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Appendix E
Water Pipeline Desktop Ecology Assessment

MARULAN GAS TURBINE FACILITIES

SUBMISSIONS RESPONSE & PREFERRED PROJECT REPORT

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URS

URS

Memorandum

Date: 23 February 2009

To: Nicole Brewer

From: Melina Budden / Lauren Branson

Subject: Marulan Gas Turbine Facilities - Desktop assessment of proposed water pipeline route

1. Introduction

1.1 Background

URS Australia was commissioned by EnergyAustralia and Delta Electricity (Delta) to prepare a Part 3A Environmental Assessment for the development of gas turbine facilities located at a site in Marulan, NSW (Marulan Site or the Site, refer to **Figures 1** and **2**). The Environmental Assessment is currently in the approval stage and has finished its public exhibition period. Community and government authorities have also provided their submissions on the Environmental Assessment.

URS, with the Proponent, is currently preparing a Submissions Response and Preferred Project Report. The Preferred Project Report provides Delta and EnergyAustralia with the opportunity to add additional information to be considered as part of the approvals process. This preliminary ecological desktop assessment of the two proposed water pipeline routes from two potential water sources: Marulan Sewage Treatment Plant (STP) and Moss Vale Sewage Treatment Plant (STP) supports the Preferred Project Report. The indicative water pipeline route has been provided by GHD in the Integrated Water Management Strategy.

This ecological desktop assessment has been completed to determine the ecological features of the area in question. This document details the methods used, reports preliminary findings of the flora and fauna desktop database review and gives a brief assessment of the potential impacts of the two proposed water pipeline routes. URS undertook a Biodiversity Impact Assessment of the Gas Turbine Facilities, Marulan, in July 2008. Information from that assessment has been used to provide background information to the Study Area.

It is also noted that GHD is currently conducting a Biodiversity Assessment of the proposed Gas Pipeline easement from the proposed Marulan Gas Turbine Facilities (Facilities) to the existing Moomba to Sydney Gas Pipeline easement. This area is a small subsection of the proposed water pipeline easement between the Moss Vale STP and the Facilities, as such this section of the water pipeline route will not be considered further within the scope of this desktop assessment.

1.2 The Proposed Activity

The proposed works involve the installation of a water pipeline and easement from the Site to either the Marulan STP or the Moss Vale STP. Two potential water pipeline routes have been identified to source water demands (types and quantity) required by the plants during construction

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and on-going operation of the Facilities. Both routes are currently being considered by the Proponent as potential options.

The water pipeline route descriptions are as follows:

Marulan STP- Water Pipeline Route 1

- 19 km from the Moss Vale STP to the Marulan Facilities Site
- Where possible, the alignment of the pipeline will follow road easements along Brayton and Canyonleigh Roads.
- Pipeline diameter is assumed to be 40mm. The area of impact for construction is estimated to be 1000m to 1200mm wide. It is not likely that any damage incurred by resident vegetation will be significant. It is expected to that the impact will be similar to a truck driving across a paddock (i.e. there may be some flattening of flora).

Moss Vale STP- Water Pipeline Route 2

- 32.5km from the STP to the Marulan Site
- Where possible, the alignment of the pipeline will follow road easements along the Illawarra Highway, then along the existing Moomba to Sydney gas pipeline and finishing along the proposed gas pipeline easement to the Marulan GTF.
- Pipeline diameter is assumed to be 40mm. The area of impact for construction is estimated to be 1000m to 1200mm wide. It is not likely that any damage incurred by resident vegetation will be significant. It is expected to that the impact will be similar to a truck driving across a paddock (i.e. there may be some flattening of flora).

It is noted that the two pipelines routes described above are referred to collectively herein as the Study Area,

The installation of the water pipeline involves:

- Establishing a 3 m wide easement along the proposed routes;
- Establishing a trench, approximately 300mm deep and 300mm wide;
- Laying a 40mm polyethylene (or similar) pipe along the trench; and
- It is assumed that the pipe will be positioned on a sand foundation and covered with the original soil. It is also assumed that any excess soil may be used to assist with developing erosion gullies in the surrounding areas, if bio-stabilising or alternative erosion controls are introduced.

The indicative water pipeline routes have been provided by GHD in the Integrated Water Management Strategy. Refer to the **Figure 2** for proposed pipeline routes.

As mentioned in the background section, the water pipeline route to Moss Vale STP would utilise the proposed gas pipeline easement between the Facilities and the Moomba to Sydney Pipeline. A Biodiversity Assessment of the potential easement is being prepared by GHD. Therefore no further reference will be made to this section of the proposed water pipeline.

It is assumed that all proposed activities will occur where possible within the established road side reserve or gas pipeline easement. These areas contain access tracks and roadside shoulders. It is assumed that these areas would be regularly maintained (i.e. reducing vegetation height) as part of the Australian Pipeline Association (APA) maintenance obligations along gas pipeline and local council's obligation along roadsides. In general these areas contain minimal vegetation. It is also assumed that where environmentally sensitive species, populations or Endangered Ecological Communities (EEC's) are identified then measurements will be taken to avoid those areas, or if impracticable translocation of individuals may be undertaken. Furthermore it is assumed that regeneration of the easement will occur once works are finished, providing habitat for fauna.

It is assumed that topsoil will be separated during excavation works and re-spread along the trench after works are facilitating natural regeneration through the existing seedbank.

This report considers potential impacts to the ecology of the area, in particular impact to threatened flora and fauna, and undertakes assessment in accordance with Section 5a of the *Environmental Planning and Assessment Act* 1979, as appropriate. Particular emphasis has been placed on the occurrence of threatened species, populations and ecological communities and any potential impacts of the proposed works. This assessment does not preclude further field surveys to be undertaken as discussed in Section 5.

1.3 Study Area and Surroundings

The Facility Site is part of the Arthursleigh property, which is located on Canyonleigh Road, Brayton, approximately 12km northeast of the village of Marulan within the Upper Lachlan local government area (LGA). Delta Electricity and EnergyAustralia own the land, which is known as Lot 2 DP 1120270.

Water Pipeline Route 1 is expected to start at the Marulan STP and where possible follow road easements along Brayton (passing by the village of Brayton) and Canonleigh Road, within the Goulburn – Mulwaree LGA .

Water Pipeline Route 2 is expected to start at the Moss Vale STP and where possible follow the road easements along Kennedy Close, Creek Street and the Illawarra Highway, then west along the existing Moomba to Sydney Gas Pipeline easement and north along the proposed gas pipeline easement to the Marulan Facilites. The first section of the proposed route (Illawara Highway area) is within the Wingecarribee LGA and the final section (Hume Highway and Moomba to Sydney Gas Pipeline easement) is within the Goulburn – Mulwaree LGA.

Refer to Aerial Map; **Figure 2** for proposed water pipeline locations.

The study area is located within the South Eastern Highlands bioregion as defined in the *Interim Biogeographic Regionalisation for Australia* (Thackway & Creswell 1995).

Topography

Water Pipeline Route 1: The proposed water pipeline crosses two intermittent tributaries of the Wollondilly River; Joarimn Creek and Chapman's Creek on four occasions. This route also contains a number of small, drainage lines which drain into Joarimin Creek. Previous field surveys have shown that the drainage lines feature moderate gully erosion when running through woodland and serious gully erosion through cleared pasture. The majority of the route appears to

pass through cleared road easement, bordered by semi-cleared pastures with scattered timber and a small area of medium to dense dry sclerophyll forest dominated by Red Stringybark (*Eucalyptus macorhyncha)* approximately 2 km south of Brayton, along Brayton road. The route slopes gently to the north east from 680 AHD to 600AHD.

Existing land uses include sheep and cattle grazing, residual native forest, transmission easement, gas pipeline easement and small village settlements.

