Figure10.2c

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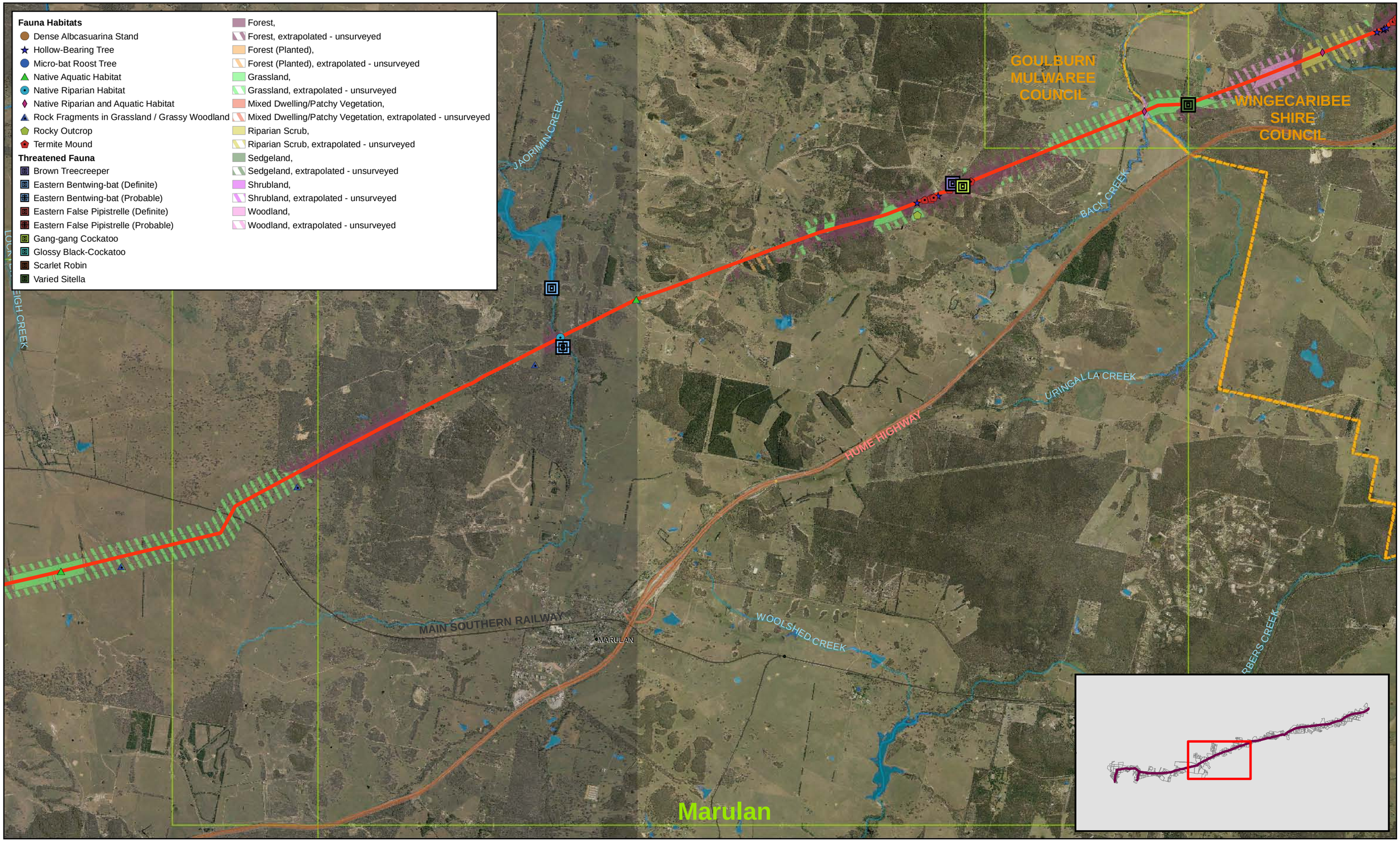


1:45,000 (at A3)

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

**Legend**

- Proposed Pipeline Alignment
- (Raw Water)
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- Sector boundary
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Fauna Habitat Types and Threatened Fauna Records
Sector: Marulan

