MELBOURNE–GEELONG INTERCONNECTION

Flora and Fauna Report

Prepared for:

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Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to survey the flora and fauna values along the modified northern route of the proposed Melbourne–Geelong Interconnection pipeline in accordance with the scope of services set out in the contract between KBR and Barwon Region Water Corporation ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from visual observations of the site and of examinations of documents in the public domain. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

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Revision History

Revision	Date	Comment	Signatures		
			Originated by	Checked by	Approved by
A	26/10/09	For review	A. Rigg/ W. Jeffery	R. Macdonald	P. Harberts
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Glossary

From DSE report template (2009 issue) for ecological assessment with net gain.

Bioregion	Biogeographic areas that capture the patterns of ecological characteristics in the landscape or seascape, providing a natural framework for recognising and responding to biodiversity values.
Bioregional conservation status (BCS of an EVC)	A state-wide classification of the degree of depletion in the extent and/or quality of an ecological vegetation class (EVC) within a bioregion in comparison to the State's estimation of its pre-1750 extent and condition.
Diameter at breast height (DBH)	The diameter of the trunk of a tree measured over bark at 1.3 m above ground level.
Ecological vegetation class (EVC)	A type of native vegetation classification that is described through a combination of its floristic, life form and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification that is based solely on groups of the same species) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating.
EVC benchmark	A standard vegetation-quality reference point relevant to the vegetation type that is applied in habitat–hectare assessments. Represents the average characteristics of a mature and apparently long-undisturbed state of the same vegetation type.
Gain target	The amount of gain that needs to be achieved to offset a loss measured in habitat–hectares.
Habitat–hectare (hha)	A site based measure of quality and quantity of native vegetation that is assessed in the context of the relevant native vegetation type.
Habitat score	The score assigned to a habitat zone that indicates the quality of the vegetation relative to the EVC benchmark—sum of the site condition score and landscape context score usually expressed as a percentage or on a scale of zero to 1.
Habitat zone	A discrete area of native vegetation consisting of a single vegetation type (EVC) with an assumed similar quality. This is the base spatial unit for conducting hha assessment.
High threat weed	Introduced plant species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term, assuming on-going current site characteristics and disturbance regime.
Large old tree (LOT)	A tree with a diameter at breast height (DBH) equal to or greater than the large tree diameter as specified in the relevant EVC benchmark.
Like-for-like	These are part of the criteria for the determination of an offset and provide a direct link between the loss and the offset gain, in terms of vegetation type or landscape function. There are more specific requirements for higher conservation significance vegetation and more flexible requirements for lower significance.
Medium old tree (MOT)	A tree with a diameter at breast height (DBH) equal to or greater than 0.75 of the large tree diameter in the relevant EVC benchmark but less than the DBH for a large old tree.
Protection (of a tree)	An area with twice the canopy diameter of the tree(s) fenced and protected from adverse impacts: grazing, burning and soil disturbance not permitted, fallen timber retained, weeds controlled, and other intervention and/or management if necessary to ensure adequate natural regeneration or planting can occur.
Recruitment	The production of new generations of plants, either by allowing natural ecological processes to occur (regeneration, etc.), by facilitating such processes such as regeneration to occur, or by actively revegetation (replanting, reseeding). See revegetation.
Remnant patch	An area of vegetation, with or without trees, where less than 75% of the total understorey plant cover is weeds or non-native plants (bare ground is not included). That is at least 25% of the understorey cover is native; or a group (i.e. three or more) of trees where the tree canopy cover is at least 20%.
Revegetation	Establishment of native vegetation to a minimum standard in formerly cleared areas, outside of a remnant patch.

Glossary continued

Scattered trees	Canopy trees within an area where at least 75% of the total understorey plant cover is weeds or non-native plants and the overall canopy cover for a group (i.e. three or more) of trees is less than 20%.
Very large old tree (VLOT)	A tree with a diameter at breast height (DBH) equal to or greater than 1.5 of the large tree diameter in the relevant EVC benchmark.
Weed of national significance (WONS)	Under the National Weeds Strategy (NRMMC 2006), 20 introduced plants are identified as weeds of national significance. These weeds are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts.

Summary

To redress a long-term shortage in water supplies for Geelong and the surrounding region, the Victorian government announced, as a part of the 2007 Water Plan, that a potable water pipeline would be constructed linking Geelong to Melbourne's water supply. In 2007, Barwon Water engaged Kellogg Brown & Root Pty Ltd (KBR) to undertake various studies, including flora and fauna surveys to determine a socially, economically and environmentally suitable option for the pipeline route. A preferred route was determined from this process.

The current report reviews the flora and fauna studies that were undertaken in 2007 of the preferred route to identify any changes in the condition of the vegetation and habitat along the alignment and to assess areas that were not previously surveyed in 2007 but are now within the proposed alignment as a result of changes.

The alignment is proposed through the State Government's proposed grassland reserve. Where the alignment passes through this area, DSE native vegetation quality and extent data has been used. A total of 12.02 ha of plains grassland is predicted to be lost within the grassland reserve. This would require a gain target of 10.64 hha to offset the loss of 5.32 hha.

Outside of the grassland reserve it is estimated that the construction of the pipeline could impact on a maximum of 63 patches of remnant native vegetation, all of which are endangered EVCs in the Victorian volcanic plain bioregion. Based on a maximum construction corridor width of 30 m, a total gain target of 7.23 habitat–hectares (hha) would be required to offset the loss of 4.38 hha of plains grassland, plains grassland/plains grassy woodland mosaic and plains grassy woodland ecological vegetation classes (EVC). Of these, 14 patches were considered to be of 'very high' conservation significance, with the remaining 49 considered to be of 'high' conservation significance, which is the minimum rating assigned to endangered EVCs.

Through recommended avoidance and minimisation techniques the impact on native vegetation is likely to be significantly reduced. By avoiding patches and reducing the construction corridor where patches of remnant native vegetation occur, the offset requirement for the pipeline could be reduced to a gain target of 3.46 hha to offset the loss of 2.20 hha. Combined with the data supplied from DSE for the grassland reserve area, a gain target of 14.1 hha would be required for the pipeline.

Outside of the grassland reserve, it is considered that 7.23 hha would be the maximum amount of native vegetation that would need to be removed based on a 30 m impact corridor. It is likely that several remnant patches could be avoided and the total disturbance of the remaining affected patches minimised by construction methods such as under-boring, micro-realignment and reducing the width of the impact corridor. Reducing the impact corridor to a width of 20 m or less and the total avoidance of some patches would reduce the area of native vegetation that would be impacted and therefore reduce the requirement to offset vegetation losses.

Final gain targets for the project can not be finalised until construction methods and design have been finalised allowing the level of disturbance of affected patches to be accurately quantified. Therefore targets discussed in this report are conservative.

All areas of plains grassland within the grassland reserve and seven patches observed outside of the reserve were found to meet the criteria for the nationally listed community, natural temperate grassland of the Victorian volcanic plain. The majority of patches, being plains grassland located on the basalt plains west of Melbourne, are also recognised as the *Flora and Fauna Guarantee (FFG) Act 1988* listed community western (basalt) plains grassland.

A single threatened fauna species was observed during the current survey. A *Pedionomus torquatus* (plains wanderer) was observed in a paddock to the south-west of Werribee River. Several habitat areas for other threatened fauna species are present throughout the study area, but are mainly represented by rocky outcrops amongst grasslands, with limited aquatic and riparian habitat and some scattered trees. Grasslands containing rocky outcrops often retain more remnant native grasses and provide potential habitat for several threatened flora and fauna species, most notably *Delma impar* (striped legless lizard) and *Synemon plana* (golden sun moth). Other threatened species with habitat along the proposed alignment include *Litoria raniformis* (growling grass frog), *Tympanocryptis pinguicolla* (grassland earless dragon) and the threatened flora species *Pterostylis truncata* (brittle greenhood).

Final gain targets to be determined for this project would need to include some habitat features required for threatened flora and fauna species, including those mentioned above.

Two nationally threatened flora species were observed during the current assessment. A population of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) was observed along the road reserves to the south and south-east of the You Yangs Regional Park and several other individuals were present within the road reserve of Tarneit Road. A suspected single immature *Dianella amoena* (matted flax-lily) was also observed amongst a number of *Pimelea spinescens* ssp. *spinescens* within a road reserve to the south of the You Yangs.

Compared with the previous 2007 detailed assessment, there has been a marked increase in the amount of hha and therefore gain targets required for the project. In 2007 the area assessed was directly beneath the overhead power lines, which has been subject to greater disturbance, including installation of pylons and maintenance track. In 2009 the area assessed included a

20 m area beyond that directly beneath the power lines, which has been subject to fewer disturbances and contains higher native grass cover and habitat, generally represented by surface rock.

Throughout the proposed route there has been an increase in native grass cover and a decrease in weed cover since 2007. During this period, between the 2007 assessment and 2009, weather conditions appear to have favoured native grasses, increasing their overall cover. This has resulted in numerous areas, previously assessed in 2007 as being slightly below the 25 per cent threshold of native understorey cover, now being classed as remnant patches in 2009.

KEY RECOMMENDATIONS

The following is a summary of the key recommendations for construction of the MGI project.

- Avoid patches of native vegetation where possible, in particular those that are of very high conservation significance and those that fulfil the criteria of the nationally threatened community, natural temperate grassland of the Victorian volcanic plain

- Erect temporary fencing around all known locations of threatened flora species to protect individuals during construction. Known locations of Victorian rare or threatened (VROT) species should also be protected where possible

- Where avoidance is not possible, minimise the impacts through measures such as reducing the corridor of construction impact as much as practicable and utilising the more degraded areas

- Minimise disturbance of habitat areas, predominantly rocky outcrops, waterways and drainage lines, by avoidance where possible and minimising the amount of physical disturbance

- Avoid disturbance of all recorded medium and large old trees within the proposed alignment. Avoid all recorded small trees where possible and retain as many planted native trees as is practicable.

1 Introduction

1.1 PROJECT BACKGROUND

The Victorian government's Central Region Sustainable Water Strategy (DSE 2006b) identified Geelong and the surrounding region as facing a long-term water supply shortfall. The preferred option for securing the region's water supply was a Melbourne–Geelong Interconnection (MGI), used as a contingency option to provide additional water to Geelong. The state government has announced as part of the June 2007 Water Plan that it intends to build a potable water connection between Melbourne and Geelong by 2012.

Kellogg Brown & Root Pty Ltd (KBR) was engaged by Barwon Region Water Corporation (Barwon Water) to prepare a concept and functional design of the pipeline scheme. The concept design found four feasible pipeline routes for investigation and assessment. A preliminary desktop environmental assessment of the four potential alignments for the potable water transmission pipeline between Werribee and north Geelong was undertaken. As a result of a risk assessment workshop in June 2007, the four options were reduced to two options—the proposed northern and southern alignments.

Following a preliminary flora and fauna field survey of the proposed northern route and a review of previous surveys undertaken for the southern route, a modified northern route was identified as the preferred option.

1.2 PREVIOUS ASSESSMENTS

1.2.1 Preliminary flora and fauna assessment

The key purpose of the preliminary flora and fauna survey, completed in 2006, was to clarify the flora and fauna issues for the proposed northern route, in particular regarding the extent of intact remnant native vegetation likely to be impacted by the proposed pipeline alignment.

The preliminary assessment stated that the proposed pipeline placement was not expected to significantly impact upon native vegetation, vegetation communities or threatened species. If avoidance measures were taken, the potential impact on patches of native vegetation, particularly in the road reserves to the north and west of the You Yangs Regional Park, and important ecological features, such as waterways, would be further reduced. These recommendations were adopted and the proposed alignment was moved in response to the assessment.

As a result, a modified northern route was chosen in order to reduce the loss of significant roadside vegetation and numerous large trees.

A detailed spring survey was required along the extent of the modified northern route to determine habitat values and the presence of species of conservation significance, and to assess the quantity and quality of native vegetation.

1.2.2 Detailed flora and fauna assessment

In November 2007 a detailed flora and fauna survey was undertaken on the modified northern route (see Appendix A for detailed maps). The detailed assessment and subsequent report (Appendix B) of the modified northern route outlined the impacts that the construction of the proposed route would have on native vegetation, significant flora and fauna species and habitat. The report also identified triggers and requirements under environmental legislation that would be required for the project. A number of management recommendations were outlined in the report to mitigate the impacts of the proposed route.

The detailed assessment, conducted during a prolonged dry period, found that 1.82 habitat–hectare (hha) of native vegetation would be required to offset the loss of 1.04 hha recorded in remnant patches along the current alignment of the proposed modified northern route (KBR 2007). The following net gain requirements would be needed for each ecological vegetation class (EVC):

- 0.86 hha for plains grassland (applies to both low rainfall and heavier-soil EVCs)
- 0.15 hha for plains grassland/plains grassy woodland mosaic
- 0.03 hha for stream bank shrubland.

A total of 0.47 hha was noted as being of very high conservation significance, with a further 0.57 hha of high conservation significance.

A nationally endangered and state listed flora species, *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower), was observed in several locations over the proposed route during the assessment.

Several potential habitat areas for threatened flora and fauna were also identified along the proposed route and noted as requiring further surveys and mitigation measures to reduce the potential impact on these species.

1.3 CURRENT ASSESSMENT

1.3.1 Objectives

The current investigation incorporates a review of the data collected in 2007 during the preliminary and detailed flora and fauna assessments, and additional assessments required, including those from alterations made to the route from previous recommendations made in the 2007 report. The recommendation incorporated as an alignment change was to align the pipeline along the northern road reserve of Peak School Road and the western road reserve of Farrars Road, to avoid known locations of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower).

The purpose of this study was to:

- assess data that have emerged since the detailed survey
- review previous studies and reports that have been conducted in the surrounding area since the preliminary and detailed assessments
- review the current condition and extent of previously assessed areas
- carry out surveys of areas that have not been assessed previously but are now within the current proposed alignment as a result of changes
- undertake assessments to recognise all relevant new legislative requirements that have come into effect since the detailed assessment
- outline further surveys or assessments that are needed or likely to be needed in order to meet approval and legislative requirements for the proposed project.

1.3.2 Scope

The scope of this report includes:

- a desktop assessment incorporating the current databases of the Flora Information System (FIS), Atlas of Victorian Wildlife (AVW) and EVCs
- an assessment of sites within the proposed route to determine whether any areas fulfil the criteria for being classified as the nationally threatened community natural temperate grassland of the Victorian volcanic plain
- an assessment of sites within the proposed route to determine whether any areas fulfil the criteria for being classified as grassy eucalypt woodland of the Victorian volcanic plain
- an assessment of areas along the current proposed alignment that were not previously assessed in 2007 because they were not then within the proposed alignment
- identification of appropriate areas to be used for construction activities, such as parking for workers, access and stockpiles
- a review of the condition and size of areas of ecological significance within the alignment and of any increase or decrease since 2007 in the quality of remnant native vegetation patches
- a review of the locations of threatened flora and fauna species, including a targeted survey for species in appropriate areas. Appropriate locations for undertaking surveys will be determined by areas specified in the detailed assessment and from the updated databases of the Department of Sustainability and Environment (DSE)
- an outline of mitigation measures required during the project to inform the applications for approvals and meet legislative requirements and any further assessments or surveys that are required.

1.4 STUDY AREA

A detailed description of the study area and of the proposed modified northern route is given in the report of the detailed flora and fauna assessment in 2007 (Appendix B).

1.5 REFINEMENT OF THE PROPOSED ALIGNMENT

Since the 2007 assessment the proposed alignment has been refined. Based on recommendations of that assessment (KBR 2007) and further detailed design and investigations, changes in the proposed alignment have occurred which were not assessed during 2007. Table 1.1 outlines the refinements that have been made to the alignment. The alignment refers to the predicted maximum 30 m width of the impact corridor required for construction.

Table.1.1 Refinement of the proposed alignment since the 2007 assessment

Area	2007 assessment	2009 refinement
Southern end of the power line easement—Peak School Road	Centre of the easement	Eastern side of the easement
Peak School Road, Forest Road to Farrars Road	Southern side of road reserve	Northern side of road reserve
Farrars Road	Eastern side of road reserve	Western side of road reserve
Little River to Ripley Road, between You Yangs Road and Gifkins Road	Eastern side of road reserve	Western side of road reserve
Power line easement, from Argoona Road to Werribee River	Centre of the easement	Southern side of the easement The proposed easement diverts twice from the power line easement along private road reserves. First heading east at Argoona Road, then north along Martins Road Second, east along an unnamed private road, then north along Edgars Road
Alternative crossing of Werribee River at Cobbledicks Ford Road	Centre of the power line easement	Extending directly west from the power line easement to Cobbledicks Ford Road Crossing the river at the existing ford Along Cobbledicks Ford Road to Dukelows Road then to the power line easement
Power line easement, from Werribee River to Tarneit Road	Centre of the easement	Southern side of the easement
Lovely Banks water transfer facility	Not included	Included site within the assessment
Cowies Hill water transfer facility	Not included	Included site within the assessment

The 2007 assessment was generally confined to the area directly beneath the power lines. With further design of the pipeline and discussions with power authorities, it is now proposed to locate the pipeline within the easement but offset to one side of the overhead power lines.

In reference to the power line easement areas in Table 1.1, the 30 m construction impact corridor generally required for the project is taken from the centre of the power lines to a distance of 30 m to the north, west or south. The proposed pipeline would be installed between 22 m and 25 m from the centre of the power lines.

As the construction zone is calculated from the centre of the power lines, some overlap of assessment has occurred along the easement during the 2007 assessment and 2009 review. Approximately 15 m directly adjacent to the outermost cable of the overhead power lines, in the direction that the pipeline would be installed, has not previously been assessed. The area directly underneath the power lines was assessed in 2007.

2 Methodology

The methodology KBR has applied in the current study is the same as was outlined in the detailed flora and fauna assessment conducted in 2007 (Appendix B), including the classification of vegetation and review of the data and literature.

In addition, an assessment of all native vegetation specified in the detailed assessment will be undertaken to determine whether areas of ecological significance meet the criteria for recognition as either the nationally threatened grassland community of the Victorian volcanic plain or the nationally threatened grassy eucalypt woodland of the Victorian volcanic plain.

The assessment for the grassland community will follow the criteria set out in the Policy statement 3.8. Natural Temperate Grassland of the Victorian Volcanic Plain: A nationally threatened ecological community (DEWHA 2008c). The assessment for grassy eucalypt woodland will follow the criteria set out in the listing advice for grassy eucalypt woodland of the Victorian volcanic plain, (DEWHA 2009d).

2.1 DESKTOP REVIEW

The findings of the desktop assessment can be found in Appendix B. This report notes any changes to previous data and new data and literature that have occurred since the 2007 assessment, including both state and federal databases.

2.2 FIELD ASSESSMENT REVIEW

The current field review occurred over two survey periods, one in August 2009 and the second in September 2009. The assessment was undertaken over a 30 m corridor, which is the optimal construction works zone.

The review consisted of three components:

- determining whether changes had occurred to the condition of the vegetation and habitat since the 2007 assessment. This was undertaken on areas surveyed in 2007 that remain within the current alignment
- conducting vegetation and habitat assessments of areas not surveyed in 2007. Section 1.5 outlines the location of these areas, which were classed as remnant patch vegetation, scattered trees or degraded treeless vegetation
- identifying the presence or likely presence of threatened flora and fauna species and habitat along the proposed alignment.

Detailed lists of flora and fauna species observed along the alignment were collected previously during the 2007 assessment. No species lists have been compiled during the 2009 review because the sites assessed are the same as 2007 or are new areas directly adjacent and within 20 m of previously assessed areas.

Where the pipeline intersects the State Government's proposed grassland reserve, see Section 2.5.1, DSE native vegetation quality and extent data has been used, based on data collected for the Strategic Impact Assessment (DSE 2009c).

Additional assessment

Barwon Water has made a deviation to the proposed MGI pipeline alignment in order to avoid areas identified in the State Government's Draft Strategic Impact Assessment (DSE 2009b), as having high quality plains grassland native vegetation. The pipeline will now deviate from the power line easement and use existing road reserves to avoid higher quality vegetation within the proposed native grassland reserve.

The deviations from the power line easement through existing road reserve areas were assessed on 12 November 2009. Two deviations occur from approximate chainages 32.1 km to 33.4 km and from 34.9 km to 39.2 km. The entire road reserve was assessed in accordance with the methods used in the previous survey conducted in September 2009 (see above). The deviations resulted in four remnant patches not being affected by the proposed route. Habitat zones 48, 49, 50 and 51 have been extracted from the current report. However, it has resulted in the loss of additional scattered trees.

2.3 WATERWAY ASSESSMENTS

Assessments of waterway condition prior to construction were undertaken in accordance with the new Victorian River Health Works Monitoring Method (DSE 2009d). The application of this method as part of the MGI project is intended to demonstrate the effectiveness of rehabilitation (including revegetation, erosion control, and in-stream habitat) after construction. Two indices, streamside zone and physical form, can be assessed along each bank depending on the proposed on-ground works. Streamside zone assesses riparian vegetation while physical form assesses bank condition and in-stream habitat. A pre-construction assessment of streamside zone for each waterway crossing along the proposed alignment has been conducted. In accordance with the method, it is envisaged that post-construction assessments would be conducted every 1, 3, 6, and 10 years after on-ground rehabilitation works.

2.4 LIMITATIONS

The report has been compiled from two survey periods. The first, conducted throughout August 2009, was a winter quality assessment of vegetation and habitat and incorporated targeted survey for winter-flowering threatened flora species. The second review, in September 2009, represents an early spring assessment.

The September assessment was conducted to qualify the findings of the August assessment and to determine any change in condition that might have occurred in that period. Conditions present in September override those found in August because spring is considered a more appropriate time to assess vegetation than winter.

The assessment period for the project began with the evaluation of route options in 2006 and continued with the detailed assessments of the preferred alignment, subsequent refinements of the alignment and the targeted surveys for threatened species up to the survey in September 2009. Weather patterns during this time have been characterised by lower than average rainfall until the 2009 year, when some increase in rainfall produced improved growth of native grassland vegetation and a decision to review and upgrade some of the previous assessment scores.

Where the condition of vegetation was similar to that recorded during the 2007 assessment, the 2007 data have been used since the earlier survey occurred in November and is considered to be within the optimal period for assessing grassland vegetation (KBR 2007).

The proposed alignment traverses numerous paddocks which are currently grazed by livestock. The condition of the vegetation through grazed paddocks at the time of both 2009 survey periods was negatively impacted by heavy grazing regimes. The extremely short paddock vegetation increased the difficulty in determining the extent of areas or remnant patches of native vegetation. Where remnant patches of native vegetation occur, and are considered to be of similar quality, a representative score was applied to the larger area and applied to other patches of matching quality, for example to adjacent heavily grazed paddocks with a similar species composition and cover.

2.5 RECENT INVESTIGATIONS AND REPORTS

2.5.1 Strategic impact assessment report

The DSE has recently released a strategic impact assessment report for the *Environment Protection and Biodiversity Conservation Act 1999* for the Victorian government's program, Delivering Melbourne's Newest Sustainable Communities. The report considers:

- designation of the expanded urban growth boundary
- the proposed Outer Metropolitan Ring E6 Transport Corridor
- the Tarneit section of the Regional Rail Link.

The Victorian government has committed to protecting two significant areas of native grassland to the west of Melbourne totalling approximately 15,000 ha. These areas will be used to offset any unavoidable losses of native vegetation and habitat associated with the government program (DSE 2009b). The report was released for public comment. The comment period has since closed.

The assessment is of relevance to this assessment of the MGI project due to the general proximity to the eastern end of the pipeline, but also the points of intersection with the proposed grassland reserves, outer metropolitan ring road and the Regional Rail Link.

The native vegetation quality and extent data collected within the grassland reserve (DSE 2009b) was used from pipeline chainage 27.1 to 45 km, with the exception of a approximately 100 m north of Ballan Road (chainage 41.14) that falls outside of the grassland reserve boundary.

This approach has been agreed through consultation with Barwon Water and DSE. The remainder of the quality and quantity calculations are based on the KBR 2009 assessment.

2.5.2 Biosis Research report

Biosis Research was commissioned by the Growth Areas Authority to prepare *Background Technical Report 2a: Biodiversity Assessment of Melbourne's Western Investigation Area* (Biosis Research 2009). The report details biodiversity information collected through investigations used to guide recommendations for revising the urban growth boundary.

The report includes details on the vegetation investigation area that extends from Taylors Road, south-west around the current urban fringe to Little River, covering an area of 25,447.1 ha. This involved 12,043 ha of ground mapping and 5,419.1 ha of incidental mapping (Biosis Research 2009). This study identified relatively large areas of plains grassland that have the potential to provide suitable management units of this community and associated flora and fauna species. The priority areas have been identified because they represent areas capable of supporting viable populations of communities and species listed under the EPBC Act, given the appropriate management resources (Biosis Research 2009).

The report was compiled with a range of assessment methods, including hha assessment, which was applied to the broader project area to meet the strategic intent of the assessments. The assessment and review methodologies applied to the proposed alignment of the MGI pipeline provide a higher level of detailed information focused specifically on the ecological values of the potential construction corridor.

3 Ecological values

3.1 VEGETATION

3.1.1 Mapped ecological vegetation classes (EVCs)

Several newly mapped EVCs are present along and adjacent to the proposed route, based on an assessment of DSE's Native Vegetation - Modelled 2005 Ecological Vegetation Classes dataset (DSE 2008b). The dominant EVC within the vicinity of the route remains plains grassland (EVC 132), but numerous newly mapped areas have been added along the extent of the proposed route.

From searches of the updated databases, an additional EVC has been mapped, intersecting the proposed route along Farrars Road. Three mapped areas of hills herb-rich woodland (EVC 71) EVC are present along the western side of Farrars Road. The same area contains additional plains grassland and plains grassy woodland (EVC 55) EVCs.

The EVC previously mapped along the Werribee River at the proposed crossing was stream bank shrubland (EVC 851). The current mapped EVC at this location is floodplain riparian woodland (EVC 56). This EVC is also indicated at the newly proposed Werribee River crossing at Cobbledicks Ford Road (DSE 2008b).

3.1.2 Nationally threatened communities

Two threatened communities listed under the EPBC Act, natural temperate grassland of the Victorian volcanic plain and grassy eucalypt woodland of the Victorian volcanic plain, are predicted to occur within the study area. These are recent listings under the EPBC Act and have been identified in a search of EPBC Act protected matters.

No habitat zones were considered to fulfil the criteria of grassy eucalypt woodland of the Victorian volcanic plain.

Natural temperate grassland of the Victorian volcanic plain

The nationally significant critically endangered ecological community, natural temperate grassland of the Victorian volcanic plain, is a native grassland community protected under the EPBC Act. This community is widespread to the west of Melbourne and is one of the most important environmental constraints affecting the proposed MGI alignment. Higher quality remnants of the community which are considered of sufficient quality to be included within the definition of the threatened community would be avoided by the proposed MGI alignment, or if that should not be possible the impact would be minimised (see Figure 3.1).

The vegetation is characterised by a native ground layer of perennial tussock grasses interspersed with a variety of wildflowers and herbs, including daisies, lilies and orchids. Large shrubs and trees are infrequent in the community. Dominant native grasses are typically *Themeda triandra* (kangaroo grass), *Austrodanthonia* spp. (wallaby-grasses), *Austrostipa* spp. (spear-grasses) or *Poa* spp. (tussock grasses). The appearance of the community can vary according to seasonal change and the history of land use and management, including grazing intensity and frequency and recent fire history.

The natural temperate grassland of the Victorian volcanic plain is a highly fragmented community. Less than 5 per cent of the pre-European distribution persists, but supports several nationally and state threatened fauna and over 20 threatened flora species (DEWHA 2008c).

The community is of variable quality and, being mostly recorded on private land, is subject to continuing degradation from rock removal, ploughing, intensive grazing and invasion by pest plants and animals. Low quality remnants of this community are still considered important for overall biodiversity conservation as part of a patchwork of available habitat and some are known to support nationally threatened species including *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) and *Synemon plana* (golden sun moth).

Outside of the grassland reserve, six habitat zones assessed during the current report were found to fulfil the criteria of natural temperate grassland of the Victorian volcanic plain. Habitat zones 34, 56, 60, 70, 71 and 72 (see Appendix A for locations of habitat zones) were of a suitable size and contained a high level of cover of Themeda *triandra* (kangaroo grass), *Austrodanthonia* spp. (wallaby-grass) or *Austrostipa* spp. (spear-grass) (DEWHA 2008c).

Further data regarding impacts on natural temperate grassland of the Victorian volcanic plain within the grassland reserve has been supplied by DSE. Within the reserve mapped areas of plains grassland community are considered to fulfil the criteria of natural temperate grassland.

Figure 3.1
AN EXAMPLE OF NATURAL TEMPERATE GRASSLAND OF THE VICTORIAN VOLCANIC PLAIN PRESENT WITHIN THE POWER LINE EASEMENT (HZ70 AT 50.6 km)

3.1.3 Victorian threatened communities

The nationally threatened natural temperate grassland of the Victorian volcanic plain community is also listed as the threatened western (basalt) plains grassland community under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). The listing of the community on the threatened species and communities list under the EPBC Act (DEWHA 2008c) recognises the importance of the matter from a national perspective and does not replace listing under state legislation.

3.1.4 Victoria's native vegetation management framework

The proposed alignment would also affect patches of vegetation not of sufficient quality to be included in the nationally threatened community, but complete enough to be included under Victoria's Native Vegetation Framework as plains grassland EVC (EVC 132). Impacts on these areas of remnant vegetation would require offsetting, and appropriate mitigation of impacts would need to be established and agreed with the Victorian government, in addition to Federal government requirements.