Water Pipeline Route 2: The proposed water pipeline route crosses Baronga Creek and other tributaries of the Paddy River on a number of occasions as well as Paddy River on one occasion. South of the Paddy River crossing on the southern side of the existing Moomba to Sydney Gas Pipeline and Hume Highway, a swamp catchment area referred to as Hanging Rock Swamp, is present. This route also contains a number of small, mostly dry drainage lines which drain into Paddy's River. Previous field surveys of the area have shown that these drainage lines feature moderate gully erosion when occurring on woodland and serious gully erosion through cleared pasture. The majority of the route passes along the existing gas pipeline easement which is bordered by semi-cleared pastures with scattered timber and areas of medium to dense woodland. The aspect of the route changes from fairly flat at 700 AHD close to Moss Vale and along the Hume Highway to very steep in the area close to the Paddy River crossing. In this area the slope faces south to south west and drops steeply from 680 to 610 AHD. This section of the route appears to have the largest tracts of medium to dense woodland.

Existing land uses include sheep and cattle grazing, residual native forest, transmission easement, Gas pipeline easement and small village settlements.

Geology

Water Pipeline Route 1: Broad geological surveys of the surrounding areas indicate that the dominant rock is porphyrtic with quartz and feldspar set in a greenish to black groundmass (Hird 1991).

Water Pipeline Route 2: Broad geological surveys of the surrounding areas indicate that the dominant rock is Mittagong Formation with interbedded shale, laminate and fine to medium grained quartz sandstone along the gentle slopes and plateaus. In the areas with steep slopes the geology is expected to be Hawkesbury sandstone medium to coarse-grained quartz sandstone with minor shale and laminate lenses.

Soil

Water Pipeline Route 1: The proposed route falls within the Goodman's Ford Soil Landscape (Hird 1991). The soils within this landscape are formed from alluvial-colluvial material derived from the parent rock, ranging from red to yellow Podzolic soils. The landscape is dominated by undulating rises.

Water Pipeline Route 2: The proposed route falls within the Faulconbridge, Lucas Heights and Hawkesbury Soil Landscape (Hazelton and Tille, 1990). The soils within this landscape are moderately deep, hard setting Yellow Podzolic soils to Yellow Soloths on the gentle slopes and plateaus. Dominate soil material in these areas range from greyish brown fine sandy loam to stony, hard setting sandy clay loam.

The soils along the steep cliffs and slopes fall with the Hawkesbury Soil Landscape (Hazelton and Tille, 1990). The soils within this landscape are shallow Earthy sands and Yellow Earths.

Dominate soil material range from loose, coarse quartz sand to earthy, yellowish brown sandy clay loam.

Climate

The study area is located within the Goulburn meteorological region and has a dry, continental climate. It experiences mean annual rainfall of 665 mm, and a mean daily temperature range of 7.3 to 20.1 degrees (BOM, 2007).

2. Legislative Framework

The proposed development of the water pipeline for the Facilities is a supplement to the proposed works of the Facility itself. Refer to the URS's Biodiversity Impact assessment Gas Turbine Facilities Project Marulan (2008) for detailed discussion of the relevant legislation. The following legislation has been considered in the preparation of this report:

- Environmental Planning and Assessment Act 1979
- Threatened Species Conservation Act 1995
- Native Vegetation Act 2003
- Noxious Weeds Act 1993
- State Environmental Planning Policy 44 – Koala Habitat Protection
- Environment Protection and Biodiversity Conservation Act 1999

3. Methodology

The preliminary ecological desktop assessment was designed to gather information to assess the impact of the proposed activity, which may involve the removal of vegetation within a narrow discrete easement. This assessment includes an initial desktop review followed by a brief desktop assessment of the available data with particular emphasis on threatened flora and fauna species that may inhabit the Study Area.

3.1 Desktop Review

Desktop research included a review of literature relevant to the ecological environment of the Study Area, particularly:

- *NPWS Wildlife Atlas Database* (2006). NSW National Parks & Wildlife Service, Department of Environment & Climate Change, Hurstville.
- *Department of Environment and Water Resources (DEWR) Species Profile and Threats Database* (SPRAT) Database (2006). Australian Government, www.deh.gov.au
- Hazelton, P. A. & Tille, P. J., (1990). *Soil Landscapes of the Wollongong-Port Hacking 1:100 000 Sheet.* Soil Conservation Service of NSW, Sydney.
- Hird, C. (1991). *Soil Landscapes of the Goulburn 1:250 000 Sheet.* Soil Conservation Service of NSW, Sydney.
- Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C. (2005). *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands.* Department of Environment & Climate Change, and Department of Natural Resources, NSW;
- URS Australia (2008). *Biodiversity Impact assessment Gas Turbine Facilities Project Marulan, NSW.* EnergyAustralia and Delta Electricity, Sydney.
- Aerial and topographic maps of the site.

3.2 Database Review

A search of the NSW and Commonwealth databases for threatened species, populations, and ecological communities was carried out during the desktop review. This search indicated that within a ten kilometre radius of the subject site there were three endangered ecological communities, 19 threatened flora species, and 32 threatened fauna species recorded or predicted to occur based on the presence of habitat and ecological community.

4. Findings

4.1 Flora and Vegetation Communities

Water Pipeline Route 1:

Previous vegetation mapping by Tozer *et al.* (2005) describes the proposed water pipeline easement and the surrounds as containing four broad communities: Tableland Grassy Box-Gum Woodland, Tableland Hills Grassy Woodland, Eastern Tablelands Dry Forest and Tableland Low Woodland (Refer to **Figure 3** for location of vegetation communities).

Tableland Grassy Box-Gum Woodland is described as eucalypt woodland with a sparse shrub layer and grassy groundcover. It is found on undulating country on the tablelands between Hartley and Braidwood. Tableland Grassy Box-Gum Woodland spans elevations from 600 to 900 m ASL in areas receiving from 650 – 900 mm average annual rainfall. It occurs on loamy soils derived predominantly from fine-grained sedimentary or acid-volcanic substrates, but is also found on granite soils near Hartley (Tozer *et al.* 2005).

Tableland Hills Grassy Woodland is described as an open eucalypt forest or woodland with a sparse shrub layer and grassy groundcover. It occurs across the tablelands, primarily between the Abercrombie River district, Berrima and Braidwood, with an outlying area to the north around Hartley. Tableland Hills Grassy Woodland occurs on loamy soils from 550 – 1100m ASL and extends to the north-west and south-west of the study area within a mean annual rainfall band of 650 – 950 mm (Tozer *et al.* 2005).

Eastern Tablelands Dry Forest is described as an open eucalypt forest with an open understorey of sclerophyll shrubs, sedges and forbs. It occurs on ridges, primarily on the eastern edge of the Southern Tablelands between Joadja and Braidwood, and less frequently further west in the area between the Cookbundoon Range and Lake Bathurst. Eastern Tablelands Dry Forest is found on sandy-loams derived from fine or coarse grained sedimentary rocks, at elevations of 550 – 900m ASL. It replaces Tableland Low Woodland (DSF p9) in areas with higher annual rainfall (700 – 950mm compared with 650 – 800 mm) or where soils are slightly deeper (Tozer *et al.* 2005).

Tablelands Low Woodland is described as low eucalypt woodland with an open understorey of sclerophyll shrubs, sedges, grass and forbs. It occurs on low ridges on the Southern Tablelands from Canyonleigh to Braidwood on sandy loam soils derived primarily from fine-grained sedimentary rocks. Tableland Low Woodland is found on dry parts of the tableland receiving 650-800mm mean annual rainfall, at elevations of 550 – 800 m ASL. In moister areas, or on slightly deeper soils, it is replaced by Eastern Tablelands Dry Forest.

The vegetation maps derived from Tozer *et al.* (2005) report indicate that the greater part of the vegetation surrounding the proposed route along Brayton Road is Tablelands Grassy Box-Gum Woodland with small pockets of Tablelands Low Woodland along the low ridges. Vegetation surrounding the proposed route along Canyonleigh Road is fairly sparse in the first 5 km heading east from Brayton due to farming practices, as such, vegetation community level identification is not considered necessary. Closer to the Marulan Facilities, where areas of native woodland occur; a large percentage of the vegetation is expected to be representative of Tablelands Grassy Box-Gum Woodland community in the areas with undulating topography. Transitions to Eastern

Tablelands Dry Forest Community are expected along the higher ridges with small vegetation mosaics of Tableland Hills Grassy Woodland community interspersed in the more rugged terrain.