Figure10.2d

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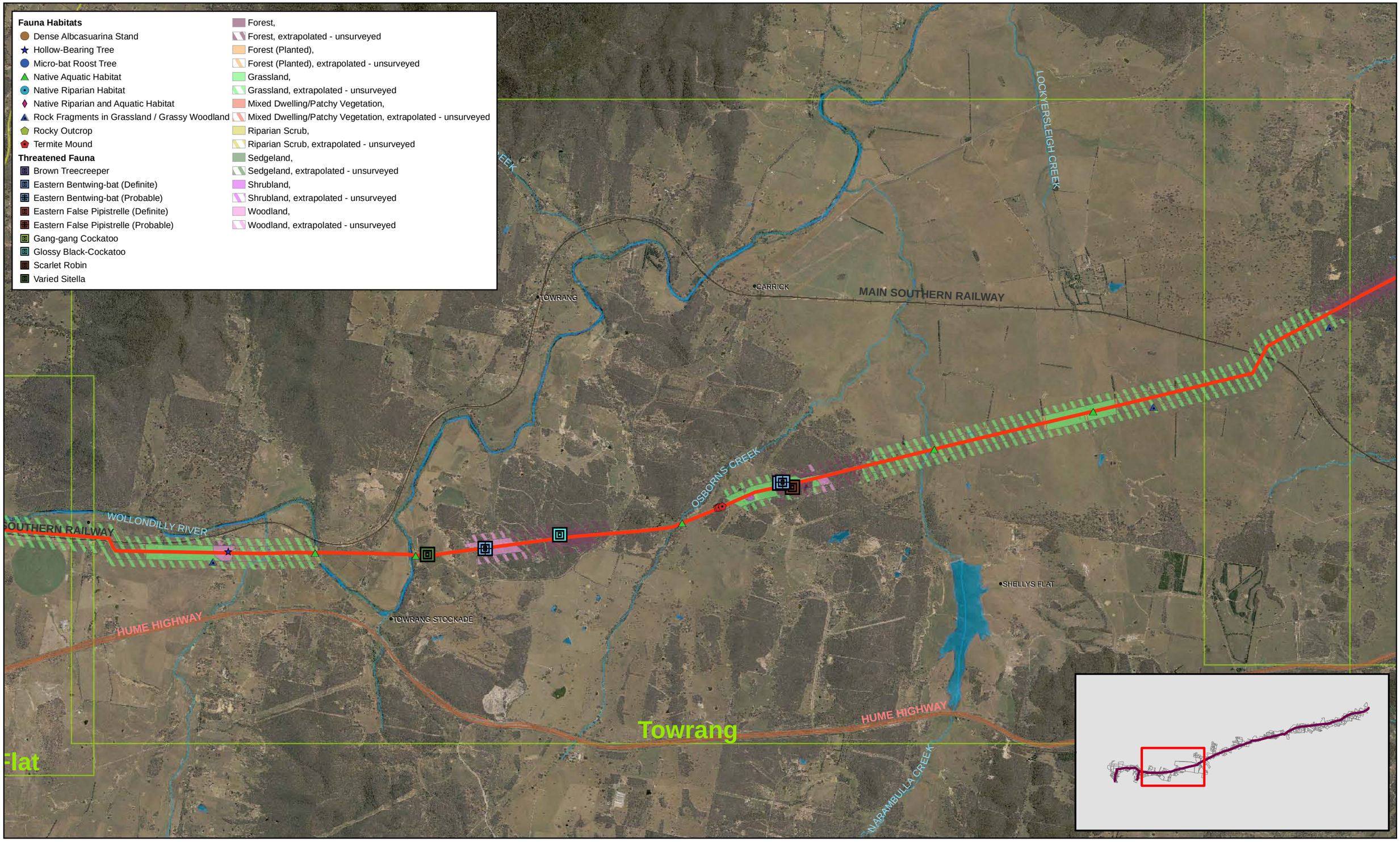


1:45,000 (at A3)

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

**Legend**

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Goulburn Mulwaree Council
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Fauna Habitat Types and Threatened Fauna Records
Sector: Towrang