Vegetation within the proposed alignment is dominated by exotic grasses present in grazed and cropped paddocks and improved pastures. Native vegetation occurs throughout the proposed alignment, most often represented by the grass species *Austrodanthonia* spp. (wallaby-grasses) and *Austrostipa* spp. (spear-grasses) in scattered areas.

Remnant native vegetation communities, with a native understorey cover greater than 25 per cent, are found along significant lengths of the proposed alignment. However, the majority of these areas are of low quality, generally with a limited suite of native grasses comprising most of the native cover, which is generally 25–40 per cent within these patches.

The most abundant vegetation community present along the alignment is plains grassland (EVC 132), with the remaining vegetation communities present being a single patch of plains grassy woodland (EVC 55) and several patches of the mosaic of plains grassland/plains grassy woodland (EVC 897). Appendix A details the patches identified along the proposed alignment and the flora and fauna results. The mosaic EVC was used where habitat zones were considered to be at an intermediate stage between grassland and woodland. On one occasion the mosaic was not applied as a result of several remnant trees present in the immediate vicinity of the patch. In this instance plains grassy woodland was used.

The benchmark used for all but one grassland EVC patch within the study area was low rainfall plains grassland (EVC 132_63) because the majority of the proposed alignment is located within an area receiving less than 500 mm of annual average rainfall (DSE 2007c). The heavier soils plains grassland (EVC 132_61) benchmark was used on the southern-most patch along the alignment where the area receives more than 500 mm of rain annually (DSE 2007c).

The method for determining landscape context scores for remnant vegetation recorded within the proposed alignment was a combination of the landscape context layer in the DSE biodiversity mapping tool, 2009 aerial photography to determine any mechanical disturbance, such as ploughing and cropping, and ground-truthing. Where possible, ground-truthing was undertaken for mapped areas to determine their suitability for use for landscape scores. The visual assessment and aerial photography indicating mechanical disturbance was used in preference to mapped native vegetation extent.

3.2 FLORA

3.2.1 Flora species recorded

A detailed list of flora species recorded along the proposed alignment is included in the 2007 assessment (see Appendix B).

3.2.2 Recorded threatened flora species

Four additional species have been identified in a review of the updated FIS database. Numerous records of *Pterostylis truncata* (brittle greenhood) have been added to the database. The species is listed under the FFG Act and is considered endangered in Victoria (DSE 2005a). The majority of these records occur in two areas, one at the northern end of Farrars Road, to the east and west of the road, and north of Peak School Road, to the west of the Flinders Avenue biosite (see Appendix A for species locations). *Pterostylis truncata* (brittle greenhood) is discussed in greater detail below.

The remaining three species identified on the FIS database are Victorian rare or threatened species (VROT) (DSE 2005a) and each has a single record present within 1 km of the proposed route. *Rhagodia parabolica* (fragrant saltbush) and *Prostanthera nivea* var. *nivea* (snowy mint-bush) have been recorded around the Flinders Avenue

biosite, located approximately 600 m north of Peak School Road. *Grevillea rosmarinifolia* ssp. *rosmarinifolia* (rosemary grevillea) has a record on the western side of Farrars Road. *Rhagodia parabolica* (fragrant saltbush) has been observed within the vicinity of the proposed alignment (see below); however, neither *Prostanthera nivea* var. *nivea* (snowy mint-bush) or *Grevillea rosmarinifolia* ssp. *rosmarinifolia* (rosemary grevillea) has been observed during the current survey.

Three threatened flora species have been recorded within the proposed alignment during the current assessment. This includes two nationally significant species. A population of 51 *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) was found scattered within the road reserves along Peak School Road, six plants were present within the road reserve of Tarneit Road and a further seven plants were located in the Farrars Road reserve (see Appendix A for locations of the species). A suspected single immature *Dianella amoena* (matted flax-lily) was observed amongst the population of spiny rice-flower within the northern road reserve of Peak School Road, between Forest Road and Flinders Avenue. The remaining two species observed during the assessment are of state conservation significance, *Rhagodia parabolica* (fragrant saltbush) and *Austrodanthonia richardsonii* (straw wallaby-grass).

Flora species present, *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower), *Dianella amoena* (matted flax-lily) and *Rhagodia parabolica* (fragrant saltbush), or with habitat present, *Pterostylis truncata* (brittle greenhood), within the proposed alignment and potentially affected by the project are discussed below. Those species considered to potentially occur within remnant patch vegetation are listed in Table 3.1.

Pimelea spinescens ssp. *spinescens* (spiny rice-flower)

Pimelea spinescens ssp. *spinescens* (spiny rice-flower) is listed under the EPBC Act as critically endangered. A total of 64 plants of this species was recorded within the proposed MGI alignment in road reserves adjacent to Peak School Road, Farrars Road and Tarneit Road where some higher quality remnants of plains grassland present within the proposed alignment were recorded. Targeted surveys were conducted for this species throughout the proposed MGI alignment. It is proposed that all recorded individual plants of *Pimelea spinescens* ssp. *spinescens* would be avoided, if possible, by deviation of the alignment or other methods, which could include boring.

Pimelea spinescens ssp. *spinescens* is a grassland sub-shrub which grows 5–30 cm in height and lives approximately 100 years (DEWHA 2008d). Flowering occurs between April to August and the plant takes its name from the spiny stems. The plant has a very large tap root extending greater than 1.5 m deep and is pollinated by an unknown species of insect. Male and female plants are required for reproduction and this is a factor likely to increase the vulnerability of the species as a result of fragmentation of populations (DEWHA 2008d, 2009a).

Pimelea spinescens ssp. *spinescens* is also listed under the FFG Act. The species is considered vulnerable in Victoria according to the Advisory List of Rare or Threatened Plants in Victoria, 2005 (DSE 2005a). The listing of the species as a threatened species under the EPBC Act recognises the importance of the matter from a national perspective and does not replace listing under state legislation (DEWHA 2008d).

The EPBC Act Policy Statement 3.11 (DEWHA 2008d) outlines thresholds to clarify the level and types of impact likely to be significant at the national level. The policy statement indicates that effects on contiguous habitat area leading to fragmentation of a population, including incomplete clearing leaving smaller isolated patches or the introduction of a physical barrier to plant dispersal are significant impacts. Effects on population viability, leading to the loss of more than five individual plants, given the low germination rate of seed from the species, are considered a significant impact under the EPBC Act. Effects on the extent of occurrence of the species, due to impacts on populations at or near the edge of the distribution of the species, leading to the loss of any individuals from a population, are also considered a particularly significant impact.

A population of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) was found within the road reserves along Peak School Road (51 plants), Farrars Road (seven plants) and within the road reserve of Tarneit Road (six plants) (see Appendix A for locations of the species). A total of approximately 64 plants was recorded during the assessment and review, all of which the project would attempt to avoid by deviation of the alignment or boring. Minimal impact is predicted to occur to any individual plants, and placement of the proposed pipeline is intended within the shoulder of existing roads, which would not result in effects on population viability or further fragmentation of the populations adjacent to Peak School Road, Farrars Road or Tarneit Road. Within the road reserves there is limited space to avoid plants; however, a minimum buffer distance of 3 m is proposed to be allowed between the trench and the plants to protect the root zone.

Figure 3.2
SPINY RICE-FLOWER ON PEAK SCHOOL ROAD

Dianella amoena (matted flax-lily)

Dianella amoena (matted flax-lily) is listed as endangered under the EPBC Act. The species has a vulnerable status within Victoria; however, it is not listed under the Victorian FFG Act (DSE 2005c).

Dianella amoena (matted flax-lily) is a tufted mat-forming lily which can form loose mats up to 5 m wide. Leaves of the species are narrow and linear with several, small irregularly spaced teeth on the leaf blade, sheath and midrib. Flower stems reach 90 cm in length, with large, nodding star-shaped flowers. The species is currently restricted to populations to the north and north-east of Melbourne, with some isolated records to the west of Melbourne and in the Latrobe Valley (DSE 2005c). A suspected individual, immature and therefore unable to be positively identified, was located in the northern road reserve of Peak School Road within habitat zone 11, amongst a population of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower). This individual would be avoided by deviating the pipeline alignment.

Currently there are no impact guidelines for the species. However, destruction and fragmentation of habitats have meant that the most natural sites for the species are found in road and rail reserves (DSE 2005c).

Habitat for the species is generally limited to small scattered areas along the alignment. Mitigation measures for the species during the MGI project would be to avoid the suspected individual, including a buffer zone, and to reduce the impact on potential habitat areas, either through avoidance or minimisation of the construction corridor.

Pterostylis truncata (brittle greenhood)

Pterostylis truncata (brittle greenhood) is currently listed under the Victorian FFG Act and is considered endangered within Victoria (DSE 2005a).

Pterostylis truncata (brittle greenhood) is a small terrestrial orchid which grows to approximately 15 cm in height, with a greenish white hood and dark green or reddish stripes on a dark brown labellum. The plants emerge as both flowering, with a single flower, and non-flowering plants. Non-flowering plants will generally emerge as a rosette of two to six leaves up to 30 mm × 18 mm. The species also grows vegetatively, with daughter tuberoids requiring three or more seasons before they emerge as a flowering individual (DSE 2003d). Within Victoria the species is mainly concentrated around the north-west and west of Melbourne, with populations in the You Yangs, Brisbane Ranges and the Tottenham–Sunshine district.

Although it was not recorded during surveys for this report, several records of *Pterostylis truncata* (brittle greenhood) within and surrounding the proposed alignment exist on the FIS database. Records are concentrated in two main areas, one at the intersection of Little River–Ripley Road and Toynes Road, with another larger grouping of records a further 2 km north along Little River–Ripley Road. Seasonal conditions may affect the annual emergence of this species and may explain why it was not observed. Further surveys would be conducted prior to construction at suitable habitat locations and where past records occur to determine whether the species is present within the proposed construction impact zone.

Rhagodia parabolica (fragrant saltbush)

Rhagodia parabolica (fragrant saltbush) is considered rare within Victoria; however, it is not listed under either the EPBC Act or FFG Act (DSE 2005a). The species is generally characterised as a rounded shrub approximately 2 m tall. Mealy grey-green leaves are opposite or sub-opposite, 1.5–4 cm long and 7–25 mm wide. The inflorescence is a pyramidal panicle to 15 cm long and wide. The shrub supports berries approximately 2–3 mm in diameter (Walsh and Entwisle 1996).

As noted above, the species has previously been recorded within the vicinity of the Flinders Avenue biosite, approximately 600 m north of Peak School Road. In addition, *Rhagodia parabolica* (fragrant saltbush) was observed within 200 m of the alternative crossing point proposed at Werribee River (Section 4.2). This individual shrub would be avoided and would require temporary protective fencing to be installed prior to and during construction works.

*Austrodanthonia richardsonii (*straw wallaby-grass)

Austrodanthonia richardsonii (straw wallaby-grass) is currently listed as vulnerable within Victoria; however, it is not listed under either the EPBC Act or FFG Act (DSE 2005a). It is a densely tufted perennial, growing to approximately 1 m in height. The leaves are glabrous with a folded or loosely inrolled blade, and are approximately 35 cm long and 3 cm wide (Walsh and Entwisle 1994).

The species has been recorded at three locations along the proposed alignment during assessments undertaken as part of this report. *Austrodanthonia richardsonii* (straw wallaby-grass) was observed on private land to the south of Elcho Road, along Farrars Road, and within a patch of remnant vegetation (Alt. A) on Peak School Road. Where avoidance would not be possible, mitigation measures (as outlined in Section 7.2) would be employed to minimise the impact on this species.

3.2.3 Potentially occurring threatened flora species

The species discussed below have some potential to occur within or surrounding the MGI alignment. However, any impact on the species is not predicted to be significant, since no records are present along the alignment and the species have not been observed during flora and fauna assessments. As these species are considered unlikely to be impacted by the project, compared with the above species, discussion is more limited.

Rutidosis leptorrhynchoides (button wrinklewort)

Rutidosis leptorrhynchoides (button wrinklewort) is listed as endangered under the EPBC Act, is listed under the Victorian FFG Act and is considered endangered within Victoria (DSE 2005a).

Rutidosis leptorrhynchoides (button wrinklewort) is an upright multi-stemmed shrub which grows to approximately 35 cm in height. Florets are orange–yellow and tubular and are terminal in the upper branches. The species is present within grasslands and grassy woodlands south of the Great Dividing Range in Victoria (DSE 2003c).

A single *Rutidosis leptorrhynchiodes* (button wrinklewort) record is present to the south of the alignment from the intersection of Peak School and Farrars Road. The record dates back to 1984 and is located within the rail reserve biosite (biosite 1194). Overall, habitat is limited along the alignment, being restricted to higher quality grasslands, and the project is not predicted to significantly impact on the species.

Habitat zone 24, located at the southern end of Farrars Road, and habitat zone 34, located along Little River—Ripley Road, contain higher quality grassland habitat that may be suitable for the species; however, no individuals of this species were identified during assessment.

Senecio macrocarpus (large-fruit fireweed)

Senecio macrocarpus (large-fruit fireweed) is listed as vulnerable under the EPBC Act, is listed under the Victorian FFG Act and is considered endangered within Victoria (DSE 2005a).

Senecio macrocarpus (large-fruit fireweed) is a low, bushy herb, with grey, woolly leaves, which grows to approximately 40 cm in height. The species is distinguished by large flower heads that are up to 18 mm long, with anywhere between 50 and 100 yellow florets on each inflorescence (DSE 2003f). The species is generally found in the western basalt grasslands to the north and west of Melbourne, but is also present in grassy and open woodlands.

A single recorded location, dating back to 1984, of *Senecio macrocarpus* (large-fruit fireweed) is present within the rail reserve biosite (biosite 1194) south of the intersection with Peak School and Farrars Road. Habitat components are similar to that of *Rutidosis leptorrhynchiodes* (button wrinklewort) and are considered to occur in the same habitat zones 24 and 34 mentioned above; however, no individuals of this species were identified during assessment.

The MGI is not predicted to significantly impact on the species since habitat is generally limited and records are more than 25 years old.

3.2.4 Best or remaining habitat for rare or threatened flora

A list of rare or threatened flora species that have the potential to occur within recorded remnant patch vegetation is provided in Table 3.1. Habitat within the proposed alignment is not limited to assessed patch vegetation since several other areas provide suitable habitat for threatened species but do not contain a patch level cover of native vegetation. Only those species considered to have habitat within remnant patch vegetation are listed in Table 3.1.

Table 3.1 Determination of best or remaining habitat for rare or threatened flora species

Species	Victorian conservation status	Steps[1]	Determination of best 50%/ remaining 50%[2]	Conservation significance[3]	Relevant habitat zones
Pimelea spinescens ssp. *spinescens* (spiny rice-flower)	Vulnerable	A, B, C, Yes	Best 50%	Very high	11, 16, 17, 79
Pimelea spinescens ssp. *spinescens* (spiny rice-flower)	Vulnerable	A, D, F, No	Remaining 50%	High	18, 19, 20, 24
Pterostylis truncata (brittle greenhood)	Endangered	A, D, F, No	Remaining 50%	High	34
Senecio macrocarpus (large-fruit fireweed)	Vulnerable	A, D, F, No	Remaining 50%	High	24, 34
Rutidosis leptorrhynchoides (button wrinklewort)	Endangered	A, D, F, No	Remaining 50%	High	24, 34
Dianella amoena (matted flax-lily)	Endangered	A, B, C, No	Remaining 50%	High	16
Austrodanthonia richardsonii (straw wallaby-grass)	Vulnerable	A, B, E, F, No	Remaining 50%	High	Alt. A

Note:

[1] From Table 2 in the Guide for Assessment of Referred Planning Permit Applications (DSE 2007d) specify steps taken in habitat assessment to determine best 50% or remaining 50% of habitat.

[2] Specify 'best' or 'remaining'.

[3] Conservation significance of the habitat zone based on consideration of threatened species.

3.3 FAUNA

3.3.1 Faunal habitat

The main types of faunal habitats present along the proposed alignment are associated with the landforms that have impeded agricultural development, including stony knolls, watercourses and wetland areas.

The stony knolls support threatened grassland fauna potentially, including *Delma impar* (striped legless lizard), *Tympanocryptis pinguicolla* (grassland earless dragon) and *Synemon plana* (golden sun moth). Watercourses and wetlands may support *Litoria raniformis* (growling grass frog) and *Rostratula australis* (Australian painted snipe). Areas of plains grassland may support *Pedionomus torquatus* (plains wanderer) and *Synemon plana* (golden sun moth). Degraded treeless areas are likely to provide connectivity and allow threatened species to move between higher quality remnants of native vegetation.

Section 3.3.3 provides detailed descriptions of threatened species, preferred habitat and the implications for the proposed alignment of the MGI pipeline.

3.3.2 Fauna species recorded

A detailed list of fauna species recorded along the alignment is included in the 2007 assessment (see Appendix B).

3.3.3 Threatened fauna species

During this survey, a single threatened fauna species, *Pedionomus torquatus* (plains wanderer), was observed within the current alignment in a paddock to the south-west of the Werribee River, within the power line easement.

Four additional records were identified in the updated database search. This includes an additional record of *Litoria raniformis* (growling grass frog). All additional records further to the previous report are at the same location, approximately 800 m west of Little River–Ripley Road, close to the You Yangs regional park and the Little River Earth Sanctuary.

Another listed species under the FFG Act, *Pyrrholaemus sagittatus* (speckled warbler), was also recorded at the same location. The remaining records, *Anas rhynchotis* (Australian shoveler) and *Melithreptus gularis* (black-chinned honeyeater), are both listed under the Victorian rare or threatened species list (DSE 2007b).

Species recorded within the proposed alignment or with local habitat areas that the project may potentially impact are discussed below.

Pedionomus torquatus (plains wanderer)

Pedionomus torquatus (plains wanderer) is listed under the EPBC Act as vulnerable and is also listed under the Victorian FFG Act. The species is considered critically endangered in Victoria according to the Advisory List of Threatened Vertebrate Fauna in Victoria, 2007 (DSE 2007a).

One individual of this species was recorded on 17 September 2009, within the proposed MGI alignment on private land between Ballan Road and the Werribee River where some higher quality but sparse remnants of plains grassland within the proposed alignment were recorded. This species is considered likely to be widespread but with a patchy distribution. Good potential habitat occurs along the alignment wherever larger tracts of native grasslands occur, including areas dominated by exotic tussock grasses. In particular, areas immediately north and south of Ballan Road along the alignment would provide the greatest potential to support the species. It is proposed to avoid any recorded habitat areas by deviation of the alignment, boring or other appropriate mitigation measures, as required.

Pedionomus torquatus (plains wanderer) is a cryptic ground-dwelling bird approximately 10 cm in height and similar in appearance to a button-quail. The female is larger and more distinctively coloured than the male and they have longer straw-yellow legs and bills than button-quail. The plumage is mainly fawn with fine black specks, but the female has a prominent white-spotted black collar above a bright rufous breast patch (DSE 2003e). The nest consists of a shallow scrape lined with grass and they usually nest between late August and early November, with a second clutch in January if there is summer rainfall. Chicks are independent at approximately two months of age (Maher and Baker-Gabb 1993). The species forages during the day for grass and saltbush seeds and insects (DSE 2003e).

Historically, the distribution of the *Pedionomus torquatus* (plains wanderer) was sparse native grasslands in eastern Australia; however, they are now most prevalent in the north-central area within Victoria. A viable population of the species is not known to occur within any existing reserves and most records of the species are from private land (DSE 2003e).

The habitat preferences of the *Pedionomus torquatus* (plains wanderer) appear to be areas where the topsoil has been eroded to expose the red clay subsoil which does not ever support dense pasture growth regardless of seasonal conditions. Typical characteristics of these areas include approximately 50 per cent bare ground and 10 per cent litter with most vegetation below 5 cm in height and the remainder rarely exceeding 30 cm. The species is then able to see over the vegetation, move freely during foraging and escaping from predators with their characteristic hunched posture, and avoid detection by aerial predators. Research from populations in the Riverina suggests that a pair of plains wanderers typically occupy a home range of 18 ha in sparse native grassland (DSE 2003e). The species is also known to avoid areas that contain large objects that may impede vision of their surrounds, particularly trees and man-made objects such as fences and buildings, by a distance of up to 200 m (Biosis Research 2009). The large pylons present in the easement may deter the species but, because an individual was observed during the survey, it is still likely to use large, open areas surrounding the pylons.

Effects resulting in habitat loss, degradation or fragmentation are likely to be significant. Sparse native plains grassland areas that are known to support the species or likely to, should not be cultivated or otherwise disturbed; however, similar disturbance effects are likely to result if the pipeline should be installed in these areas by open trenching. Disturbance during the breeding season, from early September to early November and, in a good season with summer rains, from early January to the end of March, should be avoided. As the *Pedionomus torquatus* (plains wanderer) is particularly sensitive to disturbance effects, known or likely habitat areas should be avoided and an appropriate buffer distance maintained throughout construction, by agreement with national and Victorian government authorities.

Delma impar (striped legless lizard)

Delma impar (striped legless lizard) is listed under the EPBC Act as vulnerable and is also listed as threatened under the Victorian FFG Act. The species is considered endangered in Victoria according to the Advisory List of Threatened Vertebrate Fauna in Victoria, 2007 (DSE 2007a). This species is considered likely to be widespread but with a patchy distribution emphasising areas that have not experienced substantial habitat disturbance as a result of rock removal and ploughing. It is proposed to avoid any recorded habitat areas by deviation of the alignment or other appropriate mitigation measures, as required.

Delma impar (striped legless lizard) superficially resembles a small snake in appearance, but is a pale grey lizard approximately 9 cm in length with a series of characteristic longitudinal dark brown stripes along the length of the body and tail. The underbody is whitish and the lizard has a blunt snout (Cogger 2000). The distribution of the species has declined. Fragmentation of populations is likely to be

occurring as a result of ploughing and rock removal which disturb the cracking clay soil structure and remove the overlying rock cover that provides protection from predators (DSE 2003b).

Appropriate habitat was originally thought to be limited to relatively undisturbed, lowland native grasslands dominated by spear-grasses *Austrostipa* spp. (spear-grass) and *Themeda triandra* (kangaroo grass); however, the species has since been recorded in some areas dominated by introduced species, often grazed or with improved pastures, although all occupied areas are characterised by a grassy ground cover and a lack of areas of bare ground produced by heavy grazing (DEWHA 2009b).

The existing research (Dorrough 1995) suggests that soil disturbance, rock removal and bare ground without cover are important factors affecting contiguous habitat area and leading to fragmentation of populations. Removal of rock cover and the creation of bare ground along an easement would constitute a similar physical barrier to movement and potentially be a significant impact. These potential effects may trigger referral to the Australian government under the EPBC Act and are relevant to the proposed MGI alignment.

Tympanocryptis pinguicolla (grassland earless dragon)

Tympanocryptis pinguicolla (grassland earless dragon) is listed under the EPBC Act as endangered and is also listed as threatened under the FFG Act. The species is considered critically endangered in Victoria according to the Advisory List of Threatened Vertebrate Fauna in Victoria, 2007 (DSE 2007a). This species was once locally common in the rocky native temperate grasslands north and west of Melbourne. The species is considered likely to have a patchy distribution emphasising areas that have not experienced substantial habitat disturbance as a result of rock removal and ploughing. Few prior surveys have been conducted within the area and the species has only been recorded from one location in the greater area, although the exact location is unknown (Biosis Research 2009). It is proposed to avoid any recorded habitat areas by deviation of the alignment or other appropriate mitigation measures, as required.

Tympanocryptis pinguicolla (grassland earless dragon) is a cryptic species which is approximately 150 mm in length. Dragon lizards have small, rough scales and this species is mottled light grey and brown with three pale longitudinal stripes from head to tail. The under-parts are white and a row of short spines extends from the head to the base of the neck. They have well-developed limbs and are fast moving. Three to six eggs are laid in a burrow in late spring or early summer which hatch in 9–12 weeks and the juvenile lizards disperse soon after (DSE 2008c). The distribution of the species has declined. Fragmentation of populations is likely to be occurring as a result of ploughing and rock removal which disturb the cracking clay soil structure and remove overlying rock cover that provides protection from predators. Little or no grazing occurs where the species has been recorded; however, the detailed requirements of the species are not understood (DSE 2008c).

The existing research suggests that factors affecting this species are similar to those for *Delma impar* (striped legless lizard), including soil disturbance, rock removal and bare ground without cover and their effect on contiguous habitat area and fragmentation of populations. Removal of rock cover and the creation of bare ground

along an easement would constitute a physical barrier to movement and potentially be a significant impact. These potential effects may trigger referral to the Australian government under the EPBC Act.

Litoria raniformis (growling grass frog)

Litoria raniformis (growling grass frog) is listed under the EPBC Act as vulnerable and is also listed as threatened under the Victorian FFG Act. The species is considered endangered in Victoria according to the Advisory List of Threatened Vertebrate Fauna in Victoria, 2007 (DSE 2007a). This species is considered likely to be widespread since suitable ephemeral wetland habitat occurs at intervals throughout the proposed MGI pipeline alignment. Previous surveys have identified particularly good potential habitat in the area surrounding the alignment where cane grass wetland, lignum wetland and plains grassy wetland EVCs are present along drainage lines (Biosis Research 2009). Within the alignment, it is proposed to avoid any recorded habitat areas, such as drainage lines or waterways, particularly the Werribee and Little rivers, by deviation of the alignment, boring or other appropriate mitigation measures, as required.

The closest known record of the species to the MGI alignment is located approximately 100 m west of the alignment, between the alignment and Little River–Ripley Road, 1 km south of the proposed Little River crossing.

Litoria raniformis (growling grass frog) is a large frog (the females can be more than 10 cm in length), with a dull olive to bright emerald green colour on the back and large irregular blotches of brown to bronze (Cogger 2000). The tadpoles typically reach a length of 85–90 mm and have a characteristic green or yellow dorsal colour in later developmental stages. The tail fins are deeply arched and the whole tail is yellowish with light coloured veins (DEWHA 2008b). Evidence suggests that the distribution of *Litoria raniformis* (growling grass frog) has dramatically declined across the northern and north-eastern plains of Victoria and throughout its former range Australia-wide (DEWHA 2008b). Significant remnant populations are known to persist in the greater Melbourne area (Heard et al. 2004, after DEWHA 2008b).

The frog prefers a wide variety of still water bodies, including lagoons, lakes, swamps, ponds, farm dams, irrigation channels and quarries, and slow-flowing streams and rivers. In Victorian populations, the frogs are usually found amongst vegetation within or on the edge of permanent water (DEWHA 2008b). The frog is known to utilise microhabitats, including floating vegetation, rocks, open pasture and bare ground for calling and under rocks, logs and debris close to water bodies for shelter (DEWHA 2008b). Recent research indicates that the arrangement and connectivity of water bodies within the landscape and the matrix of aquatic and terrestrial habitat are important factors affecting the presence and dispersal of the frog because they require the ability to move between breeding sites (DEWHA 2008b). Diverse aquatic vegetation and an absence of predatory fish are important factors for breeding areas (Heard et al. 2004 after DEWHA 2008b).

It is likely that the proposed MGI alignment would require referral under the EPBC Act as a result of the potential for impacts on the nationally threatened fauna species. The Draft EPBC Act Policy Statement 3.14 (DEWHA 2008f) outlines thresholds to clarify the level and types of impact likely to be significant at the national level. The

policy statement indicates that effects on habitat degradation, including removal or degradation of terrestrial habitat within 200 m of a water body that contains an important population of the species or any alteration to the diversity or structure of aquatic vegetation and wetland hydrology that contains an important population, or an introduction of predatory fish or disease, are significant impacts. Effects leading to isolation and fragmentation of populations, including impacts such as any reduction in the number and diversity of water bodies, removal or alteration of available terrestrial or aquatic habitat corridors (including during flood events), or any construction of physical barriers to movement between water bodies are also significant impacts under the EPBC Act (DEWHA 2008f).

Potential mitigation measures relevant to the MGI project include impact avoidance by retention of known or likely habitat patches, realignment of easements to avoid habitat disturbance and targeting previously disturbed river crossings, such as the ford at Werribee River. Works around known or likely habitat patches should avoid the species breeding season, between November and March or when there is localised flooding.

Synemon plana (golden sun moth)

Synemon plana (golden sun moth) is listed under the EPBC Act as critically endangered and is also listed as threatened under the Victorian FFG Act. The species is considered critically endangered in Victoria according to the Advisory List of Threatened Invertebrate Fauna in Victoria, 2009 (DSE 2009a). This species is considered likely to be widespread but with a patchy distribution, potentially throughout the proposed MGI alignment in suitable grassland vegetation. Good potential habitat occurs wherever native grasslands occur, including areas dominated by exotic tussock grasses.

Synemon plana (golden sun moth) is a medium-sized, day-flying moth with a wing span of up to nearly 3.5 cm (DEWHA 2008e). The female moth has dark grey upper wings and bright orange hind wings, the male has dark brown upper wings and bronze to brown hind wings. The moth has a larval stage which occurs underground and over a period of two to three years, and an adult stage which lasts for one to four days. The life cycle of the species is likely to be vulnerable to disturbance in both life stages (DEWHA 2008a). Adult moths are active in the hottest part of sunny days between mid-November and mid-December, depending on the warmth of the season and site aspect (DSE 2004a). Further targeted survey for the presence of *Synemon plana* (golden sun moth) within the proposed MGI alignment will be necessary during the very restricted season when the moths are active and habitat areas can be positively identified.