Water Pipeline Route 2:

Previous vegetation mapping by Tozer *et al.* (2005) describes the proposed water pipeline easement and the surrounds as six broad communities: Eastern Tablelands Dry Forest, Tableland Low Woodland, Elevated Gorge Forest, Highland Range Sheltered Forest, Shoalhaven Sandstone Forest and Tableland Swamp Flats Forest. (Refer to **Figure 3** for location of vegetation communities).

Both Eastern Tablelands Dry Forest and Tableland Low Woodland community units are described above.

Elevated Gorge Forest is described as a eucalypt forest with an understorey a eucalypt forest with an open understorey of sclerophyll shrubs and grasses, found on the dry upper slopes of rocky gorges along the Shoalhaven, Wingecarribee, Wollondilly, Nattai and Tarlo Rivers and their tributaries. It occurs from 400 to 850 m ASL on loam or sandy loam soils derived from fine or coarse grained sedimentary rocks. Average annual rainfall across the distribution ranges from 700 to 900 mm (Tozer *et al.* 2005)..

Tableland Swamp Flats Forest is described as an open eucalypt forest with sparse shrubs and dense grassy groundcover. It occurs on coarse sandy alluvial soils along drainage channels and flats on the tablelands at elevations between 500 and 900m ASL where average annual rainfall ranges from 650 to 1000 mm (Tozer *et al.* 2005).

Highland Range Sheltered Forest is described as a tall eucalypt forest with an open shrub layer and moist herbaceous groundcover, which generally occurs on upper slopes of high ranges 500 m to 1100 m ASL receiving orographic moisture. Occurrences are scattered along the eastern fall of the ranges, from the upper Kowmung River and Bindook Highlands south to Mongamulla Mountain in Deua National Park. Highland Range Sheltered Forest is recorded from sites across a wide annual rainfall band, from 750 mm along the western edge of the Southern Highlands (Barralier, Hanworth, Canyonleigh) to 1200mm near Mount Shivering in the Kowmung. This unit is found on moderately fertile, fine-grained soils derived from a range of substrates (Tozer *et al.* 2005).

Shoalhaven Sandstone Forest is described as an open eucalypt forest or woodland with an abundant sclerophyll shrub stratum and a groundcover dominated by sedges. This unit occurs on sandstone plateaux up to 700 m ASL in the lower Shoalhaven district from Meryla south as far as Pigeon House Mountain, where average annual rainfall is 950-1600 mm. Large stands occur at Meryla and Wingello State Forests, to the west of Mt Skanzi (Kangaroo Valley), west of Nowra (Bamarang and Colymea) and ascending the Morton plateau from Parma Creek Nature Reserve to Sassafrass. Within this distribution Shoalhaven Sandstone Forest occurs on sandy loam soils derived primarily from Hawkesbury or Nowra sandstone, or the Berry formation (Tozer *et al.* 2005).

The vegetation maps derived from Tozer *et al.* (2005) indicate that the greater part of the vegetation surrounding the proposed route along Hume Highway and the Moomba to Sydney Gas Pipeline is Eastern Tablelands Dry Forest Community. Close to the intersection of the gas pipeline and the highway, this community is interspersed with Shoalhaven Sandstone Forest on the sandstone plateaus. Further south west, approximately 1 km, along the proposed route small mosaics patches of Highland Range Sheltered Forest are expected to occur on the upper slopes , Tableland Swamp Flats Forest on sandy drainage lines on the plateaus and Elevated Gorge Forest on the dry upper slopes of rocky gorges. At the intersection of the Moomba to Sydney Gas

Pipeline and proposed gas pipeline to the Marulan Facilities a large percentage of the vegetation is expected to be dominated by the Tableland Lowland Woodland, particularly along low ridges with sandy loam soils. Some small pockets of Elevated Gorge forest are also considered likely to occur in this area, along steep rocky gorges.

Only limited vegetation mapping is available for the area surrounding the village of Moss Vale and heading south-west along the Illawarra Highway up to the junction of the Hume Highway. As such URS is unable to provide verification or review of existing vegetation mapping for the first section of Water Pipeline Route 2 from Moss Vale STP until the junction of the Illawarra Highway and Hume Highway.

4.1.1 Weeds

It is unknown whether the Study Area contains weeds. It is essential to determine the presence of weeds as *The Noxious Weeds Act 1993* (NW Act) requires certain noxious weeds to be control and/or eradicated. Under the NW Act noxious weeds are defined, classified, and legal requirements that the land owner must carry out are provided. The classifications are determined on a Local Government Area basis. Consequently different Local Council areas may have varying legal requirements and actions for the same plant, which is a function of varying local environmental conditions and differing levels of infestation.

It is recommended that field surveys be conducted to determine the presence of weeds as construction works can often cause a new invasion or greater invasion of weeds once soils are excavated. It is also recommended that if the proposed works proceed that prior to any works occurring; all machinery to be used onsite for earthworks should be washed down to remove any potential weed material or seeds. In addition, weed infestations within the disturbed areas should be monitored, with control actions undertaken as required in any newly infested areas.

4.2 Endangered Ecological Communities

According to the EPBC *Species Profile and Threats* (SPRAT) database search, three EEC's are considered likely to occur in the vicinity of the proposed water pipeline easement: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodlands), Temperate Highland Peat Swamps on Sandstone and Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory.

4.2.1 Box-Gum Woodland

The White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodlands) community is characterised by the presence or prior occurrence of White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and/or Blakely's Red Gum (*E. blakelyi*) which may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. The understorey in intact sites is characterised by native grasses and a high diversity of herbs; the most commonly encountered include Kangaroo Grass (*Themeda australis*), Poa Tussock (*Poa sieberiana*), wallaby grasses (*Austrodanthonia spp.*), spear-grasses (*Austrostipa spp.*), Common Everlasting (*Chrysocephalum apiculatum*), Scrambled Eggs (*Goodenia pinnatifida*), Small St John's Wort (*Hypericum gramineum*), Narrow-leafed New Holland Daisy (*Vittadinia muelleri*) and blue-bells (*Wahlenbergia spp.*). Shrubs are generally sparse or absent, though they may be locally common (NSW NPWS 2002).

Distinctive species of the vegetation communities mapped by Tozer *et al.* 2005 were compared to the Box Gum Woodland Guidelines (NSW NPWS 2002). Based on the key for identifying 'Box-Gum Woodland' in this guide, sections of the proposed water pipelines may qualify as Box-Gum Woodland due the presence of some of the characteristic primary and associated canopy species and ground layer species. Characteristic canopy species such as Yellow Box (*E. melliodora)* and Blakely's Red Gum (*E. blakelyi*) and associated species including Candlebark (*E. rubida*), Snow Gum (*E. pauciflora*), Brittle Gum (*E. mannifera*) and Red Stringybark *(E. macrorhyncha*) are considered to be diagnostic species for both the Tablelands Hills Grassy Woodland and Tableland Grassy Box-gum Woodland communities. Ground species such as Kangaroo Grass (*Themeda australis*), Common Everlasting (*Chrysocephalum apiculatum*), Small St John's Wort (*Hypericum gramineum*) and Wallaby grasses (*Austrodanthonia spp*.) are also common diagnostic species for these communities. Based on these findings Box-Gum Woodland may be a sub-community of these larger vegetation mapping units. Thus it is consider probable that some sections of the water pipeline routes mapped as Tablelands Hills Grassy Woodland and Tableland Grassy Box-Gum Woodland may qualify as Box-Gum Woodland.