Figure10.2d

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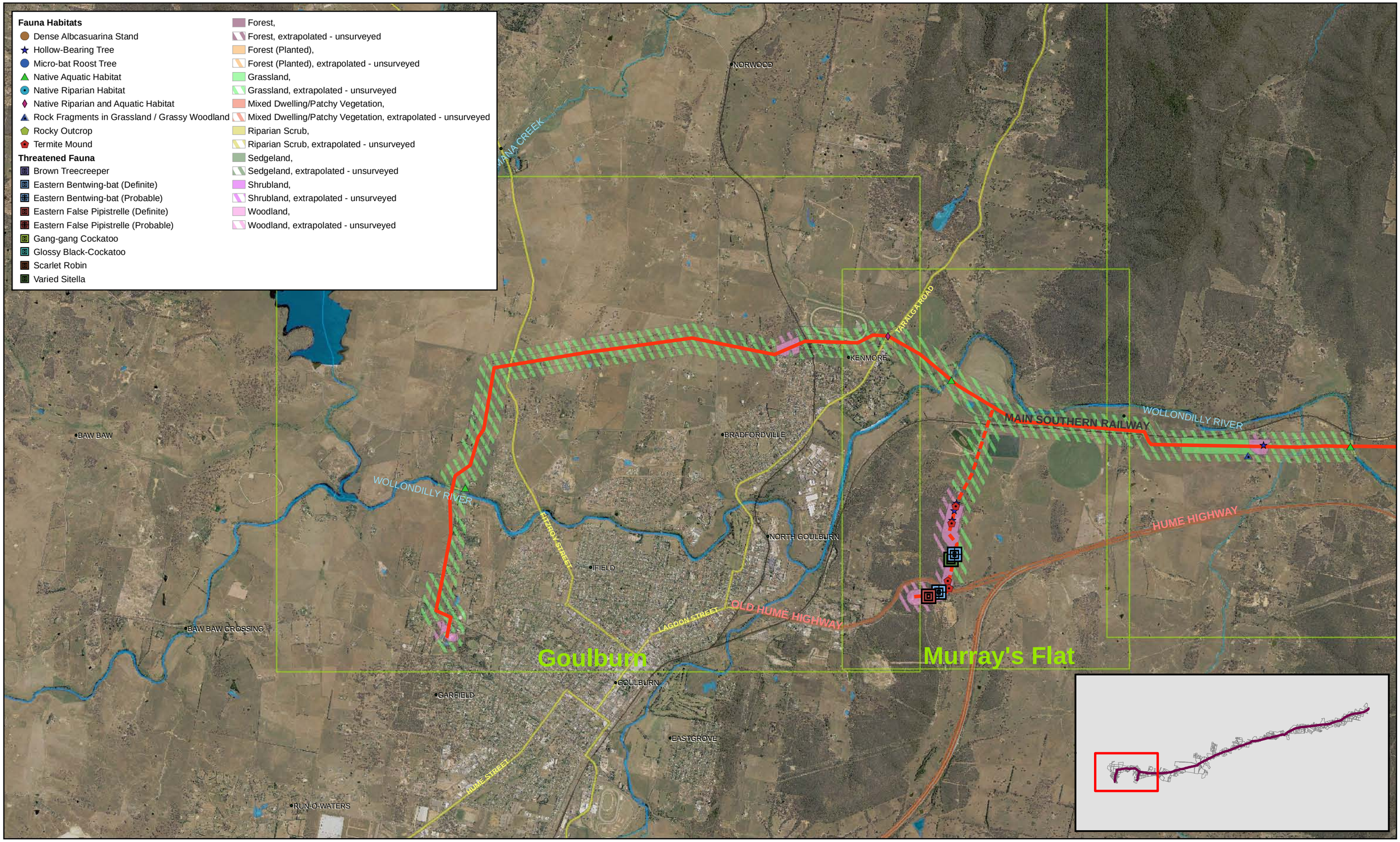


1:45,000 (at A3)

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
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CLIENTS | PEOPLE | PERFORMANCE

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Fauna Habitat Types and Threatened Fauna Records
Sector: Goulburn-Murrays Flat

Figure10.2e

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