Synemon plana (golden sun moth) has been recorded in native grasslands, grassy woodlands and degraded grasslands. It prefers slightly sloping, north facing areas with minimal shading. The inter-tussock spaces are believed to be important in helping males locate females. Adult males are thought unlikely to travel more than 100 m away from habitat patches, and populations separated by 200 m or more are isolated by their limited dispersal ability (DEWHA 2008a).

It is likely that the proposed MGI alignment would require referral under the EPBC Act as a result of the potential for impacts on the nationally threatened fauna species. The Draft EPBC Act Policy Statement 3.12 (DEWHA 2008e) outlines thresholds to clarify the level and types of impact likely to be significant at the national level. The policy statement indicates that effects resulting in habitat loss, degradation or fragmentation are significant impacts. Where areas are large and contiguous (greater than 10 ha in size), the impact threshold for triggering approval under the EPBC Act is a loss, degradation or fragmentation of more than 0.5 ha of habitat. Small or fragmented habitat areas (less than 10 ha in size) trigger approval under the EPBC Act if there is any loss, degradation or fragmentation of habitat. Effects on habitat connectivity leading to fragmentation of a population due to the introduction of a barrier to dispersal, including the creation of a break in the habitat area greater than 200 m overall, would also be considered a significant impact (DEWHA 2008e). This could occur where an existing break between available, but fragmented, habitat areas is increased by disturbance from the installation of the pipeline.

Potential mitigation measures relevant to the MGI project include impact avoidance by retention of known or likely habitat patches, realignment of easements to avoid habitat disturbance or greater fragmentation of habitat areas, and trenchless installation of pipelines by boring to a depth greater than 0.5 m. Impact minimisation measures include reduction of the impacts of construction by inclusion of a buffer to known or likely habitat areas of 100–200 m, restriction of vehicle movement when soil moisture levels are high to reduce compaction, and restriction of vehicle movement when adult moths are flying DEWHA 2008a).

3.3.4 Other threatened fauna species

The species discussed below are not predicted to be significantly affected by the construction of the pipeline, but some habitat values are present within the vicinity of the study area. As these species are unlikely to be impacted, compared with the above species, discussion is more limited.

Rostratula australis (Australian painted snipe)

Rostratula australis (Australian painted snipe) is listed under the EPBC Act as vulnerable. It is also listed as a migratory species under the EPBC Act due to its listing under the China–Australia Migratory Bird Agreement (CAMBA). The species is also listed as threatened under the FFG Act and is considered critically endangered in Victoria according to the Advisory List of Threatened Vertebrate Fauna in Victoria, 2007 (DSE 2007a).

Rostratula australis (Australian painted snipe) is a medium-sized stocky wading bird approximately 22–25 cm in length with a long pinkish bill. The adult birds have similar coloration, but the male is smaller, duller coloured and has buff spots on the wings. The female has a chestnut head with white around the eye and as a crown stripe. The back and wings are metallic green, with black and chestnut bars (DEWHA 2003).

Rostratula australis (Australian painted snipe) occurs in fresh or brackish, ephemeral or permanent, shallow inland wetlands. It is a cryptic species which nests on the ground amongst tall vegetation near water and feeds on invertebrates and seeds near the edge of the water and on mud flats (DEWHA 2003).

This species is considered likely to have habitat within the vicinity of the proposed alignment, present as suitable ephemeral and wetland habitat occurring at intervals adjacent to the proposed MGI pipeline alignment. Particularly good potential habitat occurs where cane grass wetland, lignum wetland and plains grassy wetland EVCs are present near the alignment, such as Rabbiters Lake (see Appendix A). Within the proposed alignment, habitat along drainage lines and associated with the rivers and creeks traversed by the proposed alignment contains some value for the species.

Management and mitigation measures developed for the project targeting other threatened fauna species, such as *Litoria raniformis* (growling grass frog), are likely to benefit *Rostratula australis* (Australian painted snipe).

Potentially significant impacts on the nationally threatened fauna species may include effects on habitat degradation, including removal or degradation of terrestrial habitat within 200 m of a water body, any alteration of aquatic vegetation or the hydrology, diversity and structure of wetlands, effects leading to isolation and fragmentation of populations, and removal or alteration of available terrestrial or aquatic habitat corridors.

Prototroctes maraena (Australian grayling)

Prototroctes maraena (Australian grayling) is listed as vulnerable under the EPBC Act, is listed under the FFG Act, and is considered vulnerable in Victoria (DSE 2007a). *Prototroctes maraena* (Australian grayling) is a diadromous species which migrates between fresh and marine waters, with most time spent in fresh water, but at least part of the larval and juvenile stages spent in coastal seas. Spawning occurs in fresh water and varies between late summer to winter and is likely to be initiated by an increase in river flows. Larvae hatch and are carried downstream and into marine waters, where they are thought to remain for approximately six months before returning to fresh water (DSE 2008a, DEWHA 2008g).

This species is considered likely to have a patchy but possibly widespread distribution in south-eastern Australia in coastal rivers and streams and is widely recorded in Victorian coastal waterways (DSE 2008a). No historical records of the species occur within a 5 km buffer of the site or are documented on the AVW database, although systematic surveys have not been conducted for the species. The species is unlikely to be significantly affected by the project.

Some suitable habitat occurs at intervals in rivers and creeks traversed by the proposed MGI pipeline alignment. All rivers and streams which traverse the alignment have some potential to support the species, including the Werribee River and, to a lesser extent, Little River. The proposed crossing point of the Werribee River would occur at an existing vehicle crossing (Cobbledicks Ford), which is likely to minimise any impact on the species. The proposed crossing at the Little River would be unlikely to have a significant impact on the species.

Galaxiella pusilla (dwarf galaxias)

Galaxiella pusilla (dwarf galaxias) is listed as vulnerable under the EPBC Act, is listed under the FFG Act, and is considered vulnerable in Victoria (DSE 2007a).

Galaxiella pusilla (dwarf galaxias) is a small fish. Limited potential habitat has been identified along the proposed alignment. Suitable habitat includes still waters such as swamps, drains, and backwaters of creeks and streams, usually in shallow waters (often less than 30 cm deep) with abundant aquatic vegetation. The waters are often temporary, drying up partly or completely during summer (DEWHA 2009c). Within the proposed alignment, Hovell Creek, Little River, Lollypop Creek, the Werribee River and ephemeral wetlands provide suitable habitat for the species. No historical records of the species occur within a 5 km buffer of the site or are documented on the AVW database, although systematic surveys have not been conducted for the species. The species is unlikely to be significantly affected by the project.

3.3.5 Best or remaining habitat for threatened fauna

Potential habitat for rare or threatened fauna species within recorded remnant patch vegetation is listed in Table 3.2. Habitat for threatened fauna species is not limited to assessed patch vegetation because several areas, such as Werribee River and Little River, provide suitable habitat but contain less than 25 per cent cover of native understorey.

Table 3.2 Determination of best or remaining habitat for threatened fauna species

Species	Conservation status	Steps[1]	Determination of best 50%/ remaining 50%[2]	Conservation significance[3]	Relevant habitat zones[6]
Synemon plana (golden sun moth)	CE[4]	A, D, F, No	Remaining 50%	High	6, 7, 60, 70, 71, 72
Delma impar (striped legless lizard)	E[5]	A, D, F, No	Remaining 50%	High	6, 7, 34, 60, 70, 71, 72
Tympanocryptis pinguicolla (grassland earless dragon)	CE[4]	A, D, F, No	Remaining 50%	High	6, 7, 60
Pedionomus torquatus (plains wanderer)	CE[4]	A, D, F, No	Remaining 50%	High	56

Note:

[1] From Table 2 in the Guide for Assessment of Referred Planning Permit Applications (DSE 2007d) specify steps taken in habitat assessment to determine best 50% or remaining 50% of habitat.

[2] Specify 'best' or 'remaining'.

[3] Conservation significance of the habitat zone based on consideration of threatened species.

[4] CE, critically endangered.

[5] E, endangered.

[6] Excludes grassland reserve.

4 Likely impacts

4.1 FLORA

Likely impacts on native flora of MGI construction would be generally limited to grasses and herbs scattered throughout the proposed alignment. The majority of native flora predicted to be impacted on is present in an agricultural landscape, or within road reserves.

Impacts on native flora would be minimised by utilising the most degraded areas which contain little or no native vegetation. Sites of greater significance, such as high quality remnant patches and significant species, would be avoided where possible. In Section 7, more detailed measures are described for managing native flora through the project.

Predicted impacts on patches of remnant native vegetation communities are outlined in Section 6.

4.2 FAUNA

The proposed alignment is predicted to have minimal direct impacts upon native fauna. Most animals present are likely to disperse during construction activities; however, professional handlers would be 'on call' to relocate any native fauna present in the construction zone (see Section 7 for fauna management techniques during construction). *Pedionomus torquatus* (plains wanderer) does not recolonise areas after disturbance. Disturbance areas could reach critical size for *Synemon plana* (golden sun moth) and isolate populations if the size of remnant vegetation areas was decreased by construction disturbance and resulted in a distance greater than 100 m between adjacent remnant areas. This can only be determined once a targeted survey for the species has occurred and habitat areas are confirmed.

Impacts on fauna are most likely to be disturbance of potential habitat areas. It is predicted that several grassland and rocky outcrop habitats would be disturbed during construction of the pipeline. The pipeline is also predicted to impact upon waterways in the study area (Section 4.3); however, proposed impacts are centred on previously disturbed areas and mitigation measures would be prescribed (refer to Section 7) to reduce the overall effect on remaining habitat.

4.3 WATERWAYS

4.3.1 Werribee River

For the 2007 assessment, the Werribee River crossing was located at the junction of the river with the power line easement. Assessments of the crossing at this point raised several issues in constructability and reinstatement of the steep, rocky embankments that are present on either side of the river. Of particular concern are the highly erodible soils, which would be difficult to reinstate, increasing the significant threat of heavy sedimentation into the Werribee River, which is an important habitat corridor in the landscape and potentially supports threatened species, including *Prototroctes maraena* (Australian grayling) and *Galaxiella pusilla* (dwarf galaxias).

An alternative option—using the existing road and an existing vehicle crossing point at Cobbledicks Ford Road—would significantly reduce the threat of sedimentation in the waterway and potential impacts on in-stream vegetation. In this location, the waterway is at the base of an escarpment rising 25–30 m to the surrounding plain. The site has been subject to previous disturbance, with no vegetation predicted to be disturbed at the crossing if the construction area is limited to the ford (see Figure 4.1). The waterway at this point contains only a bluestone vehicle crossing spanning the width of the river. As a result, no vegetation and little in-stream value are present. Both crossing options are within the Werribee River–Cobbledicks Ford biosite, which is of state significance (DSE 2005b).

On the western side of the crossing, the alignment would leave the road reserve and extend due west directly to the power line easement. This section of the alignment follows the edge of a cropped area which winds around a rocky outcrop dominated by *Nassella trichotoma* (serrated tussock). The proposed route would transfer into and out of both the cropped land and rocky outcrops leading up to the power line easement, but habitat values in the rocky outcrops would benefit if the proposed alignment remained within the cropped area as much as possible.

There is a short, steep embankment approximately 40 m to the west of the crossing. The embankment has limited vegetation, covered predominantly by exotic species. This site is susceptible to erosion and may be a source of sedimentation to the waterway. However, its distance from the waterway in comparison with the initial option assessed (Option 1) would reduce the risk of sedimentation during construction and reinstatement, therefore minimising the impact on habitat for native fish and amphibian species, including *Litoria raniformis* (growling grass frog).

Controlling sediment from this source would be more manageable compared with the crossing proposed in Option 1. The trench backfill would be likely to comprise selected fill which can be readily compacted to form a road sub-base and subgrade surfaced with compacted road fill or hardpack. It is likely that this type of reinstatement on a gentler slope would be less susceptible to erosion and more readily maintained than open trench construction south of Dohertys Road (Option 1).

Several isolated native shrubs were located along the proposed alternative alignment, immediately east of where the route rejoins the easement. A single VROT species, *Rhagodia parabolica* (fragrant saltbush), was identified within this area which is likely to be an unused road reserve. This individual shrub would require protection during construction works. Otherwise, the installation of the pipeline is not predicted to significantly impact on vegetation or habitat at the site.

Figure 4.1
PROPOSED CROSSING OF THE WERRIBEE RIVER AT COBBLEDICKS FORD. IT IS PROPOSED TO ROUTE THE PIPELINE THROUGH THE CENTRE OF THE CROSSING

4.3.2 Lollypop Creek

The alignment south of Ballan Road would traverse paddocks within the upper reaches of Lollypop Creek. Several mapped drainage lines are labelled as Lollypop Creek; however, many of these are depressions without a discernible creek line. The most likely source of the creek lies within a biosite approximately 300 m south along the alignment from Ballan Road and is the most defined channel of the drainage lines mapped as Lollypop Creek. The area is listed as the biosite 'Lollypop Creek, Middle and Upper Reaches' (biosite 4595) and is of state significance (DSE 2005b).

The area described as Lollypop Creek is located within a heavily grazed paddock, which contains low quality grassland consisting mainly of a single *Austrostipa* sp. (spear-grass) amongst a rocky outcrop. This native vegetation is indicative of drier areas and the site appears to hold water only very occasionally because no species typical of wetter or poorly drained areas have been identified at the site.

The installation of the pipeline is not predicted to significantly impact on vegetation or habitat at the site.

4.3.3 Little River

The Little River crossing has been aligned so that it would avoid two rocky outcrops on either side of the proposed crossing point. The channel of the river is at the base of a small, sloping escarpment, 15–20 m above the waterway, which is generally rocky (see Figure 4.2).

Native vegetation at the site is limited to some scattered shrubs at the top of the northern escarpment, which are likely to be avoided, and in-stream vegetation. The in-stream vegetation is dominated by *Phragmites australis* (common reed). Very little riparian vegetation or habitat is present in and around the proposed crossing point. Habitat is mainly restricted to common reed in the channel of the creek.

The channel of the creek is approximately 2 m wide from toe to toe and 15 m wide from the top of the bank. Either side of the bank is a sloping escarpment, which currently shows no sign of erosion and contains a stable bank. However, during construction both sides are likely to be subject to erosion as the banks of the river are likely to be rocky beneath the soil.

The installation of the pipeline is not predicted to significantly impact on vegetation or habitat at the site. The river generally holds a small amount of water and provides limited habitat which is predicted to be recolonised relatively quickly. Erosion would be a risk if a heavy rainfall event occurred before the site was adequately rehabilitated.

Figure 4.2
LOCATION OF THE LITTLE RIVER CROSSING, FROM SOUTH LOOKING NORTH

4.3.4 Hovell Creek

The proposed crossing at Hovell Creek would be on the southern side of the bridge along Peak School Road (see Figure 4.3). The site is highly degraded, most likely from the previous disturbance associated with construction of the bridge over the creek. Native vegetation at the site is mainly limited to sparse shrubs and small trees and only extends to 2–3 m from the creek. The ground layer is almost entirely exotic, being dominated by *Galenia pubescens* (galenia). The crossing point is characterised by stable banks, although it appears to have a sandy base, with little evidence of erosion. At this point there is minimal in-stream vegetation or habitat, with only some small branches and sticks.

Some habitat is present in and around the site, with several large *Eucalyptus camaldulensis* (river red gum) scattered along the creek to the north and the south; however, vegetation is relatively sparse and the channel holds little water and contains only minimal vegetation.

The creek provides a habitat corridor through the landscape; however, it is mainly restricted to large trees scattered along the creek, with a sparse mid- and understorey.

The installation of the proposed pipeline at this point is not predicted to impact significantly on the vegetation or habitat at Hovell Creek since the major habitat feature of the creek, the large *Eucalyptus camaldulensis* (river red gum), are not present at the crossing point. It is likely that some shrubs on either side of the creek would be affected by the project.

Mitigation measures stipulated in an approved environmental management plan for construction (CEMP) will address general environmental considerations, including erosion control and potential sedimentation of the waterway.

Figure 4.3
LOCATION OF THE PROPOSED CROSSING AT HOVELL CREEK (SOUTHERN SIDE OF THE BRIDGE)

4.4 PROPOSED GRASSLAND RESERVE

The proposed alignment from Gifkins Road (chainage 27.1 km) to the Werribee River (chainage 45 km) would be located within the proposed grassland reserve (DSE 2009b). As outlined in Section 2.2, the proposed route would use the power line easement and divert from the easement to intersecting road reserves in two locations to avoid higher quality remnants of native grassland.

Where the pipeline intersects the State Government's proposed grassland reserve, DSE native vegetation quality and extent data has been used. This approach has been agreed through consultation with Barwon Water and DSE. The remainder of the quality and quantity calculations are based on the KBR 2009 assessment.

4.5 WATER TRANSFER FACILITIES

4.5.1 Lovely Banks water transfer facility

The location for a new pump station and pipelines at the Lovely Banks water transfer facility is characterised by a cover of mown grass and exotic weeds, bare ground and some windbreak plantings of ageing exotic cypress trees, some of which have died and recently been removed. No native grass or herb cover was recorded within the proposed construction area or pipelines.

The installation of the water treatment facility is not predicted to impact on vegetation or habitat values.

4.5.2 Cowies Hill water transfer facility

A new pump station is proposed to be located within Melbourne Water's Cowies Hill water transfer facility. The site proposed for the transfer facility is in the north-eastern corner of the fenced reservoir site and has been subject to previous disturbance and includes a bund surrounding the area.

Vegetation at the proposed location is characterised by mown exotic grasses and herbs. Two native grass species, *Austrodanthonia linkii* (wallaby-grass) and *Austrodanthonia* sp. (wallaby-grass) were present at the site, comprising approximately 10 per cent of the vegetative cover. Outside the bunded area, the site is surrounded by planted trees and regeneration from the planted stock of *Allocasuarina* sp. (sheoak). The majority of these individuals should be avoided during construction.

The location of the water transfer facility has targeted a degraded area since the site has little flora and fauna value. The sheoaks should be retained to screen the facility from the surrounding residential area.

4.5.3 Surge tank

A surge tank would be required along the alignment at a high point to maintain pressure in the pipeline. The proposed surge tank would be located approximately 500 m north along the alignment from the intersection of the power line easement and Edgars Road. The site is adjacent to both the easement and a paddock fence line, which also contains a planted windbreak of native trees.

The vegetation at the proposed location is characterised by exotic vegetation amongst a rocky area, with some scattered native vegetation present. The proposed location is largely degraded since cattle use the area along the fence to move within the paddock. The surge tank is proposed to be located within the area used by the cattle, which will minimise the disturbance of native vegetation which was observed to increase in cover with greater distance from the fence. However, the overall area contains only scattered native species comprising approximately 5 per cent vegetative cover, increasing to 10 per cent vegetative cover.

It is unlikely that the construction of the surge tank at this location would have any significant effects on native flora and fauna. A vegetation screen should be planted around the surge tank to mitigate any visual effects for local residents.

5 Policy and legislative implications

5.1 COMMONWEALTH LEGISLATION

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act protects the environment, particularly matters of national environmental significance, and is administered by the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA). There are seven matters listed as being of national environmental significance under the EPBC Act, including world heritage properties, national heritage places, Ramsar wetlands of international importance, listed threatened species and ecological communities, listed migratory species, the Commonwealth marine area, and nuclear actions.

Species and communities listed under the EPBC Act that are predicted to occur within the proposed study area are listed in Appendix C.

Outside of the proposed grassland reserve, seven areas of an ecological community listed under the EPBC Act, natural temperate grassland of the Victorian volcanic plain, have been recorded within the study area. The six sites correspond with the habitat zones 34, 56, 60, 70, 71 and 72. Currently, it is likely that habitat zones 34 and 56 would be avoided and habitat zones 60, 70, 71 and 72 would be impacted upon. The area that could be impacted is 1.75 ha based on a 30 m corridor. However, through minimisation techniques proposed by the project, impact on the community is likely to result in a loss of 0.78 ha, with a reduced construction corridor. .

Within the grassland reserve all remnant patches of plains grassland EVC, totalling 12.02 ha, are considered to be natural temperate grassland.

Two threatened flora species and a single fauna species listed under the EPBC Act were observed during the 2007 and 2009 assessments along the proposed alignment. A total of 64 plants of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) are present along the proposed alignment in Peak School Road, Tarneit Road and Farrars Road. A suspected single immature *Dianella amoena* (matted flax-lily) was observed along Peak School Road, amongst a population of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower). An individual *Pedionomus torquatus* (plains wanderer) was observed within the power line easement, between Ballan Road and the Werribee River.

Habitat for several threatened fauna species is also present within the proposed alignment. It is likely that rocky outcrops, waterways and grasslands that provide habitat for such species as *Delma impar* (striped legless lizard), *Synemon plana* (golden sun moth), *Litoria raniformis* (growling grass frog) and *Tympanocryptis pinguicolla* (grassland earless dragon) would be impacted upon by the project.

A referral under the EPBC Act is advised for the proposed pipeline based on potential impacts to the following matters of national environmental significance:

- natural temperate grassland of the Victorian volcanic plain
- *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower)
- *Dianella amoena* (matted flax-lily)
- *Pedionomus torquatus* (plains wanderer)
- *Delma impar* (striped legless lizard)
- *Synemon plana* (golden sun moth)
- *Tympanocryptis pinguicolla* (grassland earless dragon)
- *Litoria raniformis* (growling grass frog).

5.2 VICTORIAN LEGISLATION AND POLICY

5.2.1 Flora and Fauna Guarantee Act 1988

The Victorian FFG Act 1988 identifies and protects threatened native flora and fauna species, populations or ecological communities or their habitats. The FFG Act is administered by the DSE. The DSE has issued guidelines for assessment of threatened flora and fauna which must be taken into account in an assessment of significance.

Where a proposal is likely to significantly affect critical habitat of a threatened species, population or ecological community, or is in critical habitat as defined by the FFG Act, an impact statement must be prepared.

Fauna species listed under the FFG Act and described in earlier sections of the report may use habitat within the study area to supplement habitat resources in adjoining habitat areas.

A single flora species listed in accordance with Section 10 of the FFG Act was recorded within the proposed alignment during the assessment, *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower).

There have been several recent records of the listed species *Pterostylis truncata* (brittle greenhood) within and surrounding the alignment along Little River–Ripley Road. There is also potential habitat for the species in the area along the road.

Targeted surveys for *P. truncata* occurred during the flowering period of winter and also in spring. No individuals of the species were recorded during these surveys. However, conditions might not have been suitable for the species to emerge and it might not have been detectable during the survey periods.

To manage the risk of the species being present within the proposed alignment, pre-construction surveys are recommended for the species at suitable locations containing potential habitat. Prior to the pre-construction surveys, a DSE approved management plan is to be in place in the event that the species is found on site.

Several non-listed protected flora species were recorded within the study area during the assessment. They include *Acacia pycnantha* (golden wattle), *Acacia mearnsii* (black wattle) and all daisy species, such as *Brachyscome dentata* (golden daisy) and

Chrysocephalum apiculatum (common everlasting). A permit to take protected flora would be required should these and other protected flora listed in the *Protected Flora List 2009* be impacted by the project (DSE 2009c).

The listed community, western (basalt) plains grassland, which equates to plains grassland (EVC 132), is consistently present throughout the proposed alignment and is the dominant native vegetation community. It is expected that numerous areas of the listed community would be impacted by the project.

An environment effects statement (EES) referral is advised for the current project since there is the potential for effects on several matters protected under the FFG Act.

5.2.2 Catchment and Land Protection Act 1994

The *Catchment and Land Protection Act 1994* (CaLP Act) sets Victoria's objectives for the integrated management and protection of catchments, including control of noxious weeds and pest animals.

Several weed species listed under the CaLP Act are present along the alignment. The most dominant weeds present were *Nassella* spp, with the most dominant being *Nasella trichotoma* (serrated tussock), with some scattered areas of *Nasella neesiana* (Chilean needle-grass) and *Nasella hyaline* (cane needle-grass). The former two species are weeds of national significance (WONS). These and other noxious weeds found along the alignment are listed in Appendix B.

Because of the presence of these weeds, the project would require a pest plant management plan (refer to Section 7).

5.2.3 Planning and Environment Act 1987

The purpose of the *Planning and Environment Act 1987* is to provide a framework for planning the use, development and protection of land in Victoria, including provision for the protection of natural and developed resources and the maintenance of ecological processes and genetic diversity.

Two environment and landscape overlays apply to the alignment of the Melbourne–Geelong Interconnection.

Within Wyndham City Council Clause 42.01 Environmental Significance Overlay (ESO), Schedule 1 Waterway Corridors, applies to all points of the Werribee River, Lollypop Creek and Little River where the pipeline would cross these watercourses.

Under Clause 42.01-2 a permit is required to:

- construct a building or construct or carry out works. This does not apply if a schedule to this overlay specifically states that a permit is not required
- remove, destroy or lop any vegetation, including dead vegetation. This does not apply
  - if a schedule to this overlay specifically states that a permit is not required
  - if the table to Clause 42.01-3 specifically states that a permit is not required
  - to the removal, destruction or lopping of native vegetation in accordance with a native vegetation precinct plan specified in the schedule to Clause 52.16.

Neither Clause 42.01-3, Table of exemptions, the schedule to the overlay, or Clause 52.16, Native vegetation precinct plan, provides permit exemptions applicable to the construction of a utility installation.

Within City of Greater Geelong, Clause 42.03 Significant Landscape Overlay (SLO), Schedule 1 Foothills of the You Yangs, applies at two locations: the eastern side of Little River–Ripley Road between Gifkins Road and Kirks Road and either side of Peak School Road between Bacchus Marsh–Geelong Road and Blairs Road, where Hovell Creek crosses Peak School Road.

Under Clause 42.03-2 a permit is required to:

- construct a building or construct or carry out works. This does not apply if a schedule to this overlay specifically states that a permit is not required
- remove, destroy or lop any vegetation specified in a schedule to this overlay. This does not apply
  - if the table to Clause 42.03-3 specifically states that a permit is not required
  - to the removal, destruction or lopping of native vegetation in accordance with a native vegetation precinct plan specified in the schedule to Clause 52.16.

In addition, Clause 52.17 Native Vegetation, of the planning schemes of both the Wyndham City Council and City of Greater Geelong requires planning approval to be obtained for the lopping, disturbance or removal of native vegetation.

After consultation with the Department of Planning and Community Development, Department of Sustainability and Environment, Wyndham City Council and City of Greater Geelong regarding requirements for planning approval it was agreed that a planning scheme amendment was the appropriate mechanism for obtaining planning approval.

Amendments to both the Wyndham Planning Scheme and Greater Geelong Planning Scheme are proposed in the following manner:

- Amend the Schedule to Clause 52.03 to facilitate the development and use of the Melbourne–Geelong Interconnection pipeline in accordance with the specific controls in the Melbourne–Geelong Interconnection Pipeline Project Incorporated Document, June 2009
- Amend the Schedule to Clause 81.01 to incorporate Melbourne–Geelong Interconnection Pipeline Project Incorporated Document, June 2009.

The primary purpose of the incorporated document is to allow the development and use of the land for a minor utility installation, associated infrastructure and works and the associated lopping, removal or destruction of native vegetation (pursuant to Clause 52.17 of the Wyndham Planning Scheme and the Greater Geelong Planning Scheme) to be undertaken by or on behalf of Barwon Water for the purposes of constructing and maintaining the Melbourne–Geelong Interconnection Pipeline Project.

5.2.4 Victoria's Native Vegetation Management Framework

Under *Victoria's native vegetation management: a framework for action* (DNRE 2002), three steps must be demonstrated prior to removal of vegetation. First, that adverse impacts on native vegetation have been avoided and, second, that if impacts cannot be totally avoided, that they have been minimised through appropriate planning and design. The third step requires that, if native vegetation cannot be avoided, appropriate offsets must be identified to compensate for the disturbance of any patches of remnant native vegetation within the proposed pipeline alignment.

The implications for the MGI project of applying the framework are detailed in Section 6.

6 Victoria's Native Vegetation Management—A Framework for Action

6.1 THREE-STEP APPROACH

In accordance with the three-step approach of the native vegetation management framework and in the context of the net gain policy—for which a priority is the avoidance of further permanent losses of native vegetation through clearing—the Ministerial response to a proposal to clear patches of remnant vegetation graded as of 'very high' or 'high' conservation significance is that clearing of the former is 'not permitted unless exceptional circumstances apply, or is 'generally not permitted, for the latter. 'Exceptional circumstances' are defined as impacts that are an unavoidable part of a development project, with approval from the Minister for Environment and Conservation based on considerations of environmental, social and economic values from a state-wide perspective (DNRE 2002).

In the event that some clearing is permitted, the net outcome for vegetation of 'very high' conservation significance must be a substantial net gain, that is, at least twice the calculated loss in hha. The net outcome for vegetation of 'high' conservation significance must be a net gain that is at least 1.5 times the calculated loss in hha. The requirements to achieve and secure offsets must be identified in the associated formal management agreements and permit conditions (DNRE 2002).

Further offset requirements are outlined in Section 6.2.1.