Box-Gum Woodland has the potential to occur in the following Communities along the Water Pipeline Route 1:

- Tableland Hills Grassy Woodland community in large sections along Brayton Road, just North of Marulan and in mosaic patches towards the junction of Canyonleigh Road.
- Both Tablelands Hills Grassy Woodland and Tableland Grassy Box-gum Woodland communities along Canyon Leigh Road 2km south West of the Marulan GTF.

Box-Gum Woodland is not considered likely to occur along Water Pipeline Route 2 in the areas considered within the scope of this report.

An ecological field survey and assessment is recommended in order to confirm whether the EEC Box-Gum Woodland does occur within the footprint of the proposed pipeline routes.

4.2.2 Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory

This community is characterised by the dominance of native grasses, including Kangaroo Grass (*Themeda australis*), Poa Tussock (Poa sieberiana), River Tussock (*P. labillardieri*), Red Grass (*Bothriochloa macra*), spear grasses (*Austrostipa* spp.) and wallaby grasses (*Austrodanthonia spp*.). Intact sites contain a diversity of plant species, including one or more of the main grasses, additional grass species, and a diversity of forbs, including plants in the daisy, lily, orchid, pea and other plant families.

The community also includes a range of mammal, bird, reptile, frog and invertebrate fauna species, some of which are threatened species. Many sites contain wet areas (drainage lines, soaks, springs, etc) that are habitat for wetland flora species such as rushes (*Juncus spp*.), sedges (*Carex spp*.) and a variety of forbs. It occurs in a variety of landforms but generally in fertile lower parts of the landscape (flats, drainage lines, frost hollow valleys, foothills) where resources such as water and nutrients are abundant, but tree growth is restricted by periodic drying or water logging, frosting, or exposure to westerly winds; remnants also occur on midslopes to hilltops and plateaux, particularly in basalt country, but also where exposure and soil conditions limit tree growth on other substrates.

Based on DECC's profile of the community, and our findings from the desktop reviews, this EEC is not considered likely to occur in the surrounds of the Study Area or with the proposed water pipeline routes. Considering this community generally occurs on the 'fertile lower parts of the landscape' and no native grassland communities have been mapped within the vicinity of the proposed works. Based on interpretations of local topographic maps of the area, the proposed pipeline routes would be above 600 ASL and thus no "fertile lower parts of the landscape" are within the footprint of the proposed works. The cleared grassland areas used for farming along the proposed routes are usually improved pasture grasses which would not consist of characteristic species of the EEC.

Thus, vegetation communities within the proposed pipeline routes are not expected to the description of the EEC: Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory

4.2.3 Temperate Highland Peat Swamps on Sandstone.

The Temperate Highland Peat Swamps all occur on sandstone and share similar vegetation types. Sphagnum bogs and fens occupy the wetter parts, while sedge and shrub associations occur in the drier parts of the swamps. Some, like the Blue Mountains Swamps, are hanging swamps that are prominent on steep valley sides, where water exits the ground between sandstone and claystone layers of rock. Other swamps, like Wingecarribee Swamp, occur in natural depressions or along watercourses (DEWR 2008).

The vegetation associated with this ecological community is a complex patchwork of vegetation types, and varies from bog and fen associations in the wettest parts of some components, through to sedge associations, and shrub associations in the driest parts of the ecological community (DEWR 2008).

A variety of native plants and animals make their homes in the Temperate Highland Peat Swamps. These include the nationally endangered Blue Mountains Water Skink, Giant Burrowing Frog and Wingecarribee Leek Orchid. The Giant Dragonfly, which is threatened in NSW, also occurs in this ecological community (DEWR 2008).

Based on the DEWR's (2008) profile of the community and our findings from the desktop reviews, this EEC is considered likely to occur within the footprint of the proposed water pipeline routes. Previous mapping by DEWR (2008) has qualified the presence of this EEC in Paddy River (Hanging Rock, Mundego, Long and Stingray Swamps) at elevations 600 to 650 ASL. The footprint of the proposed Water Pipeline Route 2 passes through the area referred to as Hanging Rock (**Figure 3** - Vegetation Unit Tableland Swamp Flat's Forest). In addition, one of the associated fauna species 'The Giant Dragonfly' has previously been recorded in the area (**Figure 5**). Thus it is considered probable that some sections of the water pipeline routes, mapped as Tableland Swamp Flat's Forest may qualify as Temperate Highland Peat Swamps.

An ecological field survey and assessment is recommended in order to confirm whether the EEC Temperate Highland Peat Swamps does occur within the footprint of the proposed pipeline routes.

4.3 Threatened Flora

Thirteen threatened flora species listed under the TSC Act have previously been recorded as occurring within 10 km of the proposed water pipeline routes. A further six threatened flora species were identified as 'likely to occur' within 10 km of the site, under the EPBC Act.

A full list of the threatened flora species recorded or considered 'likely to occur' within the area is demonstrated in Table 1. **Figure 4** shows the Wildlife Atlas (TSC) records for threatened species within 10 km's of the Study area for the past 10 years.

Further assessment including field surveys with targeted threatened flora species searches are recommended to determine the presence of species or species habitat within the footprint of the proposed water pipeline routes, prior to any development or works

One species *Pomaderris pallida* has been recorded on three separate occasions, in the past 10 years less than 500 m from the footprint of the proposed Water Pipeline Route 2, approximately 4 km south west of Moss Vale on the Illawarra Highway (See Wildlife Atlas Map, **Figure 4**) for locations). It is suggested that field surveys to determine the 'presence' or 'presence of habitat' for this species are vital.

Table 1: Threatened Flora Recorded Within 10 km of the Study Area

Threatened Species	TSC Status	EPBC Status	Predicted or Recorded within Study Area
Baloskin longipes	-	V	P
Thick lipped Spider Orchid *Caladenia tessellata*	-	V	P
Broad-leaved Sally *Eucalyptus aquatica*	V	-	R
Camden Woollybutt *Eucalyptus macarthurii*	V	-	R
Grevillea parviflora	V	-	R
Hoary Sunray *Leucochrysum albicans var. tricolor*	-	E	P
Cambage Kunzea *Kunzea cambagei*	V	V	R
Dwarf Phyllota *Phyllota humifusa*	V	-	R
Pimelea axiflora subsp. pubscens	E1	-	R
Pale Pomoderris *Pomaderris pallida*	V	-	R
Silky Pomaderris *Pomaderris sericea*	E1	-	R

Threatened Species	TSC Status	EPBC Status	Predicted or Recorded within Study Area
Waterfall Greenhood *Pterostylis pulchella*	V	-	R
Dwarf Kerrawang *Rulingia prostrata*	E1	-	R
Solanum celtum	E1	-	R
Austral Toadflax *Thesium Australe*	V	V	P
Velvet Zieria *Zieria murphyi*	V	-	R

4.3.1 Fauna and Fauna Habitat

It is expected that the proposed pipeline routes will contain viable foraging, sheltering and nesting resources for numerous native fauna species. Topographic and aerial maps of the Study Area have demonstrated the presence of protected lands, vegetated woodlands, scattered individual timber in cleared areas, steep and undulating rocky terrain, water catchment areas including two major rivers, secondary creeks and smaller tributary drainage lines within the vicinity of the proposed routes. Vegetation maps derived from Tozer *et al.* 2005 indicated the presence of eight different vegetation communities within the vicinity of the proposed works. In addition previous biodiversity assessments of the area by GHD and URS for the Marulan Facilities have demonstrated the presence of good habitat resources within the surrounding area (see previous reports for further detail).

Based on theses findings, various native fauna species including mammals, reptiles, amphibians and avifauna are likely to utilise the habitat within the footprint and the surrounds of the proposed works.

4.4 Threatened Fauna

Twenty five threatened fauna species listed under the TSC Act have previously been recorded as occurring within 10 km of the proposed water pipeline routes. Thirteen threatened fauna species, seven of which were not recorded under TSC Wildlife Atlas Search, were identified as 'likely to occur' within 10 km of the study area under the EPBC Act.

A full list of the threatened fauna species recorded or considered 'likely to occur' within the area is shown in Table 2. A map showing Wildlife Atlas (TSC) records for threatened species within 10 km's of the Study area for the past 10 years is shown in **Figure 5**.

Field surveys including threatened fauna habitat and targeted species searches are recommended to determine the presence of species or species habitat within the footprint of the proposed water pipeline routes, prior to any development or works.

Three threatened species Koala (*Phascolarctos cinereus*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis)* and Speckled Warbler (*Chthonicola sagittatus*) have been recorded on several occasions, in the past 10 years less than 500 m from the footprint of the proposed water pipeline routes. Koalas have been recorded within the township boards of the village Moss Vale, approximately 8 km south west of Moss Vale on the Illawarra Highway and within the township boarders of the village Marulan (**Figure 5**). Both the Eastern Bentwing Bat and Speckled Warbler have been recorded approximately 4 km north of Marulan on Brayton Road. It is suggested that field surveys to determine the 'presence' or 'presence of habitat' for these species, are vital.

Table 2: Threatened Fauna Recorded Within 10 km of the Study Area

Threatened Species	TSC Status	EPBC Status	Predicted or Recorded
Mammals			
Brush-tailed Rock Wallaby *Petrogale penicillata*	V	V	R
Chalinolbus dwyeri	-	V	P
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	V	-	R
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	R
Eastern Pygmy Possum *Cercartetus nanus*	V	-	R
Greater Broad-nosed bat *Scoteanax rueppellii*	V	-	R
Grey-headed Flying Fox *Pteropus poliocephalus*	V	V	R
Koala *Phascolarctos cinereus*	V	-	R
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	R
Large-footed Myotis	V	-	R

Threatened Species	TSC Status	EPBC Status	Predicted or Recorded
Myotis macrotarsus			
Long-nosed Potoroo *Potorous tridactylus tridactylus*	V	V	P
Spotted-tailed Quoll *Dasyurus maculatus*	V	E	R
Yellow-bellied Glider *Petaurus australis*	V	V	R
Birds			
Australian Painted Snipe *Rostratula australis*	V	V	
Australian Bittern *Botaurus poiciloptilus*	V	-	R
Blue-billed Duck *Oxyura australis*	V	-	R
Brown Tree-creeper (Eastern subspecies) *Climacteris picumnus victoriae*	V	E	R
Diamond Firetail *Stagonopleura guttata*	V	-	R
Gang-Gang Cockatoo *Callocephalon fimbriatum*	V	-	R
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	-	R
Masked Owl *Tyto novaehollandiae*	V	-	R
Powerful Owl *Ninox strenua*	V	-	R
Regent Honey Eater *Xanthomyza phrygia*	E	E1	R

Threatened Species	TSC Status	EPBC Status	Predicted or Recorded
Sooty owl *Tyto tenebricosa*	V	-	R
Speckled Warbler *Pyrrholaemus sagittatus*	V	-	R
Swift Parrot *Lathamus discolor*	E	E1	P
Amphibians and Reptiles			
Broad-headed Snake *Hoplocephalus bungaroides*	E	V	P
Giant Burrowing Frog *Heleioporus australiacus*	V	V	P
Little-John's Frog *Litoria littlejohni*	V	V	R
Stuttering Frog *Mixophyes balbus*	-	V	P
Insects			
Giant Dragonfly *Petalura gigantea*	E	-	R
Fish			
Macquarie Perch *Macquaria australasica*	V	E	P

4.4.1 Pest Species

It is unknown whether pest species currently use the areas of the proposed pipeline route. However it is recommended that field surveys (scat or footprint searches, spotlighting etc.) to determine their presence are conducted. Considering pest species will often use easements as they provide a corridor for dispersal and hunting / foraging purposes.

Pest species are considered as a threatening process under the TSC Act, as such populations of pest species must be addressed accordingly, if they are identified.

4.5 Summary of pipeline route assessment

Based on the URS's desktop assessment of the proposed water pipeline routes, it is considered that two EEC's: Temperate Highland Peat Swamps and Box-Gum Woodland may occur within the Study Area and possibly within the proposed works footprint. Please note that the presence of these communities needs to be confirmed through field surveys and further assessment.

This desktop assessment has also indicated the potential presence of threatened flora and fauna within the footprint of the proposed pipeline(s) works. This includes three threatened fauna species: Koala (*Phascolarctos cinereus*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis)* and Speckled Warbler (*Chthonicola sagittatus*) as well as one threatened flora species *Pomaderris pallida.* All four species have been previously recorded in the past 10 years within the area of proposed works. A further 18 threatened flora species, and 29 threatened fauna species have been recorded or predicted to occur based on the presence of habitat, within the vicinity of the study area (i.e. a 10 km radius of the area of proposed works).

The estimated location of these threatened species and EEC's along the proposed water pipeline routes is demonstrated in Table 3.

Table 3 – Summary of Findings of Desktop Assessment of Water Pipeline Routes

Threatened Species/ EEC	Water Pipeline Route 1- Location	Water Pipeline Route 2- Location	Estimated length of pipeline intersecting the Community
Temperate Highland Peat Swamps	-	Approximately 12km South West of the Hume Highway and Illawarra Highway Junction, near Moss Vale. It is likely to occur in sandy drainage lines between the existing Moomba to Sydney Gas Pipeline and the Hume Highway in this area. May also occur on the southern side of the Hume Highway in this area.	Up to 1km

Threatened Species/ EEC	Water Pipeline Route 1- Location	Water Pipeline Route 2- Location	Estimated length of pipeline intersecting the Community
Box-Gum Woodland	Approximately 4km north of the Marulan STP along Brayton Road. It is likely to occur on both the eastern and western side of the Brayton Road. A smaller patch is likely to occur on the eastern side of Brayton Road approximately 2km south of the Brayton Road and Canonleigh Road junction. A larger patch is likely to occur approximately 4km north north east of the Brayton Road and Canonleigh Road junction, along Canonleigh Road. The community is likely to occur on both the Northern and Southern side of the Road.	-	Up to 3.45km Up to 1km
Koala (*Phascolarctos cinereus)*	Less than 0.5km from the start of the route, within the village of Marulan.	Approximately 1 km south east of the Hume Highway and Illawarra Highway Junction, along the proposed route.	-
Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis)*	Approximately 1km north of the Marulan WTP, along the proposed route.	-	-
Speckled Warbler (*Chthonicola sagittatus*)	Approximately 1km north of the Marulan WTP, along the proposed route.	-	-
Pomaderris pallida	Approximately 4km south west of Moss Vale along the Illawarra Highway. (2 individuals recorded)	-	-

It should be noted that the estimates of the pipeline length intersecting the community are approximate only and are conservative as they account for the mass of the area mapped along the route and not the separate portions of each mapped area.

5. Discussion and Conclusions

A preliminary ecological desktop review of the proposed area of works was undertaken to determine the potential diversity of species on the site, vegetation communities and the likelihood for the potential occurrence of threatened species, populations and endangered communities.

This preliminary ecological desktop assessment has determined that the proposed water pipeline routes and its surrounds are expected to contain suitable habitat for a range of common and threatened flora and fauna species. The desktop database review determined that the proposed water pipeline routes are likely to contain potential habitat for three endangered ecological communities, 19 threatened flora species, and 32 threatened fauna species.

An assessment of these desktop searches identified that some areas of the proposed pipeline and its surrounds meet the criterion of the EEC: Box-Gum Woodland and Temperate Highland Peat Swamps of Sandstone. It is recommended that field surveys and further assessment are conducted in order to confirm the presence or absence of these communities. It is recommended that the proposed works to install a water pipeline is unlikely to have a significant impact on these communities or its habitat, provided suitable mitigation measures are implemented. Mitigation measures are recommended in Section 6 of this report.

It is recommended that field surveys and further assessment are conducted in order to confirm the presence or absence of the recorded and/or predicted threatened flora and fauna species with the proposed works area.