6.1.1 Step 1: impact avoidance

Avoidance of native vegetation has occurred in two categories throughout the development of the MGI project—a broad-scale assessment of several alignment options between Cowies Hill and Lovely Banks, and a site-scale assessment targeting cleared and disturbed agricultural land within a maintained power line easement and avoidance through various construction methodologies. Native vegetation would be avoided mainly through the following strategies:

- Numerous route options were considered for the pipeline between Cowies Hill and Lovely Banks basin and are discussed in Section 1. The impact on native vegetation, as well as biodiversity values, was a major consideration in route selection and later refinement
- The proposed alignment was modified to avoid significant continuous vegetation along the road sides to the north and west of the You Yangs Regional Park (see Section 1.2.1)

- The northern side of Peak School Road was chosen as the preferred side of the road reserve to avoid *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower), which are more numerous on the southern side. The western road reserve was also chosen at the southern end of Farrars Road to avoid the species recorded on the eastern side of the road
- Significant areas of remnant vegetation or locations of threatened species would be avoided through design and construction methods. For instance, the pipeline could be diverted away from threatened communities or species through localised micro-realignment, or construction could bore under the locations of threatened species
- Selected sites of high significance and environmental sensitivity would be avoided by underground boring techniques
- Several patches located within the proposed 30 m impact corridor could also be avoided or minimised by reducing the width of the impact corridor and using existing roads.

6.1.2 Step 2: impact minimisation

Disturbance of native vegetation would be minimised mainly through the following strategies:

- Directing the proposed alignment mainly through the power line easement would minimise the impact on native vegetation since these areas have been previously disturbed during the construction of the power lines, are continually maintained for access or are cropped or grazed. Often, the cover of native vegetation is greater with distance away from the power lines
- Where there is native vegetation, the construction impact zone would be reduced. Areas of exotic vegetation and the most degraded parts of assessed native vegetation communities would be used wherever possible
- Where the alignment occurs along road reserves, construction methods would use the existing road and road shoulder to minimise vegetation disturbance
- Within road reserves, the pipeline could be aligned to the side of the road reserve with lower environmental values, for example, on the northern side of Peak School Road, the western side of Edgars Road and the western side of Farrars Road
- To construct the pipeline with maximum efficiency, an optimal construction impact corridor of 30 m width is proposed. However, where remnant patches of native vegetation occur, the impact corridor would be reduced to minimise the losses of native vegetation.

6.1.3 Step 3: offsets for losses of native vegetation

Where loss of a remnant vegetation community classed as being of ‘very high’ conservation significance could not be avoided, offsets would need to be initiated prior to the loss. Offsets are also required to be located within the same bioregion, the Victorian volcanic plain, and within the same priority landscape zone, Werribee (DNRE 2002). Final offset requirements cannot currently be determined since it is likely that several areas would be further avoided or minimised, and the total requirements would only be determined when the construction methods are finalised.

For a large number of the remaining patches of 'high' conservation significance it is likely that they could be avoided or the impact on them minimised. Final offset requirements would be calculated for patches of 'high' conservation significance once construction methods and the overall impact of the project can be correctly determined. Offsets for these patches would be required to occur within the Victorian volcanic plain bioregion and are to be initiated within a year after loss occurs (DNRE 2002).

Offsets for the MGI project would have to occur on a like-for-like basis, where gains for plains grassland could only occur in plains grassland. This also requires that any offsets would need to be gained within a patch of the same or higher conservation value. This means that offsets for 'very high' conservation significance could only be gained in patches of 'very high' conservation significance, while those of 'high' conservation significance could be gained in patches of either 'high' or 'very high' conservation significance.

Several patches also contain suitable habitat values for threatened flora and fauna species. Offset targets would have to incorporate habitat values of those species considered to have potential habitat in order to maintain or achieve more effective ecological function in the landscape (DNRE 2002).

The quality objectives for the offset require that the existing vegetation proposed as the basis of the offset in 'very high' conservation significance vegetation must be at least 90 per cent of the quality in the area being lost, and in 'high' conservation significance vegetation must be at least 75 per cent of the quality in the area being lost. The proportion of revegetation included in the offset, in hha, is limited to 10 per cent in 'very high' conservation significance vegetation, and is limited to 25 per cent in 'high' conservation significance vegetation (DNRE 2002).

6.2 ASSESSMENT OF NATIVE VEGETATION LOSSES

6.2.1 Patches of native vegetation

Remnant patches of native vegetation have been combined from both the 2007 and 2009 assessments. Those include patches assessed in 2007, new areas assessed in 2009 and areas of native vegetation identified in 2007 that have increased in cover to qualify as a patch in 2009. Conversely, some patches recorded and assessed in 2007 are no longer considered patch vegetation where disturbance has caused the native understorey cover to drop below 25 per cent of the overall understorey cover. Patches considered for assessment and calculation of offsets and losses are located within the current proposed alignment, over a 30 m wide construction corridor, or generally the width of the road reserve where this alternative alignment is to be used. A narrower construction corridor applies where threatened species are recorded.

All EVCs present along the proposed alignment are considered endangered in the Victorian volcanic plain bioregion, which requires that the lowest conservation significance rating that can be assigned to remnant patches of these EVCs is 'high'.

A total of 63 quality assessments were undertaken within the alignment, excluding the grassland reserve. Overall, the condition of the vegetation was low quality as a consequence of past or ongoing disturbance, such as grazing, cropping, removal of surface rock and mowing, resulting in large areas of soil disturbance. The majority of

sites generally consisted of tufted graminoids, mainly *Austrostipa* spp. (spear-grasses) and *Austrodanthonia* spp. (wallaby-grasses), which tolerate some disturbance and more readily recolonise areas.

Where habitat zones were of similar quality, comparing understorey, weediness and overall cover with adjacent assessed patches, the same score was applied to the habitat zone. Where habitat zones occurred in grazed paddocks, the extent of the zones was difficult to determine. These areas have been included within a single zone where the quality is similar. Within these areas the cover of native vegetation is likely to fluctuate; however, if overall it was considered that there was greater than 25 per cent native understorey cover of similar quality, only a single hha assessment was undertaken.

Many of the patches received low understorey scores because life forms, mainly herbs, were often absent. This was particularly evident in heavily grazed paddocks, compared with patches located in road reserves or ungrazed paddocks, where herbs and shrubs were more likely to be present. The majority of sites also contained a high cover of weeds, resulting in low scores on account of the weediness.

In comparison with the 2007 assessment, there has been an overall increase in the cover of native vegetation throughout the alignment. This has led to several areas, which were assessed in 2007 as containing a small suite of native species with a cover below 25 per cent understorey cover, now being classed as remnant patch vegetation. Adjustment of the proposed alignment from the 2007 assessment (which was assessed directly beneath the power lines and exhibits more disturbance from construction and use of an access track for maintenance) to an area adjacent to the power lines has led to a greater number of remnant patches potentially being affected by the project. Improved rainfall since 2007 has also contributed to an increase in observed areas of native vegetation and less severe grazing pressure on remnants within agricultural properties.

The increase in the amount of remnant patches recorded and also recent updates to the DSE biodiversity mapping, which identify more areas of grassland in the surrounding landscape, have also increased the landscape context scores for several patches.

Within the grassland reserve there is a total of 5.32 hha of plains grassland affected by the pipeline, based on a 20 metre construction corridor, with a small length of 10 m width. This is considered to be of ‘very high’ conservation significance.

Outside of the grassland reserve, a total of 4.38 hha of plains grassland, plains grassy woodland and plains grassland/plains grassy woodland mosaic are predicted to be affected within the current proposed 30 m corridor. Eleven of these patches have been classed as ‘very high’ conservation significance from habitat quality, with a further three patches upgraded to ‘very high’ conservation significance because they are considered to be ‘best 50 per cent’ habitat for a threatened species. These three sites all contained the threatened flora species *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower), which were part of a larger population most likely to be of high significance for the species.

The combined total within and outside the grassland reserve that is proposed to be affected by the pipeline over a maximum construction corridor is 9.70 hha.

A total of 6.76 hha of 'very high' conservation significance is predicted to be lost through the current alignment. This total has been accrued from 14 habitat zones over the alignment, the majority of which are located in road reserves and the remaining on private land (see Appendix B for the location of patches) and from vegetation within the proposed grassland reserve.

The remaining 2.94 hha predicted to be lost are of 'high' conservation significance, which is the lowest rating that an endangered EVC can achieve. This has resulted from 49 habitat zones present within the proposed alignment. Appendix D summarises the quantity and significance of native vegetation losses.

Within the 63 habitat zones present outside the grassland reserve, 13 were assessed as containing best or remaining habitat for rare or threatened species (DSE 2007d). The species deemed to have habitat present within the assessed habitat zones were *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower), *Pterostylis truncata* (brittle greenhood), *Rutidosus leptorrhynchoides* (button wrinklewort), *Senecio macrocarpus* (large headed fireweed), *Synemon plana* (golden sun moth), *Delma impar* (striped legless lizard), *Pedionomus torquatus* (plains wanderer) and *Tympanocryptis pinguicolla* (grassland earless dragon). Tables 3.1 and 3.2 list zones determined to be best or remaining habitat. Several other areas are potential habitat for threatened species along the alignment but do not contain 25 per cent native understorey cover and have not been considered for best and remaining habitat (see Section 3.3.3 for discussion on threatened fauna species).

6.2.2 Scattered trees

Seven large trees were present within the proposed alignment, three within the adjacent land on Little River–Ripley Road, one within the Edgars Road reserve, two in the unnamed road reserve between Edgars Road and Middle Road, and another in the adjacent property on Peak School Road (see Appendix B for the locations of all scattered trees). A further nine, classified as small trees (CCMA 2005), were also present in the proposed alignment, with several present at the junction of Hovell Creek and Peak School Road and the remainder in the adjacent property along Little River–Ripley Road. All scattered trees are present within the Corangamite Catchment Management Authority region, except for trees 14, 15 and 16 which are located within the boundary of the Port Phillip and Westernport Catchment Management Authority, which has different requirements for offsets for large trees (PPWCMA 2006).

The benchmarks used to determine the size class of scattered trees were creekline grassy woodland (EVC 68) for trees located near Hovell Creek, and plains grassy woodland (EVC 55) for the remaining trees. In all cases the large tree benchmark was 80 cm DBH. Therefore, a scattered tree with a DBH of 60–80 cm is considered medium, while trees with a DBH greater than 120 are very large. The conservation significance of all trees was considered to be 'high' since that is the minimum rating either EVC benchmark can achieve in a hha assessment. Scattered trees present within the proposed alignment are summarised in Table 6.1.

Scattered tree data presented here and for gain targets below (Section 6.3.3) include both those trees within the state government's proposed grassland reserve and trees outside the reserve along the remainder of the MGI alignment.

Table 6.1 Scattered trees present in the study area (including the grassland reserve)

Species	Characteristics		Offsets	
	Diameter at breast height (cm)	Map identifier number (Appendix A)	Number of trees to be protected	Recruitment of trees required
Allocasuarina verticillata	25	1		12*
Eucalyptus camaldulensis	21	2		8*
Eucalyptus camaldulensis	35	3		24*
Eucalyptus camaldulensis	40	4		30*
Eucalyptus camaldulensis	38	5		28*
Eucalyptus camaldulensis	26	6		14*
Eucalyptus camaldulensis	21	7		8*
Eucalyptus camaldulensis	102	8	4	20*
Eucalyptus polyanthemos	68	9	4	20*
Eucalyptus polyanthemos	50	10		40*
Eucalyptus polyanthemos	67	11	1	5*
Eucalyptus polyanthemos	60	12	1	5*
Eucalyptus polyanthemos	35	13		25*
Eucalyptus camaldulensis	65	14	4	20†
Eucalyptus camaldulensis	103	15	4	20†
Eucalyptus camaldulensis	105	16	4	20†
Total			**22**	**299**

* *In accordance with the requirements of CCMA 2005.*

† *In accordance with the requirements of PPWCMA 2006.*

6.3 NATIVE VEGETATION GAIN TARGETS

6.3.1 Gain targets for clearance of patches of native vegetation

Outside the grassland reserve

A total of 7.23 hha would be required to offset the loss of 63 patches of native vegetation. Of this 2.88 hha of 'very high' conservation significance and 4.35 hha of 'high' conservation significance are required within the Victorian volcanic plain bioregion.

'Very high' conservation significance offsets would require a gain target of 2.06 hha in plains grassland (EVC 132) and a further gain of 0.82 hha in plains grassland/plains grassy woodland (EVC 897). However, since the mosaic EVC is a benchmark that contains very similar characteristics to plains grassland EVC, and since plains grassland would provide suitable habitat for a similar suite of species, it would be considered appropriate to obtain all gains within suitable plains grassland EVC.

'High' conservation significance offsets would require a gain target of 4.15 hha in plains grassland EVC, 0.14 hha in plains grassland/plains grassy woodland mosaic and 0.06 hha in plains grassy woodland. It would again be considered appropriate to achieve gain targets from the mosaic EVC in either of the other vegetation types; however, further negotiations with the referral authority would be required. Gain targets for clearing patches of native vegetation are summarised in Table 6.2.

Table 6.2 Gain targets for clearing patches of native vegetation based on a 30 m construction corridor (outside grassland reserve)

Target no.[1]	Habitat zones[2]	Bioregion	EVC no. Name	Conservation significance	Minimum habitat score for target[3]	Other like-for-like requirements[4]	Habitat–hectare target		
							Total losses (hha)	Net outcome (multiplier)	Gain target (hha)
VH1	11	Victorian volcanic plain	132: Plains grassland	Very high	0.36	Best 50% habitat for spiny rice-flower (habitat zones 11, 16, 17 and 79)	1.03	2	2.06
VH2	3	Victorian volcanic plain	897: Plains grassland/ plains grassy woodland	Very high	0.36		0.41	2	0.82
H1	45	Victorian volcanic plain	132: Plains grassland	High	0	Remaining 50% habitat for striped legless lizard (6, 7, 34, 60, 70, 71, 72), golden sun moth (6, 7, 60, 70, 71, 72), grassland earless dragon (6, 7, 60), plains wanderer (56), large headed fireweed (24, 34), button wrinklewort (24, 34), matted flax-lily (16), spiny rice-flower (18, 19, 20, 24) and brittle greenhood (34), straw wallaby-grass (Alt A)	2.81	1.5	4.15
H2	3	Victorian volcanic plain	897: Plains grassland/ plains grassy woodland	High	0		0.09	1.5	0.14
H3	1	Victorian volcanic plain	55: Plains grassy woodland	High	0		0.04	1.5	0.06

[1] For losses of very high or high conservation significance vegetation, the losses in different habitat zones can be added together into one offset target provided that they meet the same like-for-like criterion, e.g. losses are in the same EV or habitat type. For losses of medium or low conservation significance vegetation, losses from different habitat zones can be added together into one offset target provided that the losses are in the same bioregion.

[2] Please specify the habitat zones that contribute to the target.

[3] Based on the quality objectives for the offset specified in Table 6 of Victoria's native vegetation management: a framework for action *(DNRE 2002).*

[4] Please specify any other like-for-like requirements. These may include best or remaining habitat for threatened species, ecological function.

[5] Please note that by protecting a medium or large tree, either scattered or within a patch, it is assumed five recruits will be generated. To be considered protected, twice the canopy diameter of a tree must be fenced and protected from adverse impacts (see definition in Guide for Assessment of Referred Planning Permit Applications DSE 2007d for more information). It has therefore been assumed that protection of a tree will generate five recruits and no separate recruitment targets have been calculated.

Within proposed grassland reserve

Within the grassland reserve a gain target of 10.64 hha would be required to offset the loss of 5.32 hha, as all the remnant vegetation is considered to be of very high conservation significance.

Table 6.3 Summary of gain targets within the grassland reserve (source: DSE)

Conservation significance	Bioregion	EVC no. Name	Total area of loss (ha)	Habitat–hectare target		
				Total losses (hha)	Net outcome (multiplier)	Gain target (hha)
Very high	Victorian volcanic plain	132: Plains grassland	12.02	5.32	2	10.64

Overall gain target

When combined with the data from outside the grassland reserve, the project would require a gain target of 17.87 hha to offset the loss of 9.7 hha. This gain target is will be reduced through the application of avoidance and minimisation.

Table 6.4 Total overall gain targets for the MGI alignment (source: KBR and DSE)

Location	Bioregion	Habitat–hectare target		
		Total area to be lost (ha)	Total losses (hha)	Gain target (hha)
Outside the grassland reserve	Victorian volcanic plain	12.63	4.38	7.23
Within the grassland reserve	Victorian volcanic plain	12.02	5.32	10.64
Total		**24.65 ha**	**9.7 hha**	**17.87 hha**

6.3.2 Alignment alteration

The assessment review documented in this report is continuing to inform the detailed route selection for the pipeline alignment. An alteration to the preferred alignment, to avoid habitat zone 10 which has a conservation significance of 'very high', has already occurred. Avoidance of habitat zone 10 has been achieved by moving the pipeline alignment to the southern side of Peak School Road from the power line easement on Forest Road, then crossing to the northern road reserve for the remainder of Peak School Road. This route avoided two other patches of 'high' conservation significance, habitat zones 8 and 9, but also proposed to impact on four other remnant plains grassland patches. The patches on the northern side of the road combined would result in a loss of 0.37 hha, compared with 0.04 hha on the southern side. Overall this proposed alignment alteration reduces the gain target by 0.67 hha.

Patches on the southern side of the road to be impacted upon are labelled Alt. A through to D, as shown in Appendix A. Habitat zone Alt. A has also been identified as containing 'remaining 50 per cent' habitat for the vulnerable flora species *Austrodanthonia richardsonii* (straw wallaby-grass). Offsets for this habitat zone

should include habitat values for the species. The additional four patches have been included in the current report and the scores and offsets have been adjusted to take this alignment alteration into account.

6.3.3 Gain targets for clearance of scattered trees

The seven trees classed as large (> 0.75 per cent of the benchmark large tree size) all require protection offsets of other large trees if removed. Trees 8 and 9 were both located within patch vegetation, and require a different offset target from the target for those trees not present within remnant vegetation. Offset targets for these two trees have been obtained from the framework (DNRE 2002). Offsets for large scattered trees not located within remnant vegetation have been obtained from the regional native vegetation plans (CCMA 2005, PPWCMA 2006).

It is expected that all large trees would be avoided during the construction of the pipeline and therefore no offsets would be required.

Trees classed as small (0.25 to 0.75 per cent of the benchmark large tree size) do not require protection offsets and default to a low conservation significance. These trees only require a recruitment offset, which has been determined in Table 6.1. Replacement rates for scattered trees have been taken from the regional native vegetation plan (CCMA 2005).

A number of the small scattered trees can be avoided during construction of the pipeline. Final determination of offset targets for scattered trees could only occur when construction methods have been finalised. Total scattered tree offsets for the project are not predicted to be significant.

7 Impact mitigation and management

7.1 CONCLUSION

Overall there has been an increase in the recorded cover of native vegetation throughout the study area compared with the 2007 assessment, requiring greater offsets for the project. Numerous sites assessed as ‘areas’ in 2007 (defined as sites with five or more native species in a confined area) have been upgraded to ‘patch’ status, where the cover of the area is now greater than 25 per cent native understorey. This is generally due to an increase in density of *Austrostipa* sp. (spear-grasses) and *Austrodanthonia* sp. (wallaby-grasses) and a decrease in weed cover.

The increase could have occurred for a combination of reasons. Continued drought conditions in the region could have decreased the level of competition from exotic grass species, particularly annual species, resulting in reduced competition for the more drought-resistant native grass species, an increase in the cover of native vegetation, and a greater amount of patches observed and assessed, culminating in an increase in the offsets required. This is evident in the understorey scores within grazed paddocks where these patches achieve only the minimum score available. A total of 47 patches achieved the minimum understorey score, with only 19 obtaining a score of 10 or more.

The level of disturbance within the area of the 2007 assessment was generally higher directly beneath the power lines. Installation of the pylons and creation of a maintenance track, which is often used, have disturbed the soil and created an altered environment dominated by exotic species. Within grazed paddocks the greater the distance from directly beneath the power lines, the less disturbance and increase in the cover of native vegetation, particularly where the presence of rocky outcrops has militated against soil disturbance.

The combined factors of a general increase in native vegetation, a more detailed pipeline alignment location and its location through a less disturbed area, have contributed to a significant increase in the amount of remnant patches potentially affected by the project. However, the total gain target outside the grassland reserve of 7.23 hha is a conservative estimate of the maximum that would be required to offset native vegetation lost through construction of the proposed pipeline. It is likely that this amount would decrease significantly since several patches could be avoided, and where avoidance is not possible, the construction impact corridor could be reduced to minimise the impact.

Currently the project aims to avoid several patches outside the proposed grassland reserve. By restricting works to the road reserves along Peak School Road, Farrars Road and Little River–Ripley Road (avoiding habitat zones 21, 22 and 31–35), boring under Ballan Road (avoiding habitat zone 56), avoiding habitat zone 10 (including habitat zones 8 and 9) and aligning the pipeline through private property on Tarneit Road (avoiding habitat zone 79), a total of 12 patches could be completely avoided. Table 7.1 summarises those patches to be avoided.

Table 7.1 Summary of habitat zones to be avoided outside the grassland reserve

Conservation significance	Number of habitat zones to be avoided	Total area to be avoided (ha)	Total amount of losses avoided (hha)	Total gain targets avoided (hha)
Very high	6	1.31	0.61	1.22
High	6	0.56	0.21	0.31

The predicted avoidance of these patches would reduce the loss to 3.56 hha (from 4.38 hha) and reduce the gain target to 5.70 hha (from 7.23 hha). It is likely that these amounts could decrease further as disturbance to habitat zones is minimised.

Where patches could not be avoided, it is likely the losses could be minimised through decreasing the width of the construction corridor. Total losses within patches could only be determined when detailed construction methods have been developed in conjunction with a construction contractor.

It is recommended that in the power line easement a general rule be applied to where patches of remnant vegetation cannot be avoided by the proposed alignment. Different constraints are likely to apply when constructing the pipeline in road reserves, with the following recommendations suitable for sections of the alignment within the power line easement.

Where patches of ‘very high’ conservation significance occur it is recommended the construction corridor be reduced to 10 m to minimise impacts on higher quality vegetation and habitat. Where patches of ‘high’ conservation significance occur it is recommended that the construction corridor be reduced to 20 m. This method is likely to slow construction; however there are large benefits for the retention of native vegetation and habitat. The widths will need to be assessed on a site by site basis taking into account geotechnical and constructability issues, as well as adjacent infrastructure. Table 7.2 summarises the losses after recommended avoidance and minimisation measures have been applied.

Table 7.2 Summary of losses and gain targets after avoidance and minimisation

					Habitat–hectare target		
Conservation significance	Number of habitat zones	Bioregion	EVC no. Name	Total area of loss (ha)	Total losses (hha)	Net outcome (multiplier)	Gain target (hha)
Very high	6	Victorian volcanic plain	132: Plains grassland	0.89	0.38	2	0.76
Very high	2	Victorian volcanic plain	897: Plains grassland/ plains grassy woodland	0.17	0.06	2	0.12
Very High	DSE grassland reserve	Victorian volcanic plain	132: Plains grassland	12.02	5.32	2	10.64
High	45	Victorian volcanic plain	132: Plains grassland	5.44	1.68	1.5	2.46
High	2	Victorian volcanic plain	897: Plains grassland/ plains grassy woodland	0.24	0.08	1.5	0.12
High	0	Victorian volcanic plain	55: Plains grassy woodland	0	0	1.5	0
Total	**55**			**18.76 ha**	**7.52 hha**		**14.10 hha**

When combined with avoidance outlined in Table 7.1 the total reduction of losses from avoidance and minimisation both within and outside the grassland reserve totals 2.18 hha, reducing the total losses for the alignment to 7.52 hha. The combined gain target for the entire MGI alignment would be reduced by 3.77 hha to 14.10 hha.

Rocky outcrops have been removed or disturbed directly beneath the power lines for creation of the track for maintenance vehicles. Elsewhere, rocky outcrops generally coincide with patches of remnant vegetation since they are an obstacle to mechanical disturbance. They may also protect native species from being grazed since stock may be less inclined to enter the more rocky areas.

Offsets to be determined for the project would incorporate habitat requirements for several threatened species. Those species potentially affected by the project generally require grassland habitats, often containing rocky areas. Three nationally threatened species were recorded along the current alignment. Two flora species, *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) and *Dianella amoena* (matted flax-lily), are present in road reserves and it is proposed to avoid them during construction of the pipeline. The large numbers of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower), particularly along Peak School Road, suggest that this is a significant population. The record of *Pedionomus torquatus* (plains wanderer) within the study area would be unlikely to alter the route of the pipeline. The species is not predicted to be directly impacted upon by the project, despite being recorded within the proposed pipeline alignment because *Pedionomus torquatus* (plains wanderer) is known to have a large home range of approximately 18 ha in similar habitat and can move away from the temporary disturbance. Of concern is their known behaviour pattern of not recolonising areas of past disturbance. As a minimum mitigation measure, no disturbance should occur during the breeding season between early September and early November and, in a good season with summer rains, from early January to the

end of March. Construction activities should generally assume the presence of and manage for the species during works and minimise the amount of habitat loss.

It is not expected that impacts on waterways and associated habitat would be significant. The crossing points of Hovell Creek, Little River and Lollypop Creek target degraded areas, avoiding habitat areas such as large trees and rocky outcrops and remnant native vegetation patches. The change in the preferred crossing point of the Werribee River to the existing Cobbledicks Ford crossing point is not predicted to impact on vegetation bordering the river if the impact can be restrained to the paved ford crossing. Established riparian vegetation and habitat would have been impacted if the previous route along the power line easement was used for the installation.

7.2 RECOMMENDATIONS

These recommendations follow the 'three-step' approach by first avoiding native vegetation wherever possible, then minimising the amount of unavoidable losses, and offsetting as the last step. Following these steps will reduce the amount of native vegetation and habitat removed from the site and significantly reduce the offsets required for construction of the MGI.

7.2.1 Avoidance of native vegetation

The following recommendations emphasise avoidance of native vegetation patches of very high conservation significance and nationally threatened ecological communities:

- avoid locations of threatened species, including a buffer zone, and patches of native vegetation where possible
- avoid all remnant large trees which are usually present on private property adjacent to road reserves. Restricting the construction corridor to the road reserve will avoid or minimise disturbance of large trees. Avoid or minimise disturbance beneath the drip line of remnant trees within the road reserve or adjacent private property
- avoid planted windbreak trees where possible. Avoid or minimise disturbance beneath the drip line of planted trees within the road reserve or adjacent private property
- avoid habitat zone 10 by aligning the pipeline along the southern side of Peak School Road where the patch occurs
- restrict the construction corridor to the road reserve along Little River–Ripley Road where patches of very high conservation significance occur in adjoining land
- increase the width of boring beneath Ballan Road to include the remnant patches located within the road reserves, which are of very high conservation significance and fulfil the criteria of a listed nationally threatened community (DEWHA 2008c). Access the boring site through the adjacent properties
- ensure that post-construction rehabilitation works do not result in changes to hydrological or other physical conditions that may impact adversely on recorded sites.

7.2.2 Minimisation of impact on native vegetation

The following recommendations emphasise minimisation of the impact on remnant native vegetation:

- reduce the width of the construction corridor where the proposed alignment is predicted to impact on patches of native vegetation. Erect temporary fencing around the area of the patch to be protected during construction
- target existing cleared areas for construction activities and alignment of the pipeline where possible, such as roads, including Cobbledicks Ford Road and Edgars Road.

7.2.3 Avoidance or minimisation of impact on threatened species

The following recommendations are based on managing and mitigating the impact on all native flora and fauna, with specific actions to reduce the impact on threatened species, either directly through protecting known locations of species or indirectly through maintaining and reducing the impact on potential habitat areas:

- avoid identified significant habitat areas for threatened species within the proposed alignment where possible
- avoid creating further fragmentation of habitat areas, particularly areas designated as potential or known habitat for targeted threatened species in order to minimise isolation of adjacent populations
- minimise disturbance of significant habitat areas for threatened species where avoidance is not possible
- align the pipeline around known locations of threatened flora species, allowing an appropriate buffer zone to reduce the impact on the individual and species
- retain existing trees where possible, including remnant and planted trees
- align the pipeline to the northern road reserve of Peak School Road to avoid greater concentrations of *Pimelea spinsecens* ssp. *spinescens* (spiny rice-flower)
- conduct pre-construction surveys for *Pterostylis truncata* (brittle greenhood) at suitable locations. Develop a contingency plan in the event that the species is found.

7.2.4 Targeted fauna surveys

Conduct targeted surveys of threatened fauna species on which the proposed pipeline alignment is predicted to have a significant impact through either direct impacts or loss of habitat, as follows:

Delma impar (striped legless lizard)

Targeted surveys are to be conducted for *Delma impar* (striped legless lizard) throughout relevant grassland areas with rocky outcrops as likely habitat areas within the proposed MGI alignment between November and March.

Tympanocryptis pinguicolla (grassland earless dragon)

Targeted surveys are to be conducted for *Tympanocryptis pinguicolla* (grassland earless dragon) throughout relevant grassland areas with rocky outcrops as likely habitat areas within the proposed MGI alignment. These will correspond with the areas selected for survey for *Delma impar* (striped legless lizard) which appears to have some similar habitat requirements. Surveys should occur between November and March.

Synemon plana (golden sun moth)

Targeted surveys are to be conducted for *Synemon plana* (golden sun moth) between mid-November and the end of December throughout relevant grassland habitat areas within the proposed MGI alignment.

Avoid creating further fragmentation of habitat areas, particularly areas designated as potential or known habitat for *Synemon plana* (golden sun moth) for which a separation of 200 m will isolate adjacent populations (DEWHA 2008e).

Pedionomus torquatus (plains wanderer)

The species is known to occur in the MGI alignment north of Ballan Road and no targeted surveys will occur in this area. Targeted surveys to be conducted for *Pedionomus torquatus* (plains wanderer) have included the current assessment with limited spotlighting efforts in suitable habitat areas south of Ballan Road, between December and April throughout relevant grassland habitat areas. Pre-construction surveys should also be undertaken to locate any individuals and nests present or nearby the MGI alignment.