It is assumed that the proposed works will be contained within a narrow easement that has previously been cleared for road development and/or gas pipeline instalment and maintenance. It is also assumed that these areas would be regularly maintained (i.e. reducing vegetation height) as part of the Australian Pipeline Association (APA) maintenance obligations (along gas pipeline) and local council's obligation along roadsides. As such it is consider that large sections of the chosen route will only require the removal of already modified vegetation. The loss of vegetation within these areas would not be considered a significant loss for threatened species habitat. Furthermore it is assumed that the regeneration of the easement will occur once works are finished. This will assist in providing habitat that may be utilised by some fauna species.

It is suggested that if any significant habitat features are required to be removed during works phases; provided that suitable mitigation measures are implemented to ameliorate the effects it is unlikely that the proposed works will have to have a significant impact on threatened species.

6. Management Recommendations

The following management and mitigation measures are recommended:

During or prior to Detailed Design:

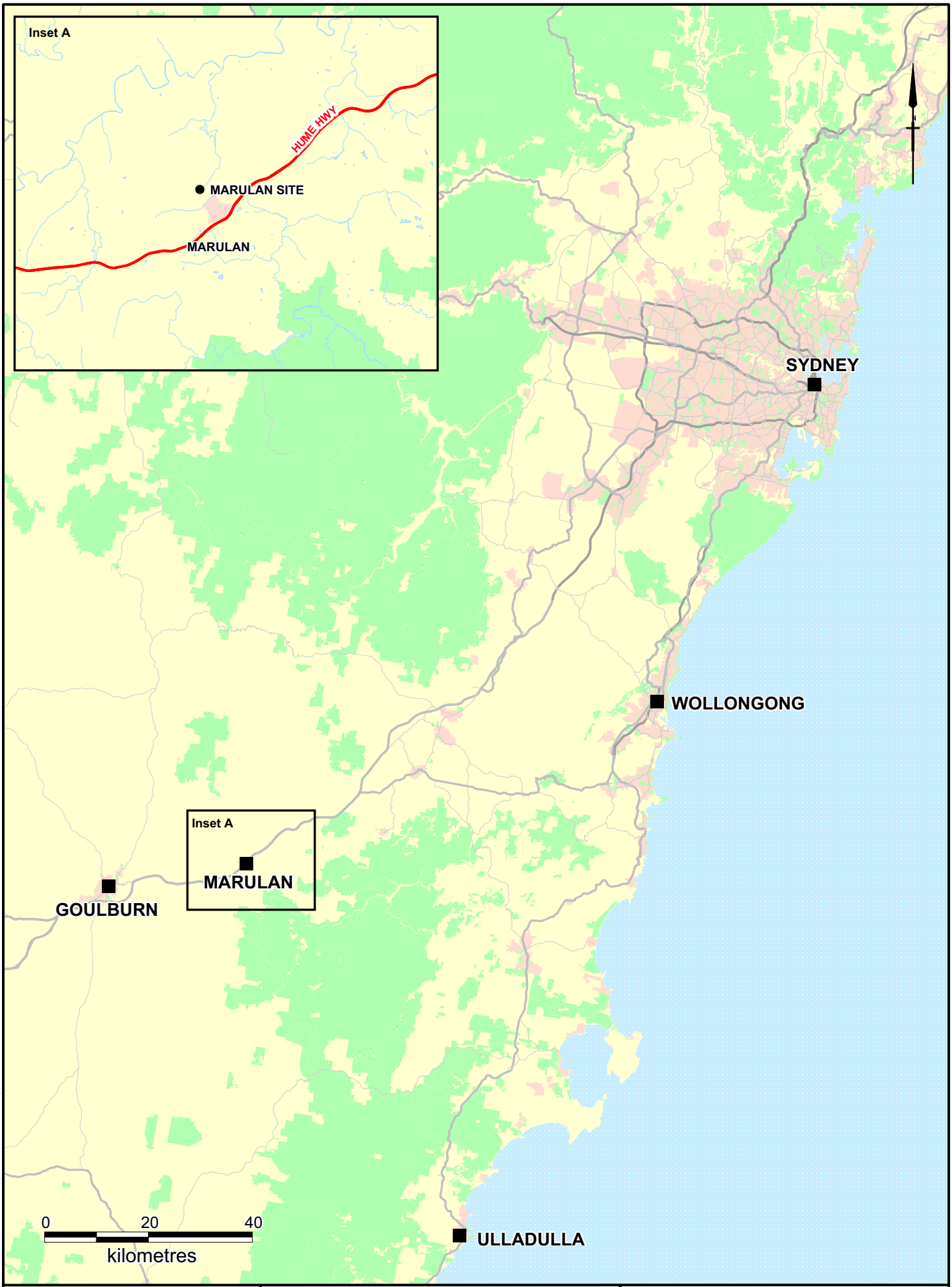
- Further assessment including field surveys of the water pipeline routes should be undertaken to confirm the potential ecological impact of the proposed water pipeline(s).

- If EEC's are confirmed through further assessment, then as far as practical, these areas should be avoided by altering the easement path. In a situation where this is not possible directional boring under the community may be an option. For example, the EEC: Temperate Highland Peat Swamps of Sandstone generally occurs in drainage lines as such it may be possible to bore under the waterway leaving the above ground community intact. Other management solutions may include re-spreading of the original top soil on the disturbed trench areas after works are finished to allow for natural regeneration of the sites from the soil seedbank.

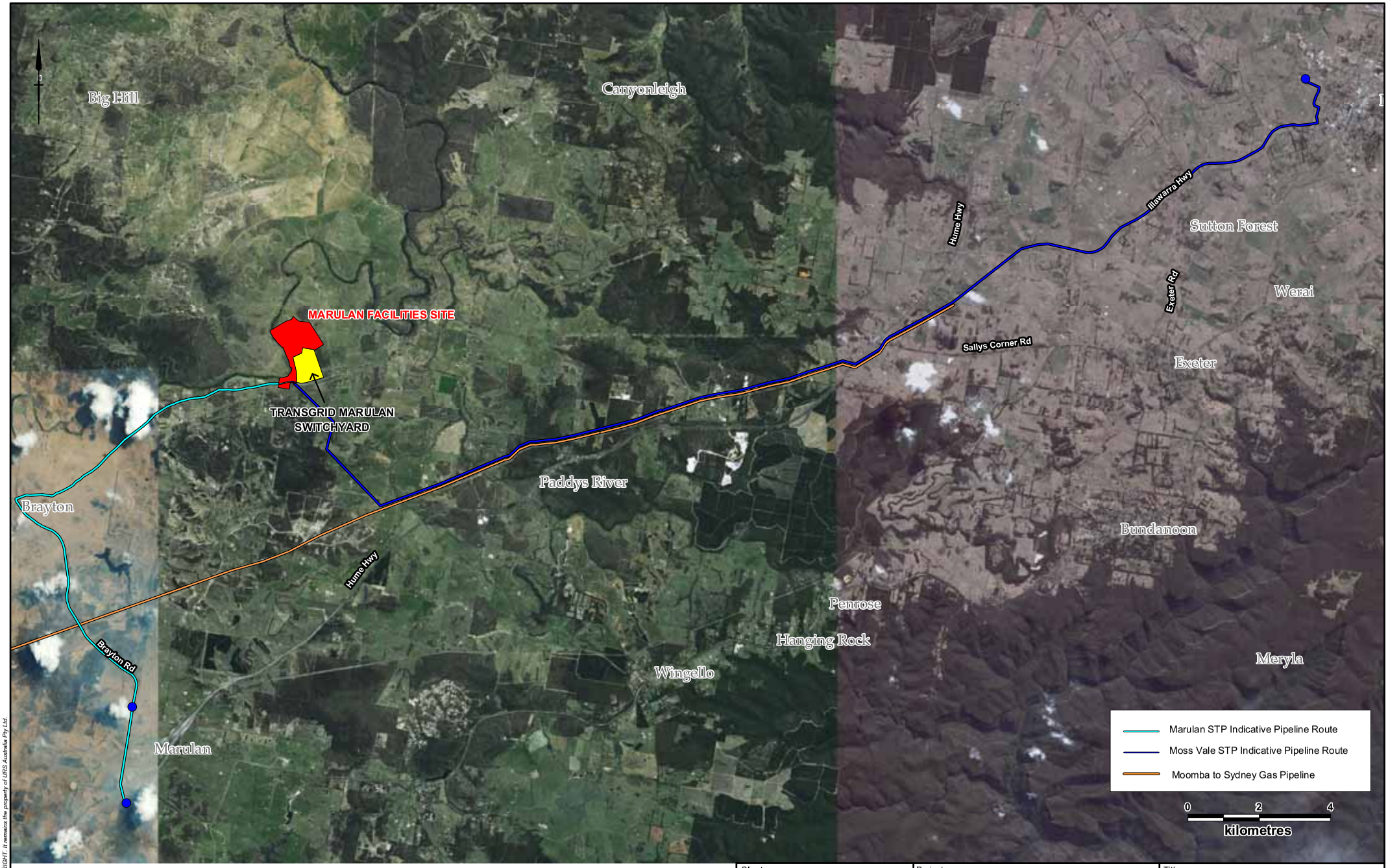
- Detailed design should consider minimising the vegetation clearing along the proposed easement as much as possible and restricted to those areas where it is necessary as no alternative path is available.

Construction

- If significant habitat features are identified within the proposed easement they should be protected as far as is practical. It is recommended that a Construction Environmental Management Plan be developed containing detail as to the management of these features during the works, specifically:
    - Removal and disturbance of existing rocks and logs, throughout the easement, should be minimised or prevented.
- Vegetation clearing along the proposed easement should be minimised as much as possible and restricted to those areas where it is necessary as no alternative path is available. It is recommended that all site personnel are aware of this practice in order to minimise unnecessary vegetation clearing and disturbance.
- Fallen logs and branches provide valuable habitat for a range of ground-dwelling fauna. It is recommended that, in as far as practical, any lopped branches removed should be used as habitat on site. To achieve this, branches and logs could be sawn down to a manageable length and simply left *in situ.* Chipping and spreading chipped material is also an appropriate alternative, particularly as a weed suppressant in areas where all native overstorey vegetation is removed.
- If weeds are identified on site, light weed control is recommended prior to works commencing. Any Noxious weeds will need to managed (eradication, control etc.) according to the Noxious Weed declarations for each LGA. Monitoring of weed infestation is also recommended at regular intervals once clearing has been undertaken.



Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES - WATER PIPELINE ECOLOGY DESKTOP ASSESSMENT	Title: **REGIONAL LOCATION MAP**
URS	Drawn: AJW | Approved: NB | Date: 05/12/2008 Job No: **43177371** | File No: 43177371-217.wor	Figure: **1**



Source: GHD, Integrated Water Management Strategy, November 2008

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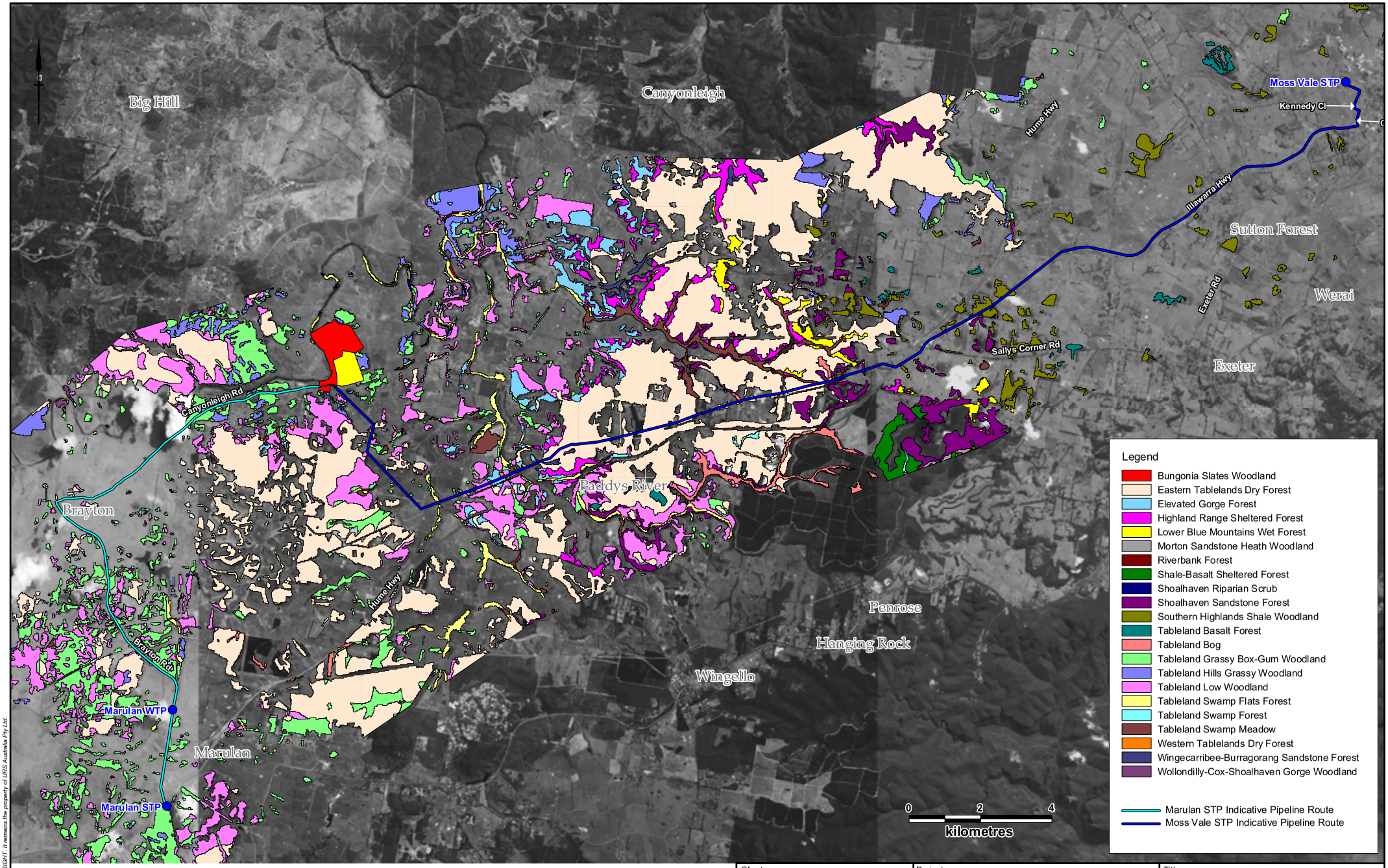
Project: MARULAN GAS TURBINE FACILITIES - WATER PIPELINE ECOLOGY DESKTOP ASSESSMENT

Drawn: AJW | Approved: NB | Date: 05/12/2008

Job No: 43177371 | File No: 43177371-199.wor

Title: **AERIAL MAP AND PROPOSED WATER PIPELINE ROUTES**

Figure: 2



Source: GHD, Integrated Water Management Strategy, November 2008, Google Earth 2008 and DECC 2008