Avoid disturbance of known or likely *Pedionomus torquatus* (plains wanderer) habitat during the breeding season between early September and early November and, in a good season with summer rains, from early January to the end of March.

Litoria raniformis (growling grass frog)

Targeted surveys will not be undertaken for *Litoria raniformis* (growling grass frog) because the species is considered to be present in the MGI pipeline alignment, it has recent known records near the alignment, it is highly mobile and has broad habitat requirements. Mitigation measures will be determined based on the assumption that the species is present in the alignment, in particular:

- avoid disturbance of known or likely habitat for *Litoria raniformis* (growling grass frog) during the breeding season between November and March. However, breeding is generally triggered by local flooding and rise in water levels (Heard et al. 2004), which may extend the breeding season beyond this period.

7.2.5 Inclusions in the environment management plan (CEMP) for project construction

In addition, the following mitigation recommendations target general environmental considerations. Further detailed measures will be developed and stipulated in an endorsed CEMP. General mitigation measures include:

- fence off all locations of threatened species, including a buffer zone, and patches of native vegetation that can be avoided during construction to identify these sites as being of high environmental significance
- reinstate remnant vegetation communities. Top soil is to be replaced on site and areas are to be seeded with locally sourced indigenous grass seed. Reinstatement is to be undertaken in accordance with an approved rehabilitation plan
- collect seed for reinstating sites from properties located within the proposed alignment that provide a suitable seed source. Where this cannot occur, seed from the surrounding area can be used
- manage rehabilitation of remnant vegetation after completion of the pipeline, including replanting where necessary and follow-up weed control
- employ clean construction techniques during the project to restrict the movement of weeds within and beyond the construction area. Initial weed control should target WONS to reduce the chance of spreading seed through the site
- use only clean materials and machinery on site. All machinery and materials are to be free of weed seed and pathogens
- plant vegetation screens around the surge tank and pump station with species indigenous to the area.

7.2.6 Inclusions in the contingency plan or threatened species management plan for the project

The following recommendations target contingency and general provisions for threatened species management for the project. Further detailed measures would be developed and stipulated in contingency and threatened species management plans to be endorsed prior to construction. General mitigation measures would include:

- stop construction works immediately in the event that threatened species are encountered within the construction corridor and notify an ecological specialist to arrange relocation or translocation
- develop specific measures for relocating any threatened fauna species encountered within the construction corridor during construction works
- develop specific measures for translocating any threatened flora species encountered within the construction corridor which cannot be avoided during construction.

8 References

Biosis Research 2009, *Biodiversity assessment of the investigation area in Melbourne's west*, Background Technical Report 2A, prepared for Growth Areas Authority.

Carter, O. and Walsh, N. 2006, National Recovery Plan for the Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens*, Department of Sustainability and Environment, East Melbourne.

CCMA 2005, Corangamite Native Vegetation Plan 2003–2008. Corangamite Catchment Management Authority, Colac.

Cogger, H.G. 2000, *Reptiles and amphibians of Australia*, 6th edition, Reed New Holland, Sydney.

DEWHA 2003, Nationally Threatened Species and Ecological Communities, Australian Painted Snipe (*Rostratula australis*), Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA 2008a, Background Paper to EPBC Act Policy Statement 3.12: Nationally Threatened Species and Ecological Communities, Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (*Synemon plana*), Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA 2008b, Background Paper to EPBC Act Policy Statement 3.14: Significant Impact Guidelines for the Vulnerable Growling Grass Frog (*Litoria raniformis*), draft, Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA, 2008c, EPBC Act Policy Statement 3.8: Natural Temperate Grassland of the Victorian Volcanic Plain, a nationally threatened ecological community, Department of Environment, Water, Heritage and the Arts, Canberra.

DEWHA 2008d, EPBC Act Policy Statement 3.11: Nationally Threatened Species and Ecological Communities, Significant Impact Guidelines for the Critically Endangered Spiny Rice-flower (*Pimelea spinescens* ssp. *spinescens*), draft, Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA 2008e, EPBC Act Policy Statement 3.12: Nationally Threatened Species and Ecological Communities, Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (*Synemon plana*), draft, Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA 2008f, EPBC Act Policy Statement 3.14: Nationally Threatened Species and Ecological Communities, Significant Impact Guidelines for the Vulnerable Growling Grass Frog (*Litoria raniformis*), draft, Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA 2008g, *Prototroctes maraena*—Australian Grayling, Species Profile and Threats Database, Department of the Environment, Water, Heritage and the Arts, Canberra, viewed 6 October 2008, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26179

DEWHA 2009a, Background Paper to EPBC Act Policy Statement 3.11: Nationally Threatened Species and Ecological Communities, Significant Impact Guidelines for the Critically Endangered Spiny Rice-flower (*Pimelea spinescens* ssp. *spinescens*), Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA 2009b, *Delma impar*—Striped Legless Lizard, Species profile and threats database, Department of the Environment, Water, Heritage and the Arts, Canberra, viewed 28 September 2009, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1649.

DEWHA, 2009c, *Galaxiella pusilla*—Dwarf Galaxias, Species profile and threats database, Department of the Environment, Water, Heritage and the Arts, Canberra, viewed 20 November 2009, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=56790.

DEWHA, 2009d, Grassy Eucalypt Woodland of the Victorian Volcanic Plain, listing advice, Department of Environment, Water, Heritage and the Arts, Canberra.

DNRE 2002, *Victoria's native vegetation management: a framework for action*, Department of Sustainability and Environment, East Melbourne.

Dorrough, J. 1995, Past and present habitat of the Striped Legless Lizard, *Delma impar* (Pygopodidae) in the Australian Capital Territory, ACT Parks and Conservation Service, Canberra.

DSE 2003a, Action Statement, Flora and Fauna Guarantee Act 1988, No. 132, Spiny Rice-flower, *Pimelea spinescens* ssp. *spinescens*, Department of Sustainability and Environment, East Melbourne.

DSE 2003b, Flora and Fauna Guarantee Action Statement No. 17, Striped Legless Lizard, *Delma impar*, Department of Sustainability and Environment, East Melbourne.

DSE 2003c, Flora and Fauna Guarantee Action Statement No. 28, Button Wrinklewort, *Rutidosis leptorrhynchoides*, Department of Sustainability and Environment, East Melbourne.

DSE 2003d, Flora and Fauna Guarantee Action Statement No. 63, Brittle Greenhood *Pterostylis truncata*, Department of Sustainability and Environment, East Melbourne.

DSE 2003e, Flora and Fauna Guarantee Action Statement No. 66, Plains Wanderer, *Pedionomus torquatus*, Department of Sustainability and Environment, East Melbourne.

DSE 2003f, Flora and Fauna Guarantee Action Statement No. 68, Large-fruit fireweed, *Senecio marcrocarpus*, Department of Sustainability and Environment, East Melbourne.

DSE 2004a, Action Statement, Flora and Fauna Guarantee Act 1988, No. 106, Golden Sun Moth, *Synemon plana*, Department of Sustainability and Environment, East Melbourne.

DSE 2004b, *Vegetation quality assessment manual: guidelines for applying the habitat hectares scoring method*, Department of Sustainability and Environment, East Melbourne.

DSE 2005a, Advisory list of rare or threatened flora in Victoria, 2005, Department of Sustainability and Environment, East Melbourne.

DSE 2005b, BioSites maps and reports, Port Phillip Region: sites of biodiversity significance (BioSites) and ecological vegetation classes (EVCs), Department of Sustainability and Environment, East Melbourne.

DSE 2005c, Matted Flax-lily, *Dianella amoena*, A nationally threatened species of the grassland community. Department of Sustainability and Environment, East Melbourne.

DSE 2006a, National Recovery Plan for the Spiny Rice-flower, *Pimelea spinescens* subspecies *spinescens*, Department of Sustainability and Environment, East Melbourne.

DSE 2006b, Sustainable water strategy—Central region. Department of Sustainability and Environment, East Melbourne.

DSE 2007a, Advisory list of threatened vertebrate fauna in Victoria, 2007, Department of Sustainability and Environment, East Melbourne.

DSE 2007b, Atlas of Victorian wildlife, Department of Sustainability and Environment, East Melbourne.

DSE 2007c, Flora information system, Department of Sustainability and Environment, East Melbourne.

DSE 2007d, Native Vegetation Guide for Assessment of Referred Planning Permit Applications, Department of Sustainability and Environment, East Melbourne.

DSE 2008a, Background and Implementation Information for the Australian Grayling *Prototroctes maraena* National Recovery Plan, Department of Sustainability and Environment, East Melbourne.

DSE 2008b, EVC mapping and benchmarks, Department of Sustainability and Environment, East Melbourne.

DSE 2008c, Grassland Earless Dragon (*Tympanocryptis pinguicolla*), Department of Sustainability and Environment, East Melbourne.

DSE 2008d, National Recovery Plan for the Australian Grayling, *Prototroctes maraena*, Department of Sustainability and Environment, East Melbourne.

DSE 2009a, Advisory list of threatened invertebrate fauna in Victoria, 2009, Department of Sustainability and Environment, East Melbourne.

DSE 2009b, *Delivering Melbourne's newest sustainable communities: strategic impact assessment report for Environment Protection and Biodiversity Conservation Act*, Department of Sustainability and Environment, East Melbourne.

DSE 2009c, Flora and Fauna Guarantee Act 1988, Protected Flora List, July 2009. Department of Sustainability and Environment, East Melbourne.

DSE 2009d, Victorian River Health Works Monitoring Method User's Manual Version 1.1, Department of Sustainability and Environment, Melbourne.

Heard, G.W., Robertson, P. and Scroggie, M.P. 2004, The ecology and conservation status of the growling grass frog (*Litoria raniformis*) within the Merri Creek corridor, second report: additional field surveys and site monitoring, Wildlife Profiles Pty Ltd and the Arthur Rylah Institute for Environmental Research, prepared for the Department of Natural Resources and Environment, East Melbourne.

KBR 2007, Melbourne–Geelong Interconnector Pipeline, Modified Northern Route Detailed Flora and Fauna Survey, 19 December 2007, prepared for Barwon Region Water Corporation, Kellogg Brown & Root Pty Ltd, Melbourne.

Maher, P.N. and Baker-Gabb, D.J. 1993, Surveys and Conservation of the Plains-wanderer in Northern Victoria, ARI Technical Report No. 132, Department of Conservation and Natural Resources, East Melbourne.

NRMMC 2006, *Australian weeds strategy: a national strategy for weed management in Australia*, Natural Resource Management Ministerial Council, Australian Government Department of the Environment and Water Resources, Canberra.

PPWCMA 2006. Port Phillip and Western Port native vegetation plan. Port Phillip and Western Port Catchment Management Authority, Victoria.

Walsh, N. G. and Entwisle, T. J. 1994, *Flora of Victoria: Volume 2, ferns and allied plants, conifers and monocotyledons*, Inkata Press, Melbourne.

Walsh, N. G. and Entwisle, T. J. 1996, *Flora of Victoria: Volume 3, dicotyledons winteraceae to myrtaceae*, Inkata Press, Melbourne.

Appendix A

DETAILED FLORA AND FAUNA MAPS

Doherty's Rd
Tarneit
Cowies Hill Reservoir
Quandong
Werribee
City of Greater Geelong Council
Wyndham City Council
The You Yangs
Princes Freeway
Little River
Peak School Rd
Lara
Avalon
Lovely Banks Basins
Corio

Legend

- Pipeline
- Facility Site
- Watercourses
- Road
- Railway
- Proposed Grassland Reserve
- Local Government Boundary

Barwon Water

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SOURCE : Barwon Water, Vicmap, SP AusNet

GIS FILE	PROJECTION	DATE
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Prepared by Eric McCowan

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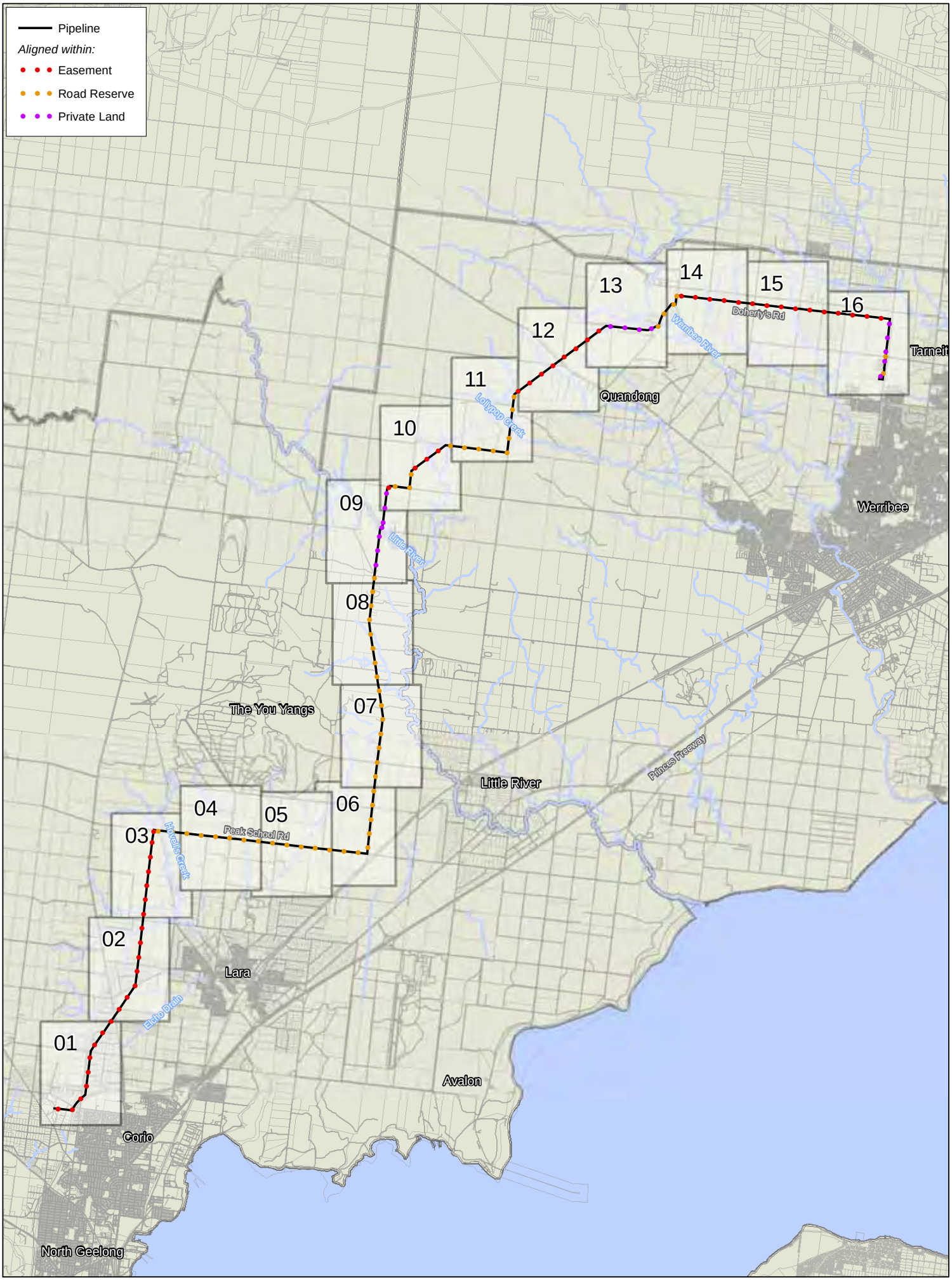
Barwon Water Interconnection

Alignment Map

FIGURE No. 1 **PROJECT No. MEG831**

Map No. **MEG831-G-MAP-018-E** REVISION E



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Environmental Map Series Overview

APPENDIX A	PROJECT No. MEG831
MAP No. MEG831-G-MAP-032-E	REVISION E

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Threatened Flora Data Source: 'THFLO100', © The State of Victoria, Department of Sustainability and Environment. The contribution of the Royal Botanical Gardens Melbourne to the database is acknowledged.
Threatened Fauna Data Source: 'Atlas of Victorian Wildlife', © The State of Victoria, Department of Sustainability and Environment.

SOURCE: Barwon Water, Vicmap, DSE, Melbourne Water

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Environmental Assessment Map

Map 01 of 16

APPENDIX A	PROJECT No. MEG831
MAP No. MEG831-G-MAP-032-D	REVISION D

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APPENDIX A	PROJECT No. MEG831
MAP No. MEG831-G-MAP-032-D	REVISION D

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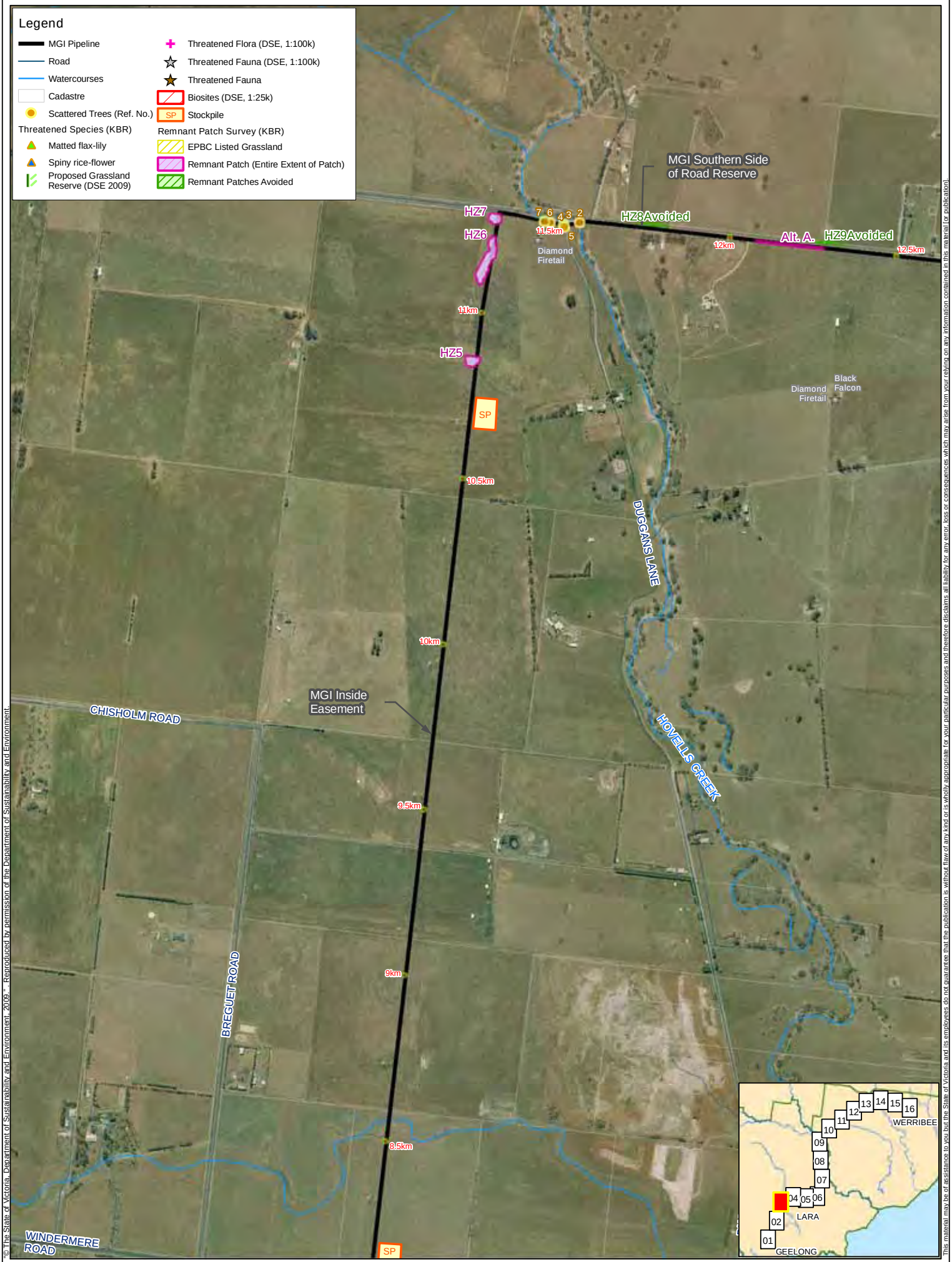

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Map 03 of 16

APPENDIX A	PROJECT No. MEG831
MAP No. MEG831-G-MAP-032-D	REVISION D

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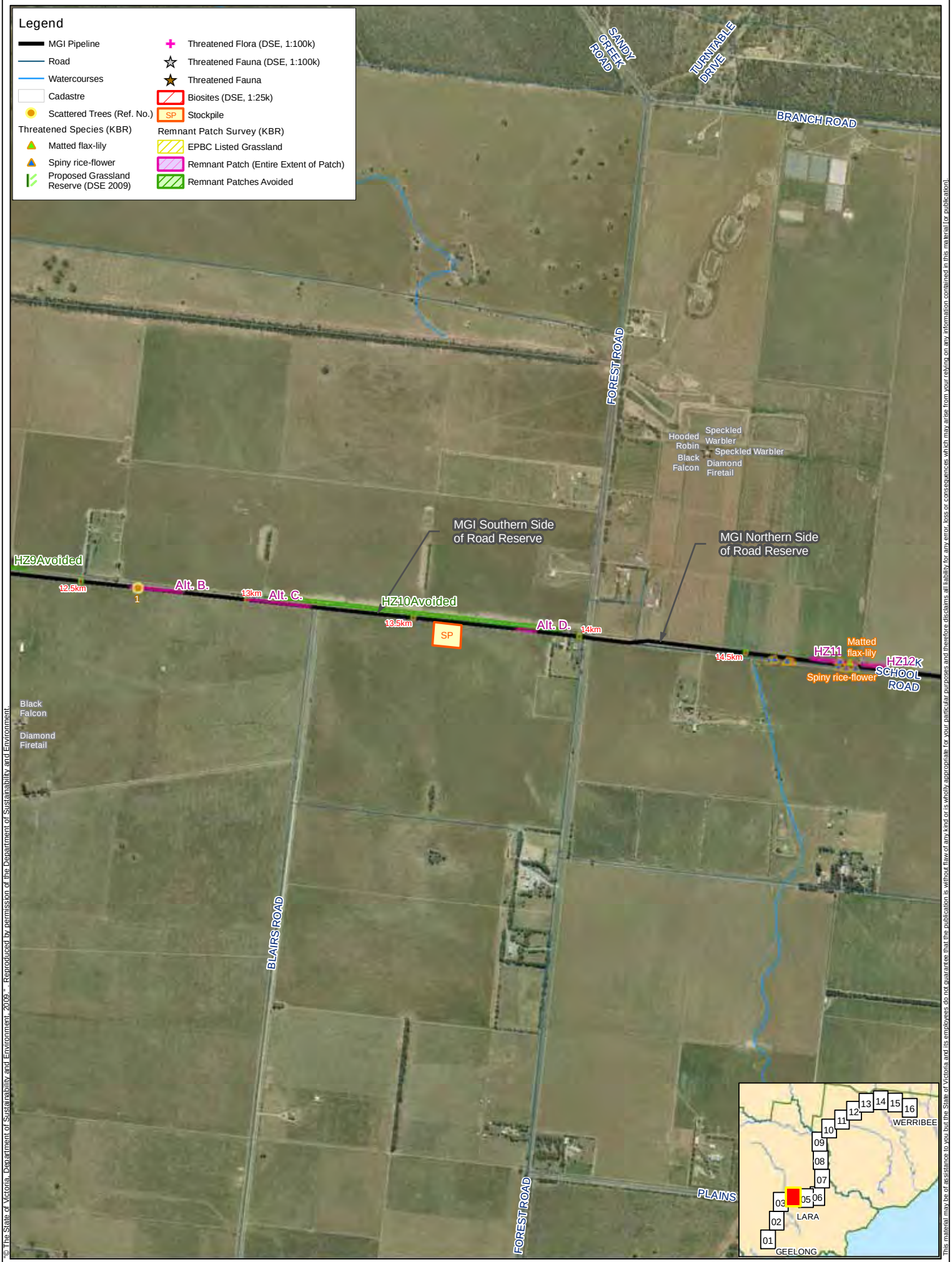

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Map 04 of 16

APPENDIX A	PROJECT No. MEG831
MAP No. MEG831-G-MAP-032-D	REVISION D

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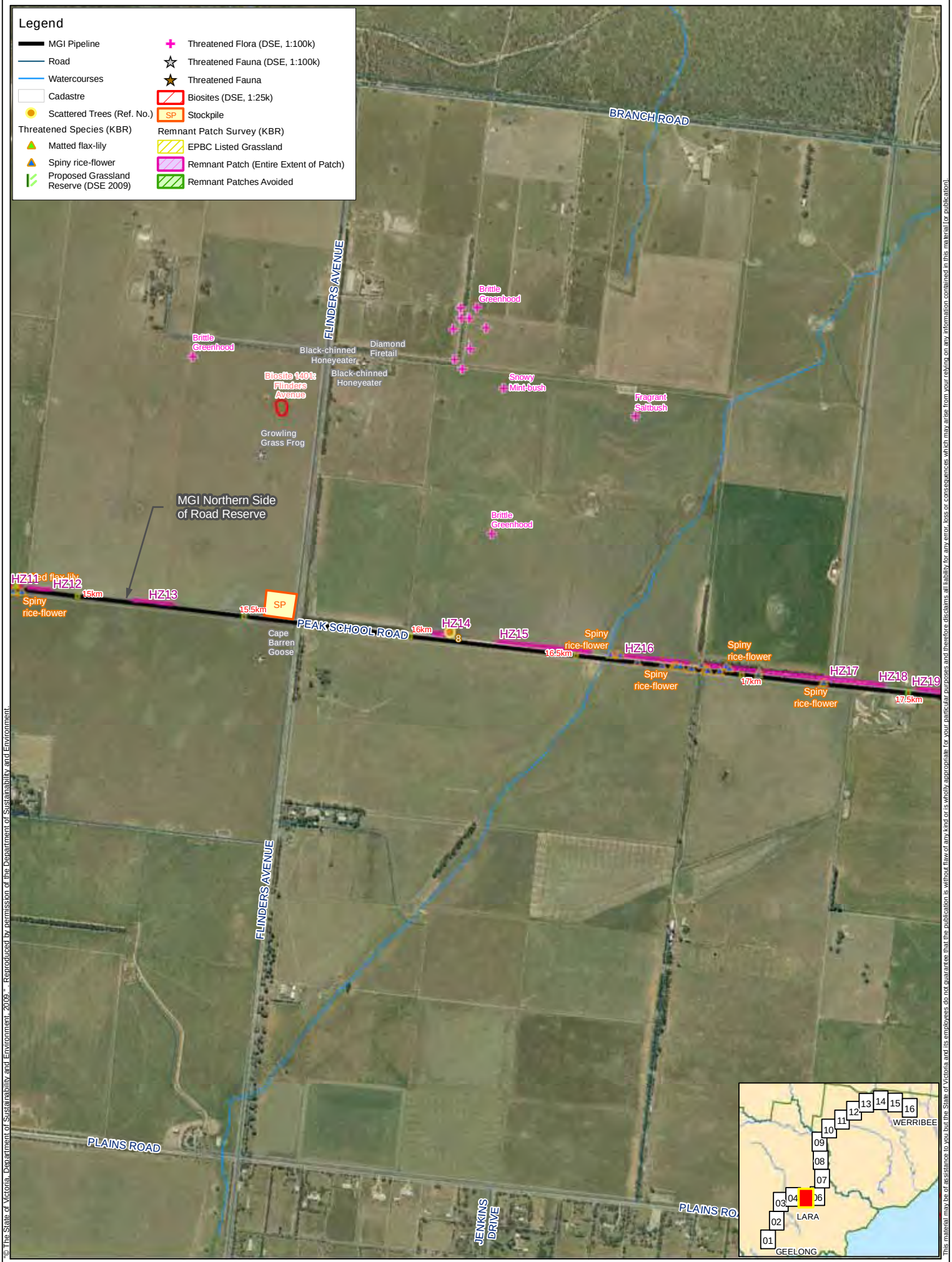

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Environmental Assessment Map

Map 05 of 16

APPENDIX A	PROJECT No. MEG831
MAP No. MEG831-G-MAP-032-D	REVISION D

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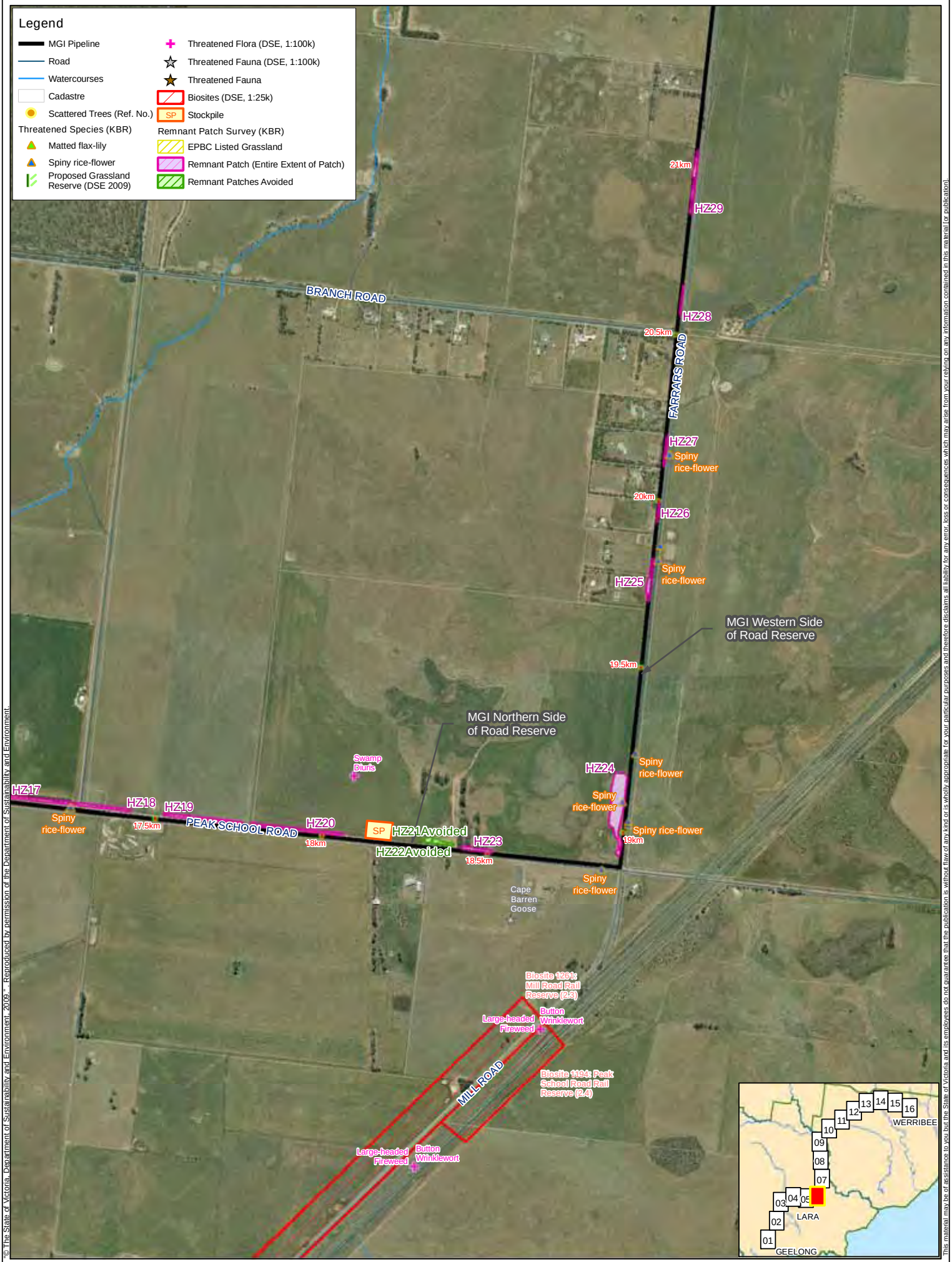

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Map 06 of 16

APPENDIX A	PROJECT No. MEG831
MAP No. MEG831-G-MAP-032-D	REVISION D

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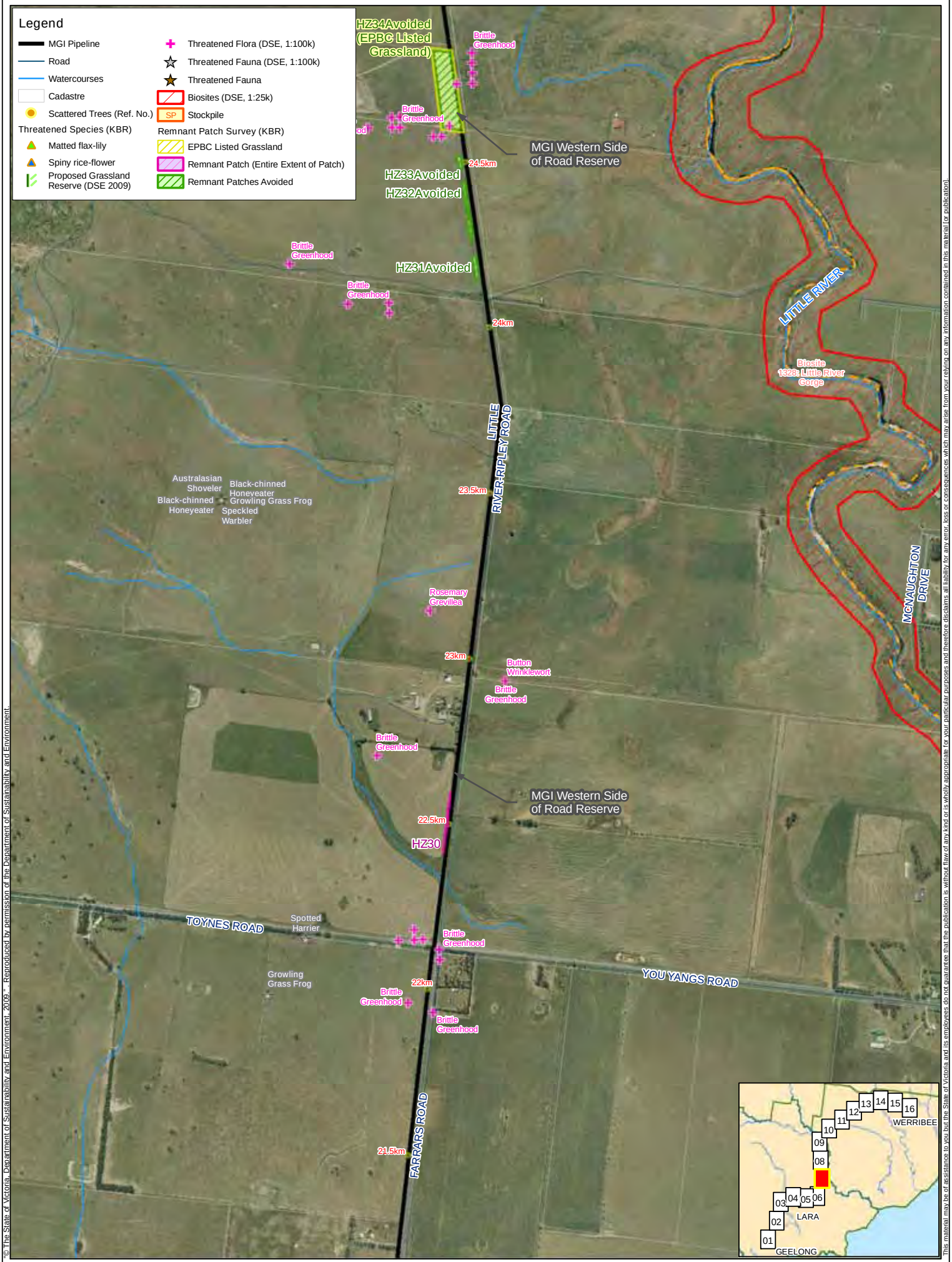

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APPENDIX A	PROJECT No. MEG831
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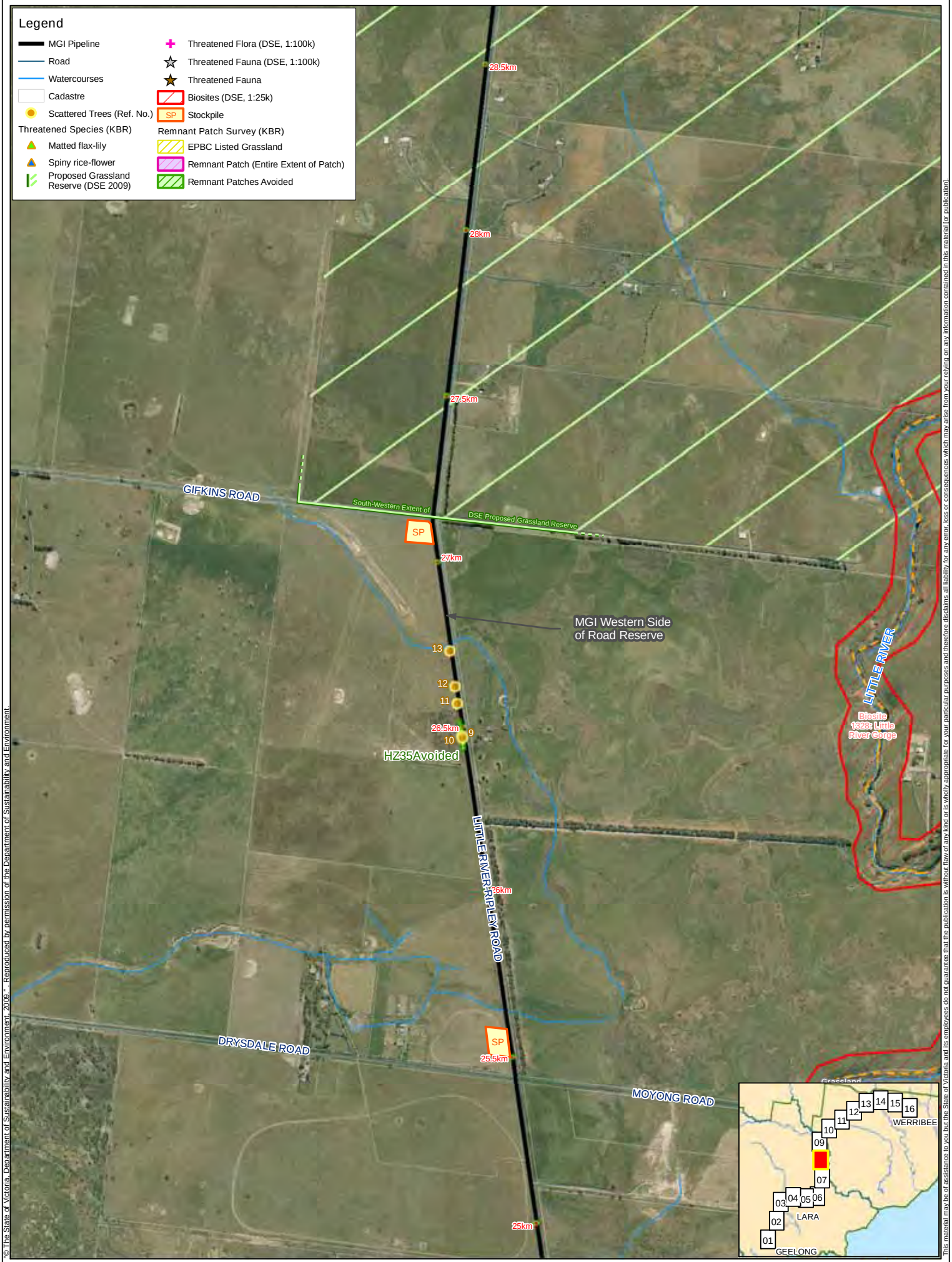

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Environmental Assessment Map
Map 08 of 16

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MAP No. MEG831-G-MAP-032-D	REVISION D

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Prepared by Eric McCowan

TITLE
Barwon Water
Melbourne Geelong Interconnection
Environmental Assessment Map
Map 09 of 16

APPENDIX A	PROJECT No. MEG831
MAP No. MEG831-G-MAP-032-D	REVISION D

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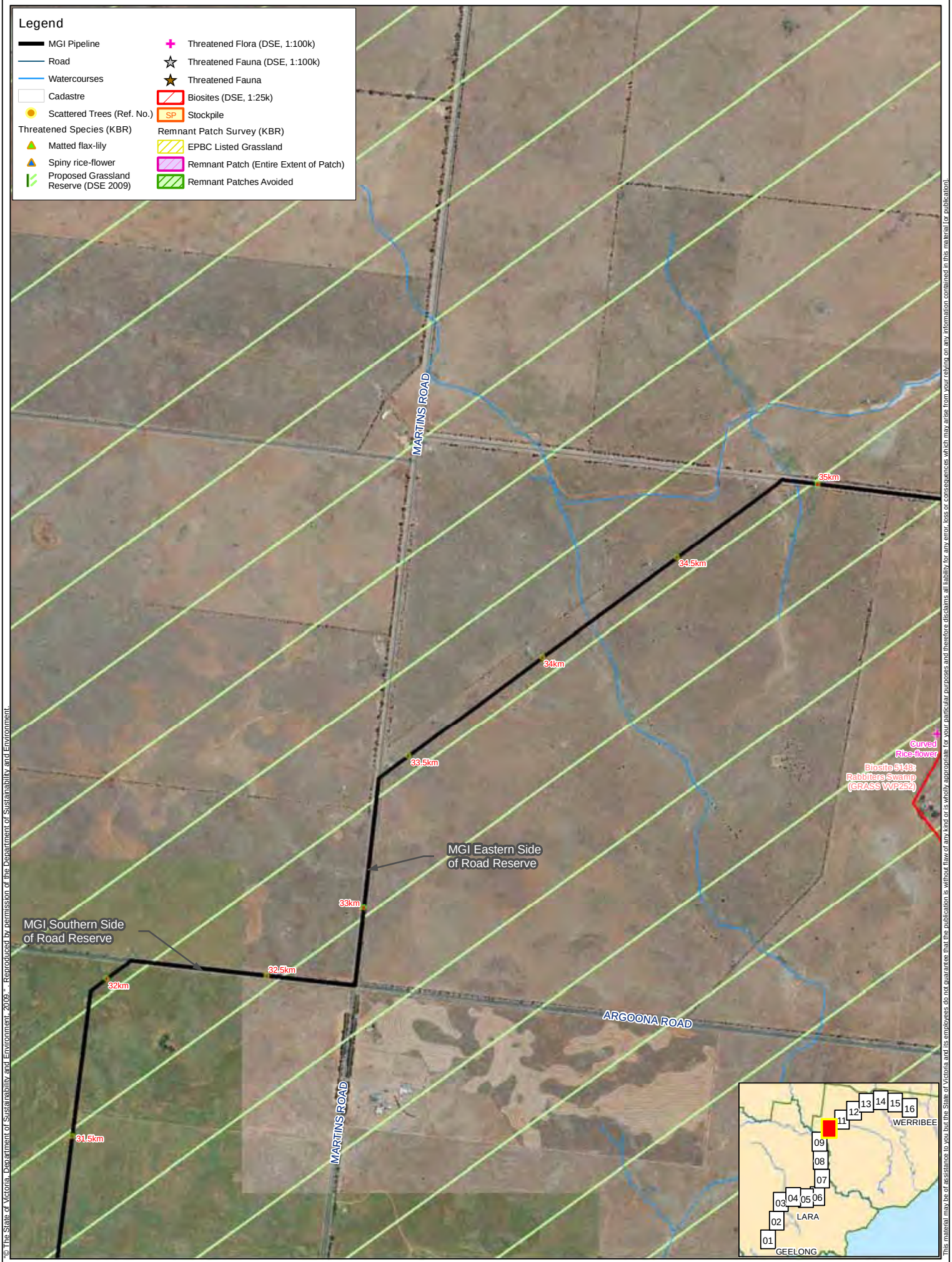

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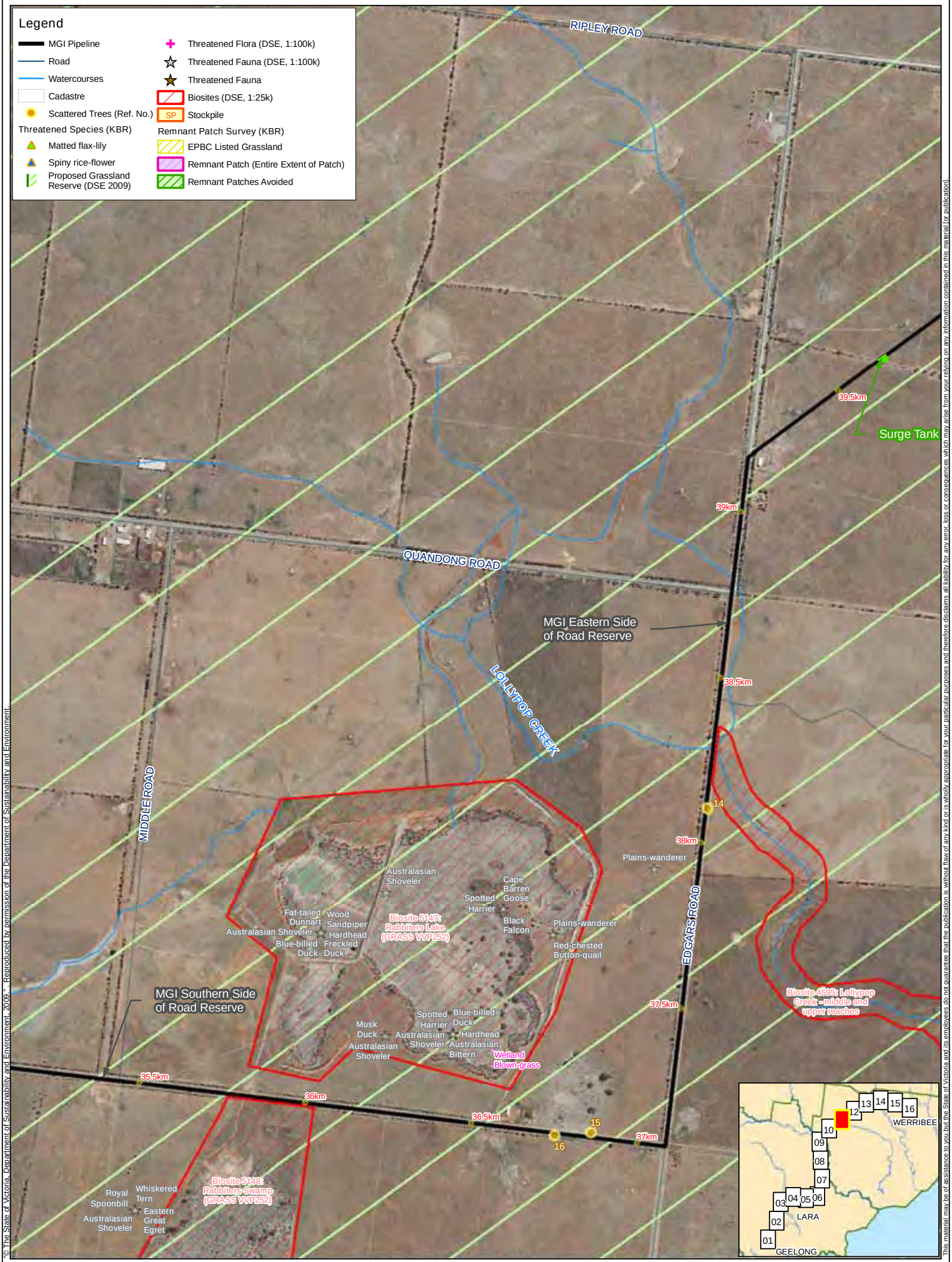

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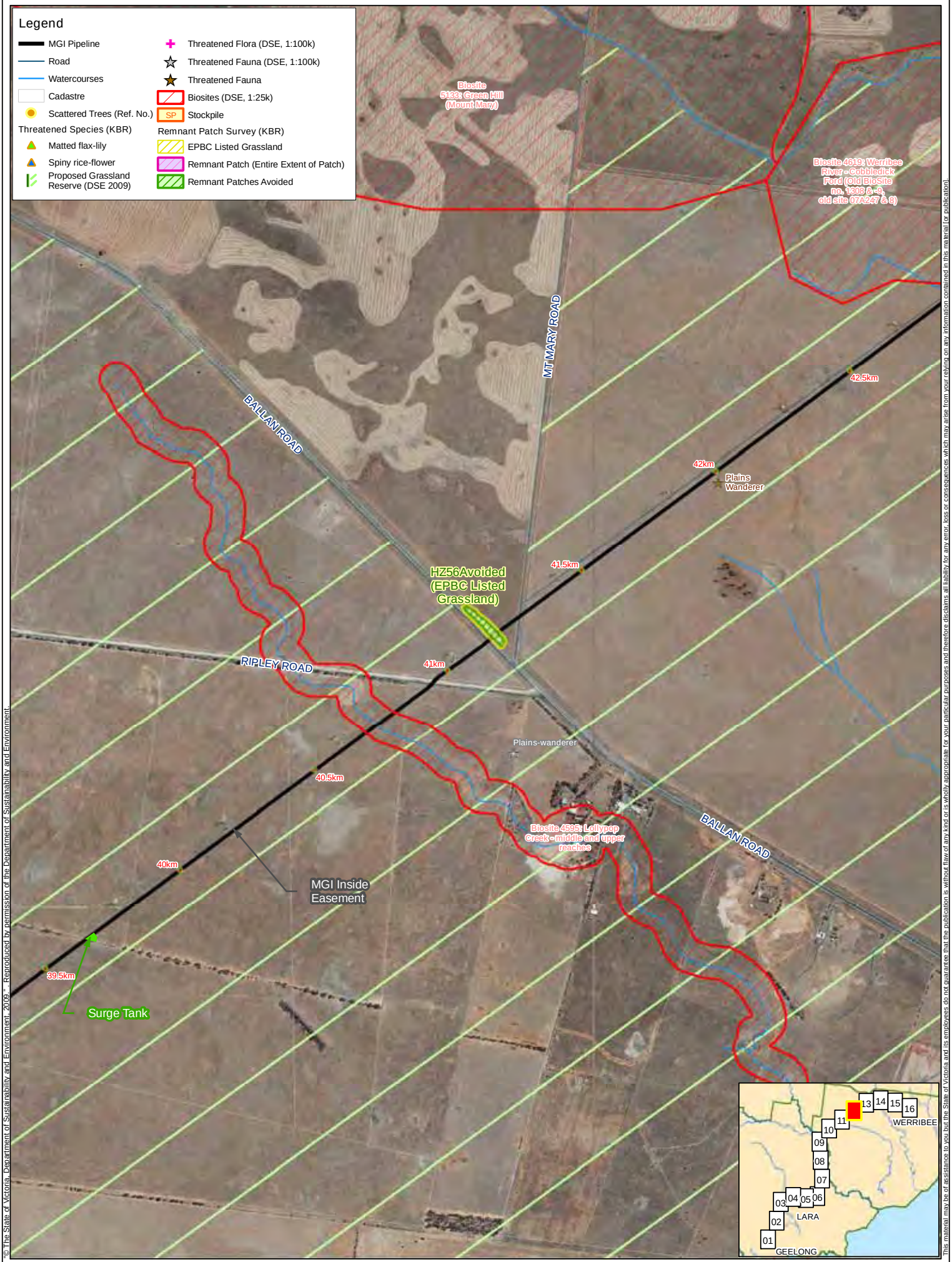

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MAP No. MEG831-G-MAP-032-D	REVISION D

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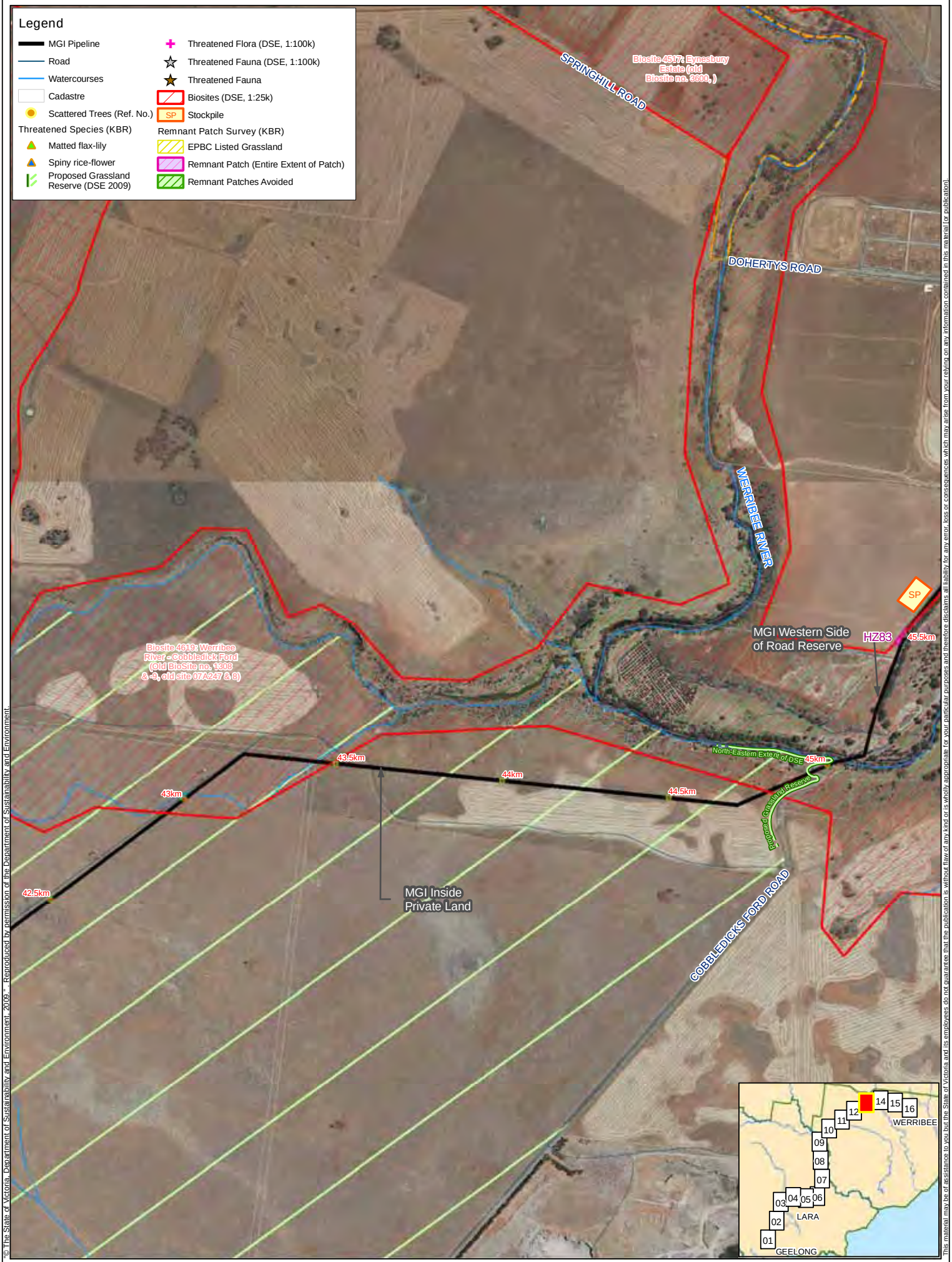

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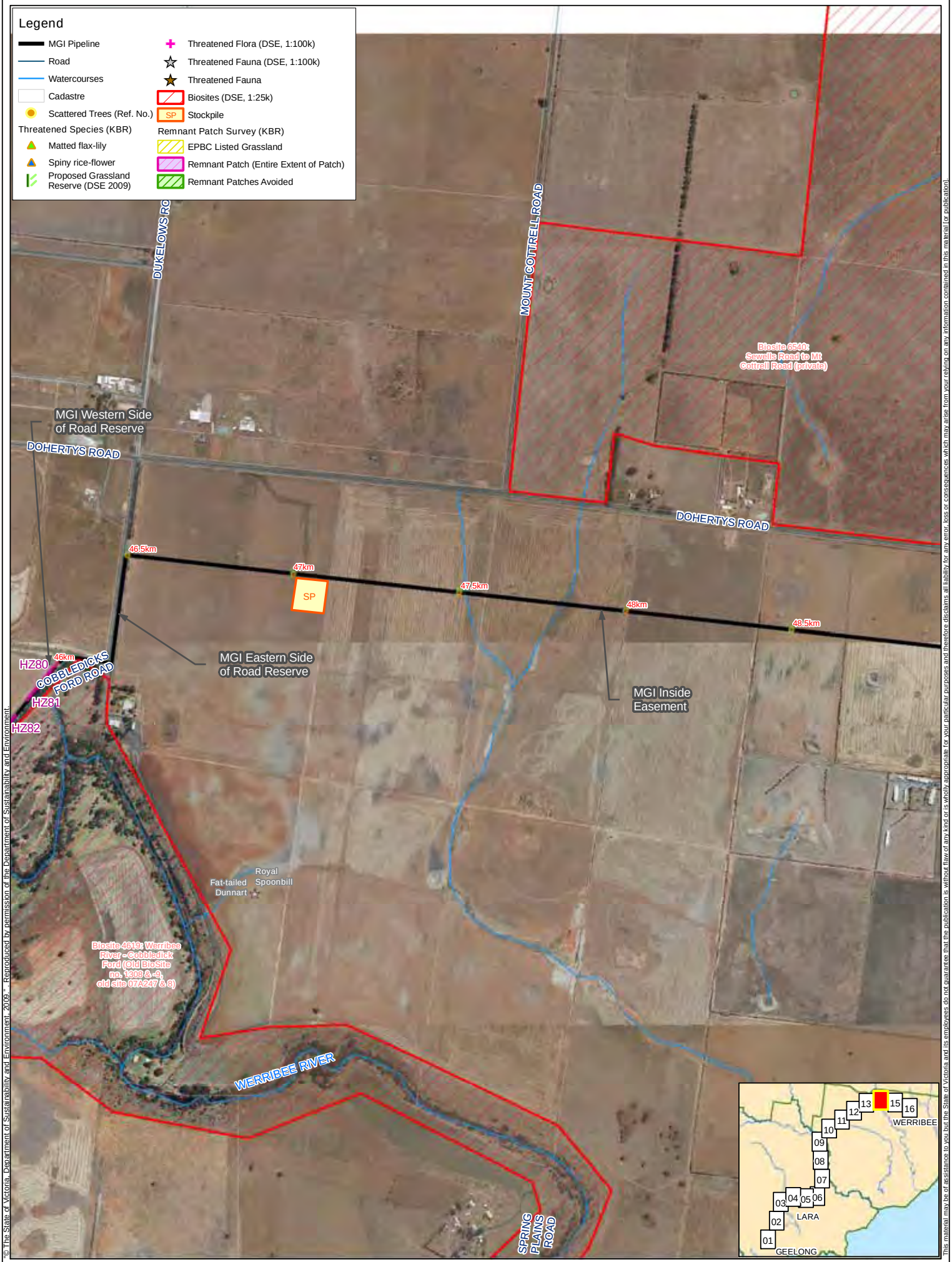