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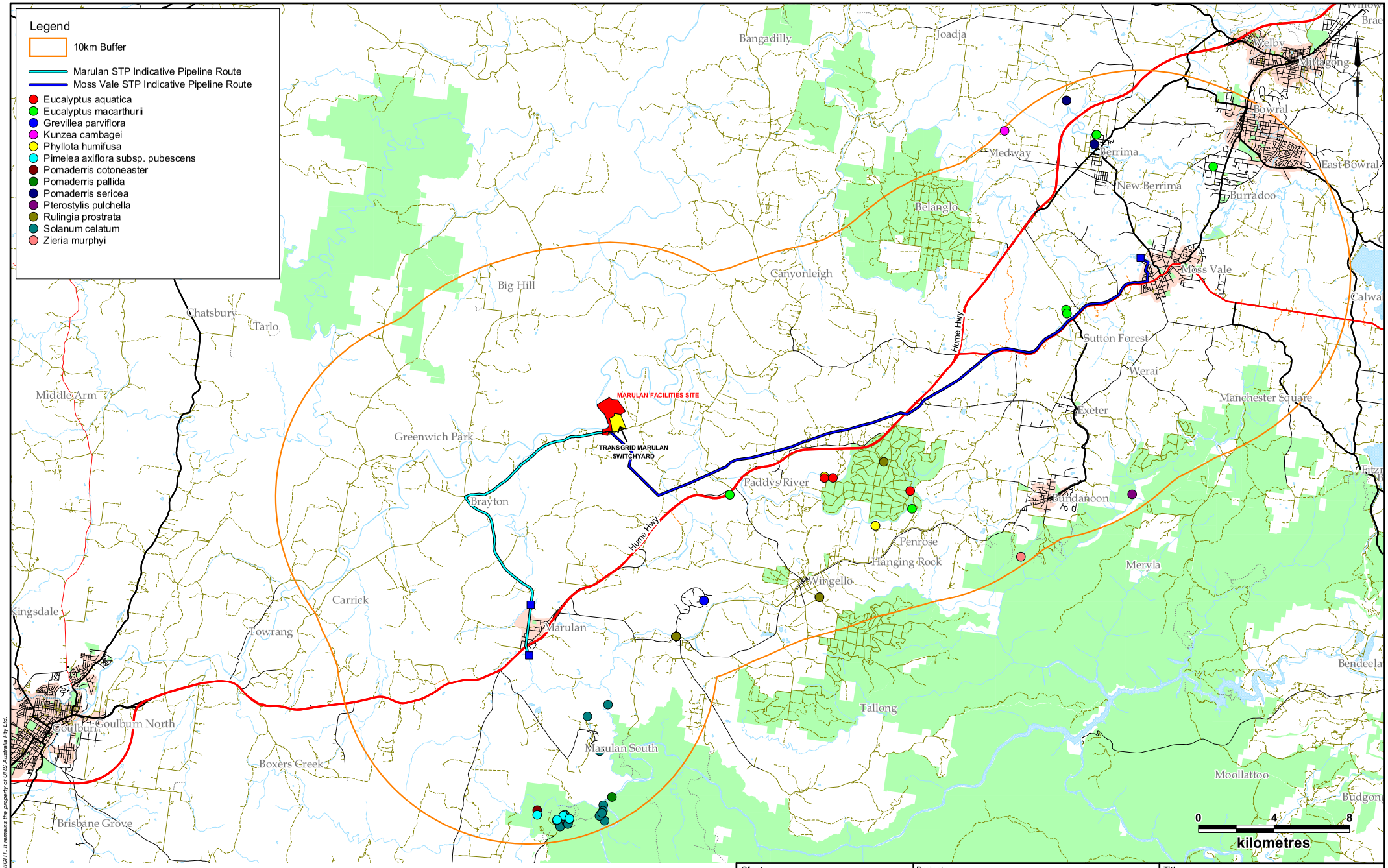
Drawn: AJW | Approved: NB | Date: 05/12/2008

Job No: 43177371 | File No: 43177371-216.wor

Title: **SCIVII VEGETATION MAP AND WATER PIPELINE ROUTES**

Figure: 3



Source: NPWS Wildlife Atlas November 2008

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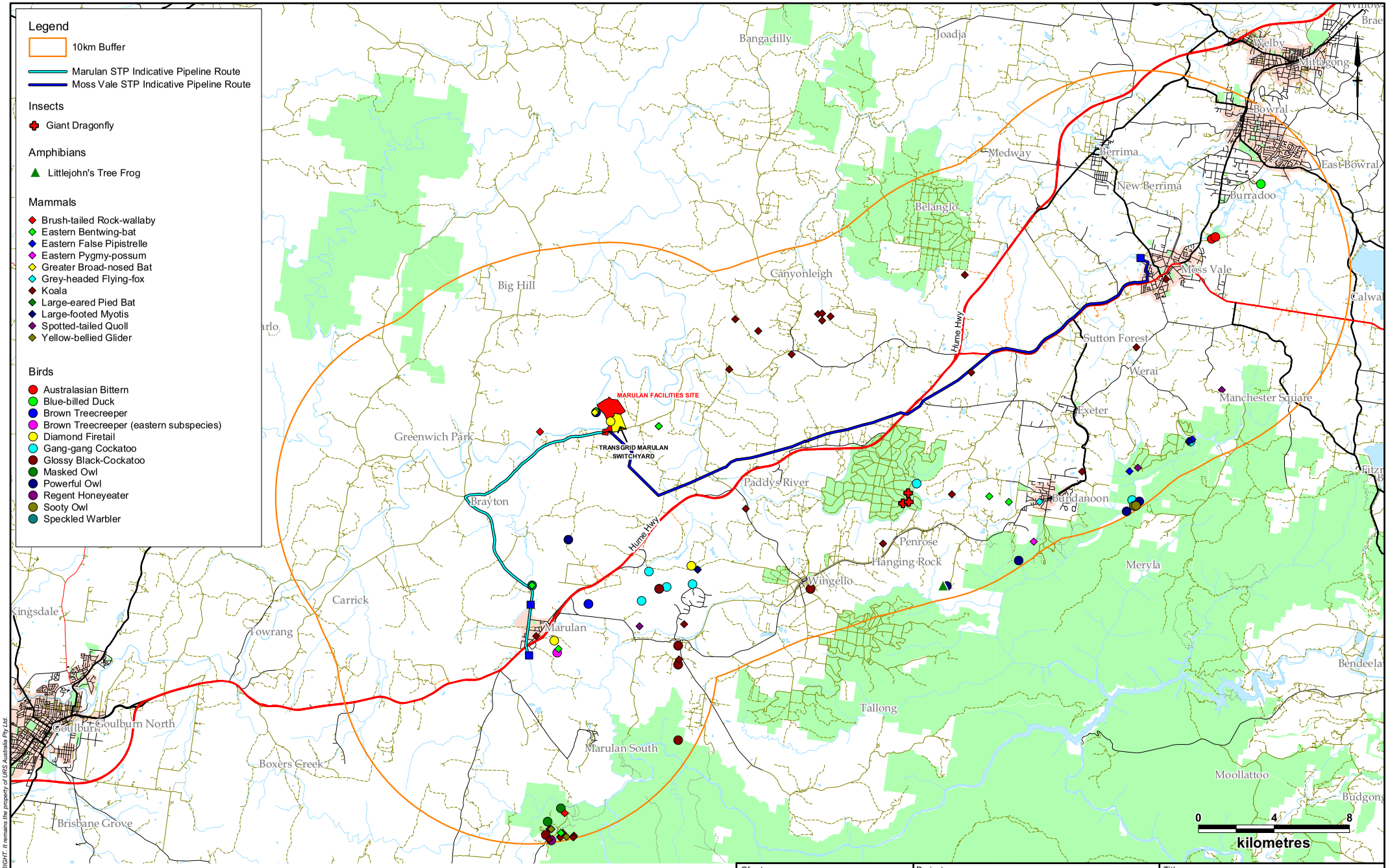
MARULAN GAS TURBINE FACILITIES - WATER PIPELINE ECOLOGY DESKTOP ASSESSMENT

Drawn: AJW | Approved: MB | Date: 05/12/2008

Job No: 43177371 | File No: 43177371-201.wor

Title
WILDLIFE ATLAS MAP OF THREATENED FLORA SPECIES RECORDED WITHIN 10 KM OF STUDY AREA

Figure: 4



Source: NPWS Wildlife Atlas November 2008

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Job No: 43177371 | File No: 43177371-202.wor

Title
WILDLIFE ATLAS MAP OF THREATENED FAUNA SPECIES RECORDED WITHIN 10 KM OF STUDY AREA

Figure: 5