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TITLE

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Melbourne Geelong Interconnection

Environmental Assessment Map

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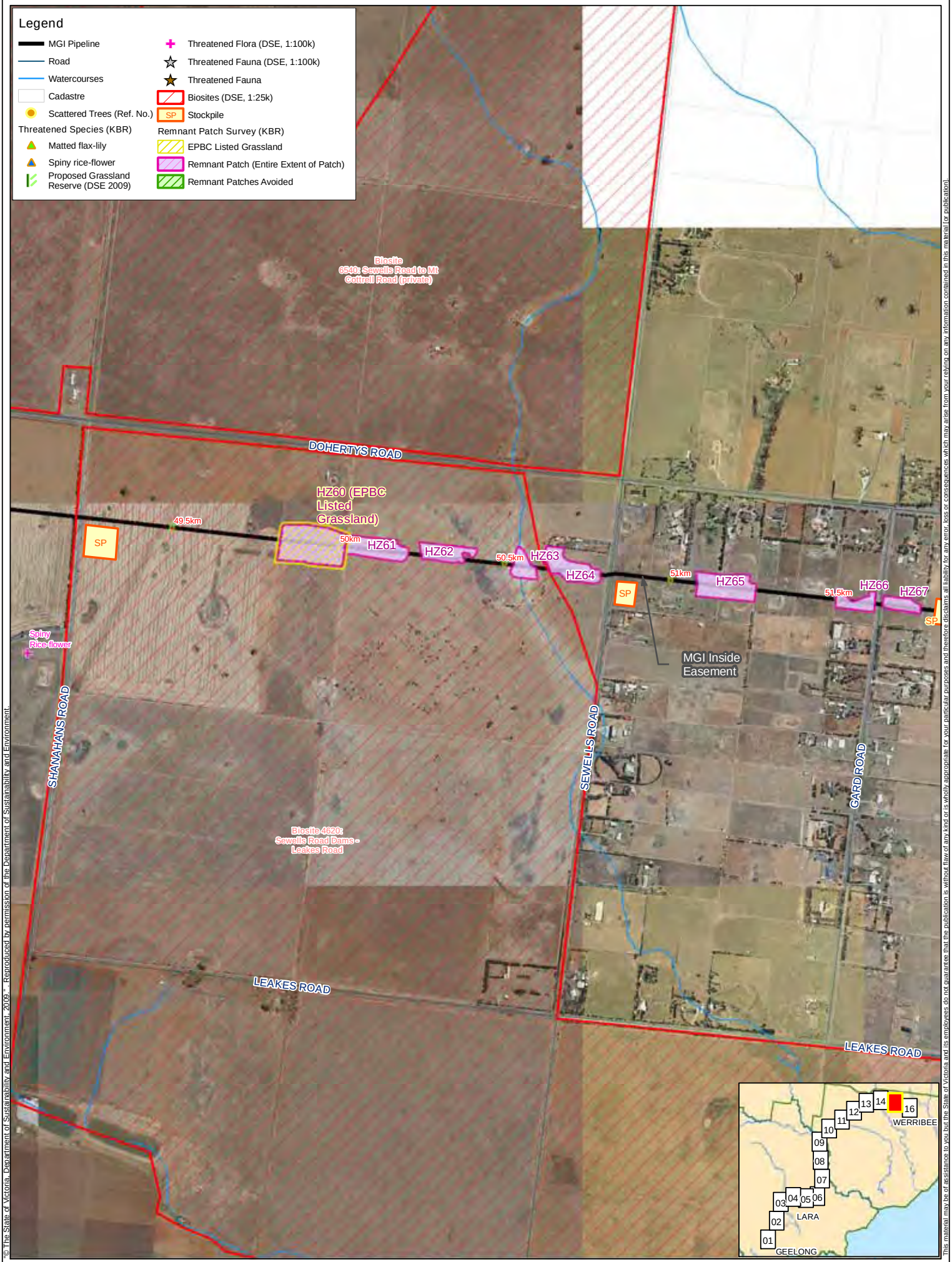

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MAP No. MEG831-G-MAP-032-D	REVISION D

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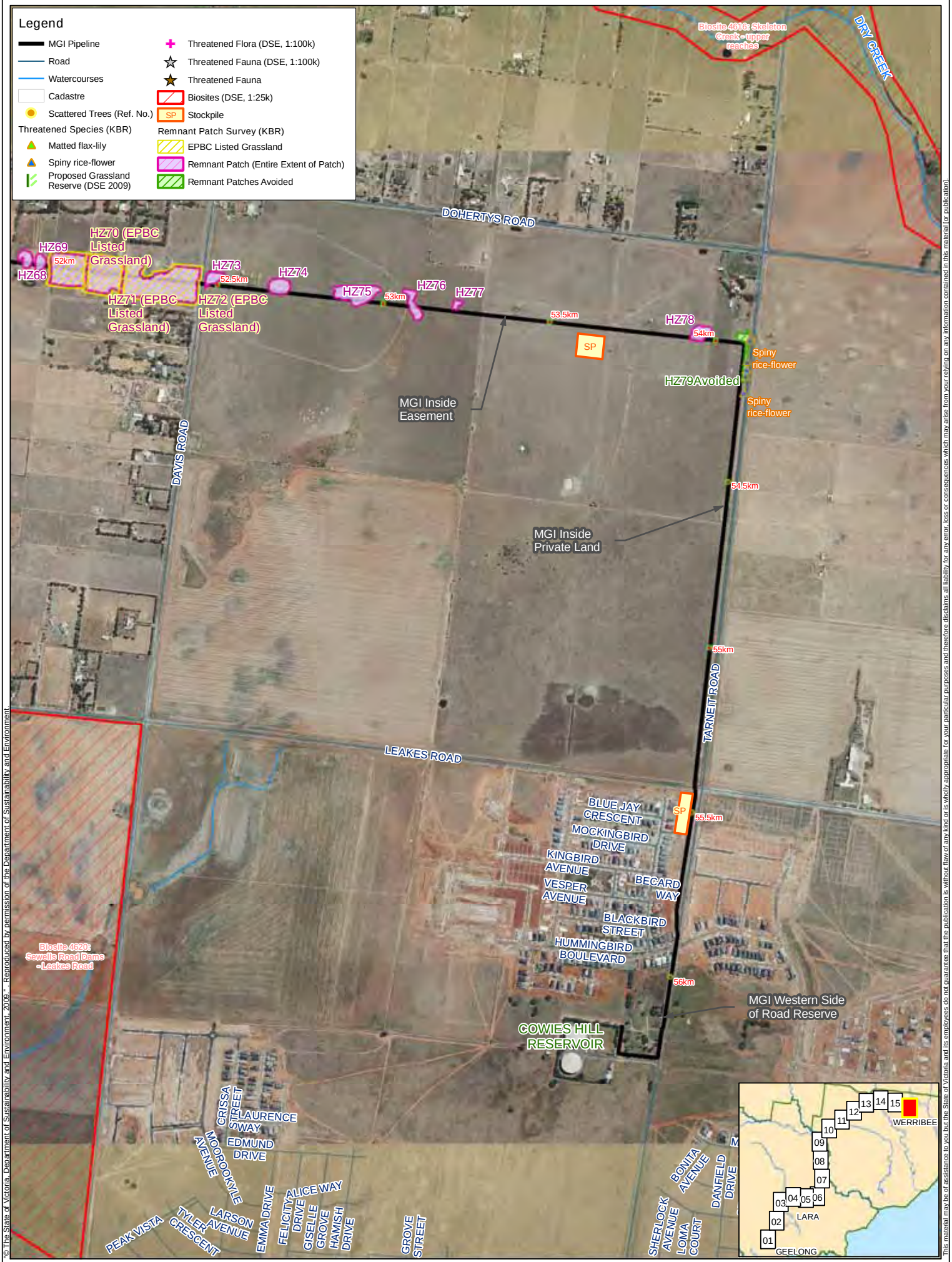

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Map 16 of 16

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Appendix B

DETAILED FLORA AND FAUNA ASSESSMENT 2007

MELBOURNE–GEELONG INTERCONNECTOR PIPELINE

Modified Northern Route Detailed Flora and Fauna Survey

Prepared for:

BARWON REGION WATER CORPORATION
61–67 Ryrie Street Geelong Victoria 3220

Prepared by:

Kellogg Brown & Root Pty Ltd
ABN 91 007 660 317
Level 3 441 St Kilda Road Melbourne Victoria 3004
Telephone (03) 9828 5333, Facsimile (03) 9820 0136

5 October 2009

MEG703-G-REP-005 Rev. B

Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to survey the flora and fauna values along the modified northern route of the Melbourne–Geelong Interconnector Pipeline in accordance with the scope of services set out in the contract between KBR and Barwon Region Water Corporation ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from visual inspections and examination of records in the public domain. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to the site provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon site conditions and information in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

Revision	Date	Comment	Signatures		
			Originated by	Checked by	Approved by
A	19/12/07	Draft issue	A. Rigg	W. Jeffery	D. D'Agostin
B	05/10/09	Minor editorial changes		WJ	

CONTENTS

1 Introduction

1.1 PROJECT BACKGROUND

General

The Victorian Government's Central Region Sustainable Water Strategy (DSE 2006) identified Geelong and the surrounding region as facing a long-term water supply shortfall. The possible options for providing water to meet this future shortfall include connection to the Melbourne water supply. The state government has announced as part of the June 2007 Water Plan that it intends to build a potable water connection between Melbourne and Geelong by 2012.

Kellogg Brown & Root Pty Ltd (KBR) was engaged by Barwon Region Water Corporation (Barwon Water) to prepare a concept and functional design of the pipeline scheme. The concept design found four feasible pipeline routes for investigation and assessment. A preliminary desktop environmental assessment of the four potential alignments for the potable water transmission pipeline between Werribee and north Geelong was undertaken. As a result of a risk assessment workshop in June 2007, the four options were reduced to two options—the proposed northern and southern alignments.

Preliminary assessments

Preliminary route studies and workshops were conducted on several alternative routes. As a result the northern route was chosen as the preferred option.

Preliminary flora and fauna survey

The key purpose of the preliminary flora and fauna survey was to clarify the flora and fauna issues for the proposed northern route, in particular the extent of intact remnant native vegetation likely to be impacted by the proposed pipeline alignment.

This preliminary assessment stated that the proposed pipeline placement was not expected to significantly impact upon native vegetation, vegetation communities or threatened species. If avoidance measures were taken, the potential impact on patches of native vegetation and important ecological features, such as waterways, would be further reduced.

As a result, a modified northern route was chosen in order to reduce the loss of significant roadside vegetation and numerous large trees.

Barwon Water subsequently requested KBR to undertake a detailed flora and fauna assessment along the modified northern route. This took the form of a detailed spring survey along the extent of the modified northern route in order to determine habitat values and the presence of species of conservation significance, and to assess the quantity and quality of native vegetation.

1.2 PURPOSE OF THE DETAILED ASSESSMENT

The purpose of the detailed flora and fauna assessment is to identify areas, species or issues that would require consideration during design and construction of the proposed water pipeline.

The objectives of this assessment were to:

- conduct background research and a review of state (Department of Sustainability and Environment) and national (Department of the Environment and Heritage) flora and fauna databases to determine the potential occurrence of significant flora and fauna species
- undertake field surveys in order to document the flora and fauna values of the proposed modified northern route, with particular regard to remnant patches, species of significance and potential habitat areas. Field surveys are conducted during spring as this is the optimal time for species identification
- review the implications of state and commonwealth biodiversity legislation as it relates to the pipeline, including the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Flora and Fauna Guarantee Act 1988* (FFG Act)
- make recommendations for any further environmental work that may be required if the modified northern route is chosen as the option for the placement of the water pipeline.

1.3 STUDY AREA

1.3.1 General study area description

The study area is located to the west of Melbourne, with the proposed pipeline commencing north-west of Werribee at Cowies Hill and then heading in a general south-west direction where it would terminate in the northern Geelong suburbs. The study area occurs within the Victorian Volcanic Plain bioregion and traverses both the Port Phillip and Westernport and Corangamite Catchment Management Authority areas.

The pipeline alignments (see Figure 1.1) are predominantly located within an agricultural landscape, crossing rural properties and residential areas surrounding the townships of Lovely Banks, Lara, and Cowies Hill, Werribee. The modified northern alignment study area also includes road side verges of Farras Road and Peak School Road, where the route diverges from the existing electricity easement.

The most common ecological vegetation class (EVC) for the region is plains grassland (EVC 132) which has a bioregional conservation status of endangered. Other EVCs with current records within the study area include plains grassland woodland (EVC 55), floodplain riparian woodland (EVC 56), creekline grassy woodland (EVC 68), stream bank shrubland (EVC 851) and hills herb-rich woodland (EVC 71). These EVCs all have a conservation significance of endangered.

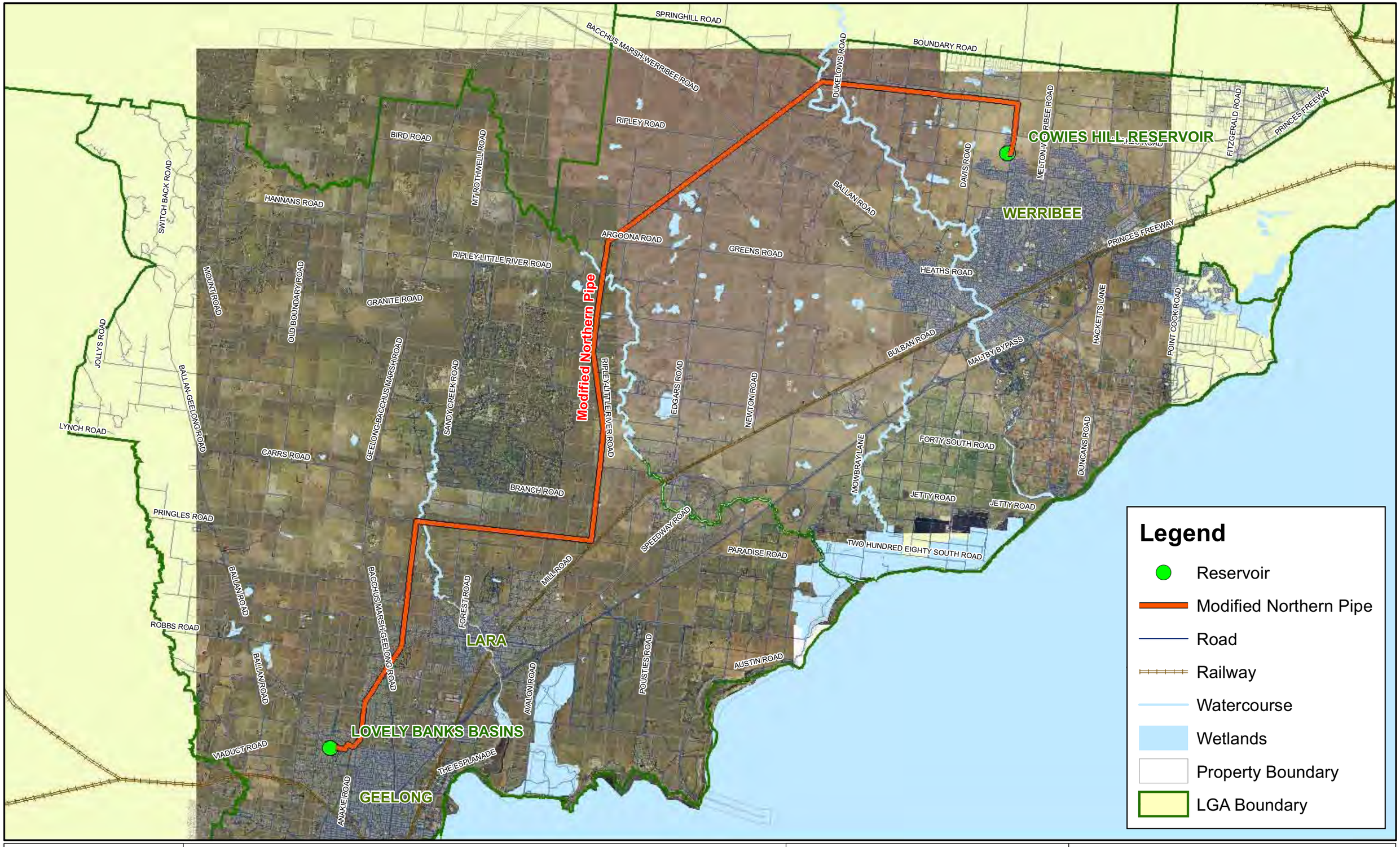
The proposed northern option would traverse the Werribee River, Little River, Hovells Creek and Lollypop Creek. The Werribee River is the major waterway in the surrounding area and flows into Port Phillip. Lollypop Creek is a small ephemeral creek which drains into the Werribee River. Little River is a small river which begins in the Brisbane Ranges and flows into Port Phillip. Hovells Creek begins south of the Brisbane Ranges and flows through the town of Lara to Port Phillip.

1.3.2 Modified northern route

The modified northern route begins at Cowies Hill reservoir and extends north along Tarneit Road to the easement for an existing 220 kV power transmission line. The route then follows the easement west until the Werribee River, where the easement heads south-west, prior to crossing the river. The proposed route then crosses Ballan Road and Lollypop Creek, then several private roads before diverting from the easement, heading south along an old property boundary and crossing the Little River north-east of Little River Earth Sanctuary.

The route diverts from the easement around the You Yangs Regional Park, continuing south along Farras Road, then heading west along Peak School Road, over Hovells Creek to where the easement crosses the road. The route then follows the easement, crossing Bacchus Marsh Road and crossing several residential properties and roads to an existing easement adjacent to the Geelong bypass freeway, where it then follows Plantation Road to Kulina Drive, then heads west along Eva Place, through a single residential property to the Lovely Banks Basins.

Hereafter, the modified northern route is described as the northern route.



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SOURCE : Barwon Water, Vicmap

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Level 3, 441 St Kilda Rd, Melbourne 3004

Prepared by Jimmy Cheruseril

TITLE

Barwon Water Interconnector Project

Environmental Assessment of
the Modified Northern Pipeline Option

FIGURE No. 1 **PROJECT No. MEG703**

Map No. **MEG703-G-MAP-031-A3** REVISION A

2 Methodology

2.1 DESKTOP INFORMATION SEARCH

A database review was conducted to establish the potential presence of species of conservation significance and vegetation communities, listed under the EPBC and FFG Acts occurring in the vicinity of the study area. Databases reviewed included the following:

- Department of Sustainability and Environment (DSE) Ecological Vegetation Class (EVC) mapping and benchmarks
- Department of the Environment and Heritage's (DEH) EPBC Act on-line database
- Flora Information System (FIS) and Atlas of Victorian Wildlife (AVW) database searches conducted by DSE
- Department of Sustainability and Environment (DSE) Sites of Biological Significance (Biosites) Maps and Reports.

2.2 FIELD SURVEY

2.2.1 Survey method

A detailed field survey was conducted along the northern route between 19 and 28 November 2007. Two ecologists conducted visual assessments of the route on foot.

Observations of the vegetation and habitat for significant flora and fauna species were made and recorded during the survey with a hand-held GPS recorder (Trimble, GeoExplorer XH, 2005). Data were entered directly into the GPS recorder and mapped with a GIS (ArcGIS) (Appendix A).

Data recorded during the field survey included:

- remnant patches of native vegetation, including the location and species composition
- scattered areas of native vegetation (smaller or of lesser quality than a patch)
- scattered native trees and shrubs not included in the above category
- observations of significant flora and fauna species
- observations of potential habitat for significant flora and fauna species
- locations of significant weed species.

A single flora species list is included in Section 3.2 and a fauna species list for the northern route is included in Appendix B. Planted and introduced native vegetation, although native species, were not recorded as removal does not require a permit.

Vegetation along the pipeline route was classed into three categories: remnant patch, scattered trees and degraded treeless vegetation, as outlined in *Victoria's Native Vegetation Management: A Framework for Action* (DNRE 2002). Each is discussed below.

2.2.2 Remnant patch

Areas that include > 25 per cent native understorey cover are classified as a remnant patch. Also, an area that includes three or more trees with a combined cover of > 20 per cent is classified as a remnant patch. For all remnant patches recorded, a habitat–hectare (hha) quality assessment is conducted.

Habitat–hectare assessments are conducted as outlined in the Vegetation Quality Assessment Manual (DSE 2004) by two qualified ecologists and are used in conjunction with the EVC benchmarks to quantify the quality of remnant native vegetation on site compared with its predicted quality prior to European settlement. Quality scores are included in Appendix C.

2.2.3 Scattered trees

Trees present along the route with < 20 per cent combined cover and < 25 per cent native understorey cover are classified as scattered trees. A scattered tree assessment was conducted on each individual tree, recording diameter at breast height (DBH), canopy health and the presence of hollows. All trees are recorded and mapped.

2.2.4 Degraded treeless vegetation

Vegetation that does not fall into the above two categories is classed as degraded treeless vegetation, that is areas with no trees and a native understorey cover of < 25 per cent. Scattered indigenous species and small remnant areas present in degraded treeless vegetation are recorded and mapped. A species list for each individual area is included in Appendix D.

2.3 ASSESSMENT AREA

2.3.1 General

The area assessed during the current survey was located along a power transmission line easement and along road reserves. Along the easement, the study area was located between the two outermost cables. Along the road reserves the area assessed was located between the edge of the road to 10 m beyond the property fence line. The extent of the area was based on previous impact areas for similar water pipelines.

The road reserves assessed during the current survey include the western side of Tarneit Road and Farras Road to Gifkins Road, then the eastern side of Farras Road to Peak School Road and along the southern side of Peak School Road.

2.3.2 Limitations

Victoria is currently suffering prolonged drought conditions. The diversity and abundance of flora species observed during field surveys are often reduced, although seeds of a number of flora species may be lying dormant in the soil awaiting more optimal conditions.

This is not considered a major limitation of the current assessment because the majority of the sites have been previously disturbed.

2.4 TARGETED SURVEY

As a result of the discovery of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) in the road reserves along Tarneit Road, Farras Road and Peak School Road during the detailed assessment, a targeted survey was undertaken for the species.

Pimelea spinescens ssp. *spinescens* is listed under the EPBC Act and the FFG Act. It is a low, spreading shrub which can grow to 30 cm tall. It has up to 12 small, unisexual yellow flowers and small, narrow, hairless, oval-shaped leaves. The spine-tipped stems distinguish it from other *Pimelea* spp. The species is endemic to Victoria and occurs in grasslands and open shrublands on the basalt plains of western Victoria.

The purpose of the targeted survey was to determine the presence of *P. s.* ssp. *spinescens* in the opposite road reserve to where it was observed during the detailed survey. If not recorded in this location the pipeline could potentially be placed on the opposite side of the road from the current proposed position.

The targeted survey was undertaken on 5 December 2007. This was an extension of the scope following the identification of the species during the detailed survey.

Habitat–hectare assessments were conducted in these areas, where there is > 25 per cent native understorey cover, to quantify any losses that may occur as a result of realigning the route. The quality results are included in Appendix C. Indigenous species in degraded treeless vegetation were also recorded and included in Appendix A. Habitat–hectare scores and indigenous species in degraded treeless vegetation are differentiated by Alternative (Alt.), within Appendices C and D, as an alternative option.

3 Survey results

3.1 OVERALL SITE CONDITION

The majority of the study area is degraded as a result of past and present agricultural activity (such as cropping, grazing, de-rocking), roadside management techniques, weed invasion and increasing pressure from the urbanisation of Lara and Werribee. The study area is dominated by agricultural land, primarily between Tarneit Road and Little River and road reserves, mainly along Farras Road and Peak School Road.

Sections of the route occurring on agricultural land, including between Tarneit Road and Little River and from Peak School Road to Patullos Road, have been cleared of indigenous vegetation and surface rock for grazing cattle and sheep and cropping. These sections are generally dominated by introduced grass species, with some scattered patches and areas of native vegetation representative of plains grassland EVC, occurring primarily within the smaller properties between Tarneit Road and Sewells Road, north of Cowies Hill.

The northern route is located along numerous road verges which are mainly adjacent to agricultural land, including Tarneit Road, Farras Road, Peak School Road, and several road crossings, such as Ballan Road. Along the roadsides there are several patches and areas of native vegetation occurring in the road reserve and extending into adjacent properties. The patches recorded are generally plains grassland vegetation EVC. Several scattered shrubs are also present in the road reserves and several large trees were recorded around Hovell Creek, where Peak School Road crosses the creek. Large sections along the roadsides are dominated by introduced grasses and planted trees and shrubs.

The study area around the residential area of Lara has also been cleared of indigenous vegetation, with residents using the power line easement for a variety of land uses, including vegetable growing, small paddocks for domestic animals, storage areas and maintained yards. The vegetation through this area is dominated by introduced grasses and herbs that occur on cropped land and in the rear yards of residents. However, scattered remnant patches of plains grassland vegetation were present. Several properties had planted vegetation between paddocks and along fence lines, the majority being non-indigenous native tree and shrub species.

At the beginning of the route north of Werribee, the surrounding area is currently being cleared for housing, with several houses in the adjacent land at Cowies Hill already erected.

3.2 FLORA

3.2.1 Survey results

A total of 95 indigenous flora species was recorded during the current survey (Table 3.1). The dominant species observed throughout the study area were groundcover species, mainly *Austrodanthonia* spp. (wallaby-grasses), most commonly *A. caespitosa* (common wallaby-grass), *A. racemosa* (slender wallaby-grass) and *A. eriantha* (hill wallaby-grass). Also prevalent are *Austrostipa* spp. (spear-grasses), including *A. bigeniculata* (tall spear-grass) and *A. curticoma* (spear-grass). Other grasses that commonly occur through the study area include *Themeda triandra* (kangaroo grass), *Bothriochloa macra* (red-leg grass) and *Walwhalleya proluta* (rigid panic).

The two herb species, *Oxalis perennans* (wood-sorrel) and *Convolvulus erubescens* (blushing bindweed) are the most common herbs observed over the study area. Other common herbs include *Enchyleana tomentosa* (ruby saltbush), *Acaena* sp. (sheep's burr) and *Haloragis heterophylla* (varied raspwort). Several small shrubs are present scattered along the study area, generally within remnant patches, such as *Atriplex semibaccata* (berry saltbush), *Einadia nutans* (nodding saltbush) and *Eutaxia diffusa* (shrub eutaxia).

Overstorey species are present in the study area in only two locations, one around the Werribee River and the other where the route crosses Hovell Creek at Peak School Road. The dominant species is *Eucalyptus camaldulensis* (river red gum) with *E. baueriana* (blue box) occurring along the Werribee River. Several shrub species are scattered over the study area, including *Acacia pycnantha* (golden wattle) and *A. implexa* (lightwood), generally found on roadsides, and *Melicytus dentatus* (shrub violet) was often recorded along fence lines.

Several patches of native vegetation and many areas of native vegetation that consisted of < 25 per cent native understorey cover are recorded throughout the study area. The majority of the patches and areas of native vegetation are predominantly the same or derived from the same plains grassland EVC along the entire northern route. Indigenous flora species recorded within areas of native vegetation with < 25 per cent native understorey cover have been recorded and mapped and are included in Appendix D.

Table 3.1 Indigenous species recorded in the study area

Scientific name	Common name
INDIGENOUS SPECIES	
Acacia implexa	Lightwood
Acacia mearnsii	Late black wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden wattle
Acacia retinodes var. *retinodes*	Wirilda
Acaena sp.	Sheep's burr
Asperula conferta	Common woodruff
Atriplex semibaccata	Berry saltbush

Table 3.1 Continued

Scientific name	Common name
Austrodanthonia auriculata	Lobed wallaby-grass
Austrodanthonia caespitosa	Common wallaby-grass
Austrodanthonia duttoniana	Brown-back wallaby-grass
Austrodanthonia eriantha	Hill wallaby-grass
Austrodanthonia geniculata	Kneed wallaby-grass
Austrodanthonia pilosa	Velvet wallaby-grass
Austrodanthonia racemosa	Slender wallaby-grass
Austrodanthonia setacea	Bristly wallaby-grass
Austrodanthonia richardsonii	Wallaby-grass
Austrodanthonia tenuior	Wallaby-grass
Austrostipa bigeniculata	Spear-grass
Austrostipa curticoma	Spear-grass
Austrostipa nodosa	Spear-grass
Austrostipa oligostachya	Spear-grass
Austrostipa scabra	Rough spear-grass
Baumea rubiginosa	Soft twig-rush
Bolboschoenus medianus	Marsh club-rush
Bothriochloa macra	Red-leg grass
Brachyscome dentata	Golden daisy
Bulbine sp.	Bulbine lily
Callistemon sieberi	River bottlebrush
Calocephalus citreus	Lemon beauty-heads
Calotis anthemoides	Cut-leaf burr-daisy
Carex sp.	Rush
Cassinia arcuata	Drooping cassinia
Centella cordifolia	Swamp pennywort
Centipeda cunninghamii	Sneeze-weed
Chielanthes austrotenuifolia	Rock fern
Chloris truncata	Windmill grass
Chrysocephalum apiculatum	Common everlasting
Convolvulus erubescens	Blushing bindweed
Correa glabra	Rock correa
Crassula helmsii	Swamp crassula
Crassula sieberiana	Sieber crassula
Dianella longifolia	Pale flax-lily
Dianella revoluta	Black-anther flax-lily
Dichondra repens	Kidney weed
Einadia nutans	Nodding saltbush
Eleocaris acuta	Common spike-rush
Enchylaena tomentosa	Ruby saltbush
Enneapogon nigricans	Niggerheads
Eryngium ovinum	Blue devil
Eucalyptus baueriana	Blue box
Eucalyptus camaldulensis	River red gum

Table 3.1 Continued

Scientific name	Common name
Euphorbia drummondii	Flat spurge
Eutaxia diffusa	Shrub eutaxia
Geranium sp.	Crane's bill
Goodenia sp.	Goodenia
Haloragis heterophylla	Varied raspwort
Juncus subsecundus	Finger rush
Lachnagrostis billardieri ssp. *billardieri*	Common blown-grass
Leptospermum lanigerum	Wooly tea tree
Lobelia alata	Angled lobelia
Lobelia pratiodes	Poison lobelia
Lomandra filiformis	Wattle mat-rush
Lomandra micrantha	Small-flowered mat-rush
Lythrum hysoppifolium	Small-flowered loose-strife
Mariena enchylaenoides	Wingless bluebush
Marselia costulifera	Narrow-leaf nardoo
Marselia drummondii	Nardoo
Melicytus dentatus	Shrub violet
Mimulus repens	Creeping monkey-flower
Muehlenbeckia florulenta	Tangled lignum
Nicotiana nicotiana	Native tobacco
Oxalis perennans	Wood-sorrel
Pelargonium australe	Austral storks-bill
Persicaria sp.	Knotweed
Phragmites australis	Common reed
Pimelea curviflora var. *sericea*	Curved rice-flower
Pimelea spinescens ssp. *spinescens*	Spiny rice-flower
Plantago gaudichaudii	Narrow-leaf plantain
Plantago varia	Variable plantain
Pleurosorus rutifolius	Blanket fern
Poa labillardieri var. *labillardieri*	Common tussock-grass
Poa sp.	Tussock-grass
Potamogeton sp.	Pondweed
Pseudognaphalium luteo-album	Jersey cudweed
Rhagodia parabolica	Fragrant saltbush
Rubus parviflorus	Small-leaf bramble
Rumex dumosus	Wiry dock
Sambucus gaudichaudiana	Native elderberry
Schoenoplectus validus	River club-rush
Schoenus apogon	Common bog-rush
Scleroleana murticata var. *murticata*	Five-spined saltbush
Themeda triandra	Kangaroo grass
Triglochin procera	Water ribbons
Triglochin striatum	Streaked arrow-grass
Walwhalleya proluta	Rigid panic

3.2.2 Ecological Vegetation Classes (EVC)

A review of the DSE mapping database identified four pre-1750 EVCs present in the study area:

- plains grassland (EVC 132)
- plains grassy woodland (EVC 55)
- low rise woodland (EVC 66)
- creekline grassy woodland (EVC 68).

Plains grassland was identified as the most dominant EVC within the study area, occurring across the entire northern route, except for an area of plains grassy woodland along Peak School Road, an area of low rise woodland around Werribee River and creekline grassy woodland surrounding Little River and Hovells Creek.

A review of the DSE mapping database for present EVCs indicated that the northern route traversed only a small area of creekline grassy woodland at Little River. No other EVCs were present along the proposed route. Several small isolated patches of the above EVCs were present in the surrounding area, as well as patches of stream bank shrubland along Werribee River.

Current EVCs recorded during the present survey, consisted of four different vegetation communities over the study area:

- low rainfall plains grassland (EVC 132_63)
- heavier-soils plains grassland (EVC 132_61)
- plains grassland/plains grassy woodland mosaic (EVC 897)
- stream bank shrubland (EVC 851).

3.2.3 Significant species

Four species of conservation significance were recorded during the current survey. A single listed species, *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) was recorded within the study area. The species is listed as critically endangered under the federal EPBC Act and is a listed species under the state FFG Act. The species was observed in the road reserves along Tarneit Road, Farras Road and Peak School Road (Appendix A).

Three Victorian rare or threatened (VROT) species were recorded within the study area. *Rhagodia parabolica* (fragrant saltbush) is listed as rare and was found within a small rocky outcrop of a small tributary of the Werribee River, to the west of the river (Appendix A). *Scleroleana murticata* var. *murticata* (five-spined saltbush) is listed as poorly known in Victoria and was recorded in several locations throughout the study area (Appendix A). The remaining species cannot be absolutely identified but is thought to be *Austrodanthonia richardsonii* (straw wallaby-grass), based on best knowledge, which is listed as vulnerable in Victoria and was found along several road verges (Appendix A). The species is herein referred to as *A. richardsonii* and is assumed to be a VROT species.

Also recorded within the study area on an escarpment west of the Werribee River, was a *Nicotiana* sp. (native tobacco). Several plants were present but could not be identified to species level. The two species found around Melbourne, *N. suaveolens* (Austral tobacco) and *N. maritima* (coast tobacco) are both listed as VROT species and the new record should be considered as such. Further work is required to properly identify the species.

3.3 FAUNA

A total of 48 fauna species was recorded during the current survey of which seven species are exotic (five bird and two mammal species). The majority of the indigenous species recorded are avian species, with 35 species observed. The remainder of recorded fauna species are three mammal species, two amphibians and a single reptile (Appendix B).

Avian species recorded over the study area are predominantly large open country birds which require little structural diversity of vegetation within their habitat (Johnson *et al.* 2007). The species include raptors, waterbirds and pastoral and paddock species. Raptor species include *Aquila audax* (wedge-tailed eagle), *Circus approximans* (swamp harrier) and *Falco peregrinus* (peregrine falcon). Waterbird species include *Anas superciliosa* (Pacific black duck), *Threskiornis spinicollis* (straw-necked ibis) and *Ardea pacifica* (white-necked ibis). Species that inhabit pastures and paddocks include *Corvus coronoides* (Australian raven), *Ocyphaps lophotes* (crested pigeon) and *Eolophus roseicapillus* (galah).

Three mammal species were recorded within the study area, *Macropus giganteus* (eastern grey kangaroo), *Tachyglossus aculeatus* (short beaked echidna) and evidence of *Hydromys chrysogaster* (water rat) was present around the Werribee River.

Amphibians present in the study area were the frog species *Limnodynastes dumerilii* (eastern banjo frog) and *Litoria ewingii* (brown tree frog), which were heard calling from low depressions and standing water. The single reptile species in the study area, *Lampropholis guichenoti* (garden skink) was observed often.

No fauna species listed under the state FFG Act or the federal EPBC Act were observed in the study area.

3.4 WEEDS

Two weeds of national significance (WONS) were recorded during the current survey. *Nassella trichotoma* (serrated tussock) was predominantly found within agricultural areas, with several large areas between Werribee River and Little River, but was recorded along the majority of the northern route. *Nassella neesiana* (Chilean needle-grass) was also present in the study area, particularly along the road reserves, where it occasionally dominated an area.

Several other significant and prohibited weeds were recorded during the present survey. These include *Nassella hyaline* (cane needle grass), which is not yet widespread in Australia (Richardson *et al.* 2006). Other weed species present include *Lycium ferocissimum* (African boxthorn), *Echium plantagenium* (Paterson's curse) and *Rosa rubiginosa* (briar rose). Locations of these and other weed species are included in Appendix A.

3.5 TARGETED SURVEY RESULTS

Pimelea spinescens ssp. *spinescens* (spiny rice-flower) was located within two of the three road reserves that were surveyed. Several scattered individuals are located along Peak School Road, with a single plant found within the adjoining property of Farras Road. No plants are present on the opposite road reserve along Tarneit Road (Appendix A).

Three hha assessments were conducted within the road reserves. All assessments were undertaken on patches along Farras Road. One patch assessed achieved very high conservation significance, with the two remaining patches achieving high conservation significance. All patches assessed were low rainfall plains grassland, which is considered an endangered EVC. A total of 0.18 hha was calculated for the loss of the three patches.

No patches were recorded along the northern side of Peak School Road. However, several areas and scattered indigenous species were present. The area also contained a line of planted *Eucalyptus cladocalyx* (sugar gum) within the adjoining property along the fence line.

Along Tarneit Road, several individuals of *Scleroleana murticata* var. *murticata* (five-spined saltbush) are recorded in the opposite road reserve. The species is listed as poorly known in the advisory list of VROT flora.

4 Discussion

4.1 FLORA

4.1.1 Quality assessment

A total of 25 hha assessments was conducted along the proposed northern route (Appendix C). All assessments but one were conducted as treeless vegetation communities, with 21 patches being two variants of plains grassland. Low rainfall plains grassland comprised 13 remnant patches and heavier-soils plains grassland totalled eight patches. Three remnant patches of plains grassland/plains grassy woodland were recorded along Peak School Road, with the remaining patch being stream bank shrubland located at the Werribee River.

The patches of low rainfall plains grassland were recorded west of the Werribee River, occurring within road reserves of Farras Road and Ballan Road and in residential areas of Lara. The patches of heavier-soils plains grassland were recorded east of the Werribee River, along the power line easement between Tarneit Road and Sewells Road.

All EVCs recorded within the study area have a conservation status of endangered. The lowest achievable score for endangered EVCs is high conservation significance. Of the 25 assessments undertaken, 19 of the patches achieved a conservation significance of high. The remaining six patches achieved very high conservation significance. Patches of very high conservation significance require ministerial approval for removal. All patches would require offsets to achieve a net gain for the loss of vegetation.

Remnant patches that received the highest scores (very high conservation significance) were all recorded within road reserves, except for a patch located on private land between Davis Road and Gard Road, north of Werribee. This patch achieved the highest overall score during the current survey (Appendix C). Of the patches in road verges, one occurred on Farras Road, two on Peak School Road and two on Ballan Road.

Overall, patches recorded throughout the study area were small and isolated, with very few patches present in the surrounding area, which is dominated by agricultural land. As a result the landscape context score for all patches was low.

A total of 1.82 hha would be required to offset the loss of 1.04 hha recorded in remnant patches along the current alignment of the proposed northern route (DNRE 2002). Losses are to be offset within the same EVC. Currently the following would be required for each EVC:

- 0.86 hha for plains grassland (applies to both low rainfall and heavier-soils communities)
- 0.15 hha for plains grassland/plains grassy woodland mosaic
- 0.03 hha for stream bank shrubland.

A total of 0.47 hha is of very high conservation significance, with 0.57 hha of high conservation significance. This requirement would be likely to change once the final route is chosen and certain patches can be avoided.

'Best 50 per cent of habitat' (DNRE 2002) for *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) remains in two remnant patches because of the higher quality of the two patches. Loss of these patches would require habitat management specifically for the species. However, the loss of these patches should be avoided and therefore offsets would not required.

4.1.2 Scattered trees

A total of eight scattered trees was recorded over the northern route (Table 4.1). All of the scattered trees recorded within the study area are present along Peak School Road around Hovell Creek (Appendix E).

Table 4.1 Scattered trees recorded in the study area

	Characteristics		
Species	Diameter at breast height (cm)	Health (projective foliage cover) (%)	Trees to be replaced (no.)
Allocasuarina verticillata	25	40	12
Eucalyptus camaldulensis	21	50	8
Acacia mearnsii	10	40	6
Eucalyptus camaldulensis	35	25	24
Eucalyptus camaldulensis	40	55	30
Eucalyptus camaldulensis	38	55	28
Eucalyptus camaldulensis	26	50	14
Eucalyptus camaldulensis	21	55	8

All trees recorded within the study area are considered small trees (< 0.75 per cent of the benchmark large tree size) and default to a low conservation significance. A replacement rate for scattered small trees is specified in the Corangamite Native Vegetation Strategy. A total 130 trees would need to be recruited for the loss of scattered trees over the study area. This total may change if the loss of some trees is avoided.

4.1.3 Indigenous vegetation

No offsets are needed to compensate for any loss of native vegetation within degraded treeless vegetation. However, a permit to remove native vegetation within these areas would be required. Several areas of native vegetation are identified throughout the northern route, many of which were marginally below the threshold of > 25 per cent native understorey cover that defines a patch. Some of the areas that appeared to have > 25 per cent native understorey cover were too small to warrant a hha assessment.

Indigenous vegetation is generally scattered across the study area, occurring predominantly in either remnant patches or areas. Some scattered individuals of indigenous vegetation do occur in vegetation dominated by exotics and are generally trees or shrubs.

Indigenous vegetation throughout the study area generally occurs on previously disturbed land, with many sites de-rocked. Many of these areas have been recolonised by a small suite of indigenous grasses, in particular *Austrodanthonia ceaspitosa* (common wallaby-grass), *A. racemosa* (slender wallaby-grass) and *Austrostipa bigeniculata* (tall spear-grass), and two common herbaceous species, *Convolvulus erubescens* (blushing bindweed) and *Oxalis perennans* (wood-sorrel). Continued dry weather conditions have favoured these indigenous species, out-competing exotic species in areas to form patches.

All remnant patches of indigenous vegetation should be avoided where possible. This would reduce the amount and cost of offsets to compensate for losses. Remnant patches should be fenced off and subject to appropriate protection measures prior to any construction works in the area.

4.1.4 Flora of significance

One species, *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower), listed under both the EPBC Act and the FFG Act, was recorded several times throughout the study area. The species is considered to be critically endangered in Australia and vulnerable in Victoria. Any construction works in the vicinity of the federally listed species are likely to trigger an EPBC Act referral. The species should be avoided at every location. Large portions of the plant biomass are underground (DSE 2003b), and translocation of the plant is known to be difficult and largely unsuccessful.

Rhagodia parabolica (fragrant saltbush), *Scleroleana murticata* var. *murticata* (five-spined saltbush) and *Austrodanthonia richardsonii* (straw wallaby-grass) are listed on the advisory list of rare or threatened flora in Victoria (DSE 2005a). *Scleroleana murticata* var. *murticata* is the most common of these species, occurring often over the study area, with *A. richardsonii* also occurring in several scattered locations. *Rhagodia parabolica* is recorded in a single location, west of the Werribee River within a small escarpment.

Construction works should avoid the above species where possible, erecting temporary fencing where required to protect significant species. The single record of *R. parabolica* should be avoided because it occurs on the outer edge of the study area, within a small escarpment. The remaining two species are scattered over the study area. If avoidance is not possible, the species should be propagated from seed or cuttings. This should be undertaken in conjunction with a local nursery.

The *Nicotiana* sp. (native tobacco) present in the study area on an escarpment should be avoided. Operational issues may divert the alignment away from the species because of the steepness of the escarpment. The species should be managed in the same way as the above VROT species.

Several flora of significance are predicted to occur or have past records in the general study area (potential occurrence of significant species is included in Appendix E). Few recent records exist for significant species in the general vicinity of the study area as the majority of habitat has been cleared for grazing and cropping. Remaining habitat has been reduced to small, isolated areas or along linear corridors, which are subject to intense edge effects, such as invasion by pest plants and animals.

4.2 FAUNA

4.2.1 General

The proposed placement of a water pipeline along the northern route is not predicted to significantly impact upon any fauna species.

4.2.2 Significant species

No state or federally listed fauna species were recorded during the current survey.

Riparian habitat along the Werribee River may provide potential habitat for *Litoria raniformis* (growling grass frog), which has past records in the area (BLA 2006). This species is listed under the FFG Act and the EPBC Act.

Several areas of natural rock and rocky outcrops occur throughout the area. These may provide potential habitat for *Delma impar* (striped legless lizard), particularly where indigenous grasses occur with natural rocky areas. This species is listed under the FFG Act and the EPBC Act.

Targeted surveys for these threatened fauna are recommended in order to clarify the potential impact of pipeline construction on these species. Boring the pipeline underneath waterways and the placement of the pipeline along the route to avoid indigenous vegetation and habitat would reduce impacts on threatened fauna species.

Further mitigation measures would be required if these species were located within the study area, or if they were considered to have a high likelihood of occurrence.

Several significant fauna species are predicted to occur or have past records in the general study area (potential occurrence of significant species is included in Appendix E). Potential habitat for significant species is greatly reduced in the study area to small, isolated patches in a degraded agricultural landscape.

4.2.3 Fauna habitat

Habitat for significant fauna species has been greatly reduced in the vicinity of the study area. The majority of available habitat is open paddocks and cropped areas which contain little indigenous vegetation and no structurally diverse habitat. Habitat within the study area is most suitable to large open country and predatory bird species. Some species of waterbirds may occasionally overfly the site given its close proximity to several wetlands, including a RAMSAR site on the western Port Phillip shoreline.

Vegetation along Werribee River provides the most structurally diverse habitat within the study area. Several large trees are located in the riparian zone of the river within the study area, as are a number of medium to tall shrubs. The groundcover layer is mostly dominated by exotic species and several exotic species are also present in the shrub layer. The vegetation continues along the river in both directions from the study area, providing a significant habitat corridor in the landscape.

The large trees present at the site contain several hollows that show signs of continued use by arboreal mammal species. Hollows provide a valuable resource for several bird and mammal species (including senesced trees) and are scarce in the landscape. Several small woodland birds were observed utilising the vegetation surrounding the river, which included nests present in some shrubs. The Werribee River is a permanent water feature and the presence of several aquatic vegetation species provides potential habitat for several frog and possibly fish species.

Several large trees are also present along Hovell Creek, however none were located within the study area. The surrounding large trees provide important habitat features for several species, which may pass through or over the study area at Hovell Creek. At the time of the survey the creek contained water and several *Litoria ewingii* (brown tree frog) were heard calling. The creek provides potential habitat for frog species, which may also use the creek as a habitat corridor.

Two escarpment areas are located within the study area to the west of Werribee River. Both are ephemeral waterways that drain into the Werribee River. The smaller, eastern most escarpment begins within the study area and heads south to the river. This escarpment contains an animal burrow at the base of the drainage area and numerous rocky ledges and crevices, providing potential habitat for several reptile species.

The second escarpment lies approximately 500 m west of the first escarpment. This site is dominated by weed species, but also contains several indigenous species. The western escarpment is particularly steep and contains several rock ledges and crevices, suitable for reptile habitat. The eastern escarpment is not as steep within the study area, however immediately north of the escarpment is a steep cliff face.

The presence of grassland patches within the northern route may provide habitat for a limited suite of terrestrial species due to the isolated nature of the patches. Reptile species will be most suited to these patches, particularly areas that contain rocks and cracking earth used for shelter (DSE 2003a).

4.3 SIGNIFICANT WEED SPECIES

Several large patches of significant weed species were recorded within the study area. The dominant weed species recorded in the study area is a weed of national significance (WONS), *Nassella trichotoma* (serrated tussock). This occurs often throughout the study area particularly along the easement between the Werribee River and the Little River. Another significant weed occurring within the study area is *Nassella neesiana* (Chilean needle-grass), which is also a WONS (Blood 2001) and is most prolific along roadsides. These two species are also identified as prohibited species under the *Catchment and Land Protection Act 1994* (CALP Act) and require specific management from land managers.

The presence of the above two nationally significant weed species, along with other prohibited weeds listed under the CALP Act, such as *Lycium ferocissimum* (African boxthorn) and *Echium plantagineum* (Paterson's curse), will need to be managed prior to and during construction.

Prior to construction, suitable and effective control of areas of WONS and other prohibited weed species should occur. During construction, clean construction techniques would be required to prevent the spread of weed species within or beyond the study area.

4.4 WATERWAYS

The proposed pipeline would cross the Werribee River, Little River, Lollypop Creek and Hovell Creek. During the current survey all waterways contained water, except for Lollypop Creek.

The main waterway within the study area is the Werribee River. It is situated at the bottom of steep escarpments, which occur either side of the river. Both escarpments are almost exclusively covered with introduced species, such as *Lycium ferocissimum* (African boxthorn), *Nassella neesiana* (Chilean needle-grass) and *N. trichotoma* (serrated tussock). *Oryctolagus cuniculus* (European rabbit) was present at the site and has had a negative impact on much of the ground layer vegetation, leaving large areas of exposed soil. At the bottom of the escarpment along the riparian zone of the river there is relatively intact remnant indigenous vegetation, including large trees. All large trees present at the site should be protected from construction prior to undertaking works.

The vegetation around Little River within the study area is located on short, steep escarpments which occur on either side of the river. The site indicates previously mapped EVC vegetation but is highly degraded and currently dominated by introduced vegetation, both in-stream and along the riparian zone. Very little indigenous vegetation is present at the site.

The area around Lollypop Creek is mapped as a biosite. The site is dominated by natural rock and *Nassella neesiana* (Chilean needle-grass). The creek lies within a grazed paddock and has been greatly modified from its natural condition.

Hovell Creek contained several scattered trees in the riparian zone. Several large trees occur outside of the study area scattered along the creek. Overall, the site is degraded, with the vegetation dominated by introduced grasses.

There are legal requirements for construction at all waterways to be managed so that it minimises impact on potential habitat areas and water quality. These include the *Environment Protection Act 1970* and the State Environmental Protection Policy (Waters of Victoria).

5 Legislation and statutory requirements

5.1 INTRODUCTION

The implications of state and federal government legislation affecting the species and environments identified during this assessment are discussed below.

5.2 COMMONWEALTH LEGISLATION

5.2.1 Environment Protection and Biodiversity Conservation Act

One species listed under the EPBC Act has been identified on the northern route, *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower). Under the EPBC Act, unless exempt, actions require approval from the Federal Environment Minister if they significantly impact on a 'matter of national environmental significance'. Any action that will or is likely to have a significant impact on a matter of national environmental significance triggers the Act and requires approval from the Federal Environment Minister to proceed. The onus is on the proponent to make a referral with supporting documentation to the Minister. Conditions may be attached to any approval issued by the Minister, in the form of a 'controlled action'.

For the current placement of the proposed route, the locations of *P. s.* ssp. *spinescens* will most likely trigger an EPBC Act referral, which is advisable for this proposal. However, ministerial approval is unlikely to be required if appropriate protection and mitigation measures are documented in the referral and are implemented prior to and during construction (refer to Section 6.1). The referral should examine the potential for *Litoria raniformis* (growling grass frog) and *Delma impar* (striped legless lizard) to occur in the study area.

5.3 STATE LEGISLATION

5.3.1 Flora and Fauna Guarantee Act

Several protected flora species were identified during the current survey. A permit is required under the FFG Act from DSE if any works or other activities on public land 'might kill, injure or disturb' protected native flora. The proposed project is predicted to impact upon several protected species, hence a permit is required from DSE for the removal of protected flora.

A single threatened community listed under the Act is identified along the proposed route. Plains grassland is the dominant EVC within the study area and is listed as threatened under Western (Basalt) Plains Grasslands Community. The proposed project is expected to impact upon several patches of the community and a separate permit is required from DSE for its removal.

5.3.2 Planning and Environment Act

A planning permit will be required from the relevant local councils, Wyndham City Council and the City of Greater Geelong, to remove native vegetation.

A planning permit is required under the *Planning and Environment Act 1987* to remove, destroy or lop native vegetation on a landholding greater than 0.4 ha. Applications under the Act must have regard to Victoria's Native Vegetation Management Framework (DNRE, 2002). The framework is the state government policy for the protection, enhancement and restoration of native vegetation in Victoria. The aim of the policy is a reversal, across the whole landscape, of the long-term decline in the extent and quality of native vegetation, leading to a net gain.

The intention of the framework is to investigate all options for avoiding impacts or, if that is not possible, for minimising the removal of native vegetation. If vegetation removal is unavoidable, then a net gain assessment is required to determine what actions would offset losses, which are measured in hha (a measure of the quality and quantity of native vegetation). Offsets are improvements in the quality or extent of native vegetation in another area, as compensation for the loss of the area that would sustain impacts.

Remnant patches and scattered trees that would require consideration under Victoria's Native Vegetation Management Framework are outlined in Section 4.

6 Conclusions and recommendations

6.1 THE NORTHERN ROUTE

While the overall study area is largely degraded, there are numerous small and isolated patches of remnant native vegetation along the proposed route. The patches recorded and assessed vary greatly in quality, but generally comprise the same suite of species, which in most patches are likely to have recolonised these areas following prior disturbance.

The current proposed route should be reviewed based on the findings of this report to avoid and minimise impacts on patches of native vegetation wherever possible. Particular importance should be placed upon avoiding and protecting patches of very high conservation significance. For the current proposed route, it is predicted that 1.82 hha would be required to offset the losses of native vegetation. However, it is expected that further revision of the route will occur. Once the route is finalised, offset targets would need to be recalculated for each EVC. Currently 0.86 hha of plains grassland, 0.15 hha of plains grassland/plains grassy woodland mosaic and 0.03 hha of stream bank shrubland are predicted to be lost through the proposed alignment. All offsets are to be negotiated with the local council and DSE and are to occur within the Victorian volcanic plains bioregion.

The small population of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower) along Peak School Road and scattered individuals along Farras Road and Tarneit Road should be protected and avoided by the alignment of the pipeline. The targeted survey showed that no plants were present along the opposite side of Tarneit Road and only a single plant was present on the opposite side of Farras Road within the adjoining property. Several scattered individuals were located along the opposite side of Peak School Road.

It is recommended that the pipeline should be placed on the eastern side along Tarneit Road and west of Farras Road, where *P. s.* ssp. *spinescens* has been recorded. A patch of very high conservation significance was recorded on this side, located in the adjoining property along Farras Road. The construction impact zone should be reduced to avoid this patch, which contains the solitary *P. s.* ssp. *spinescens*, as it did not extend into the road reserve. Several individuals of *Scleroleana murticata* var. *murticata* (five-spined saltbush) are present on the opposite side of Tarneit Road where *P. s.* ssp. *spinescens* occurs. Propagation of these plants should occur if this section is chosen for realignment.

The proposed pipeline should occur to the north of Peak School Road where *P. s.* ssp. *spinescens* is present on the southern side. Although the species is present along the northern verge, it is significantly less abundant. The placement of the pipeline should avoid these plants through means such as boring under plants, or diverting around the species. No remnant patches are present along the northern side of Peak School Road.

Given the presence of large old trees and a patch of remnant vegetation at Werribee River, it is highly recommended that boring should occur under the waterway. It is recommended that the open-cut trenching method should be used along the escarpment, then boring should begin on the lower tier, above the riparian zone, and finish above the riparian zone, beyond the tree-line, on the opposite bank. The area above the riparian zone is highly degraded and largely devoid of indigenous vegetation.

The remaining waterways in the study area, Little River, Hovell Creek and Lollypop Creek are highly degraded waterways with very little indigenous vegetation present at each site. Because of their degraded nature these waterways may be ecologically suitable for open trenching. However, further assessment is required and consultation must occur with the relevant authorities to minimise any potential impacts within the receiving waters.

6.2 RECOMMENDED CONSTRUCTION MITIGATION MEASURES

6.2.1 Introduction

The following mitigation measures are recommended to mitigate significant environmental impacts of the proposed project. Mitigation measures are not limited to the following recommendations.

6.2.2 Native vegetation management

- Avoid patches of native vegetation and scattered trees where possible.
- Where avoidance is not possible, minimise the extent of native vegetation removal.
- Develop a vegetation management plan prior to construction. This plan should include native vegetation management and detailed protection measures.
- Avoid damage to and protect all individuals of *Pimelea spinescens* ssp. *spinescens* (spiny rice-flower). Protection measures should be included in the vegetation management plan.
- Avoid the three VROT species, and *Nicotiana* sp. (native tobacco), where possible. Where it is not possible to avoid plants, propagation from seeds or cuttings of the species is to occur. These plants may be introduced back to the site after construction.
- Avoid riparian vegetation along the Werribee River by boring under the waterway. Boring's to begin on the lower tier of the escarpment, immediately beyond the riparian vegetation.
- Rehabilitate disturbed patches and areas of native vegetation with seeds collected from the study area, cuttings from the proposed route and the planting of indigenous forbs and shrubs of plains grassland communities that were not present at the site prior to construction. This should include the propagation of VROT species. Rehabilitation should be outlined in the vegetation management plan, with negotiation and approval from DSE.

6.2.3 Fauna

- A local wildlife carer is to be on call during the construction works.
- Trenches are to be open for a minimum amount of time.
- Fences are to be erected along sections of open trenches when works are not occurring.
- DSE is to be advised if any native fauna species requires to be moved away from the construction site, prior to and during construction
- Targeted searches for significant species are to be undertaken.

6.2.4 Soil management

- Remove top soil and stockpile it separately from other excavated material. The use of top soil should be included in the rehabilitation plan.
- Dispose of excess excavated materials appropriately.
- Install appropriate sediment controls prior to works and maintain them during and after construction in accordance with EPA Victoria requirements.

6.2.5 Weed management

- Include weed management in the vegetation management plan. The plan should cover weed control prior to and during construction and identify clean construction techniques. Weed control should occur in spring the year before construction (Corr 2003).

6.2.6 Plant, vehicles and stockpiles

- Limit parking of construction and non-construction vehicles to designated areas. These areas are to be identified prior to construction by a qualified ecologist or botanist.
- Site stockpiles away from areas and patches of native vegetation, waterways, floodplains and drainage lines. Suitable stockpile sites are to be identified prior to construction by a qualified ecologist or botanist.
- Restrict plant and vehicle movements to designated disturbed areas and current vehicle tracks and roads.

7 Bibliography

Blood, K. 2001, *Environmental weeds, a field guide for SE Australia*. The Cooperative Research Centre for Weed Management, Victoria.

BLA 2006, *Brooklyn Lara pipeline project, flora and fauna assessment*. Prepared by Brett Lane & Associates for Enesar Consulting on behalf of GasNet, Victoria.

Carter, O. and Walsh, N. 2006, *National recovery plan for the spiny rice-flower* Pimelea spinsecens *subsp*. spinescens. Department of Sustainability and Environment, East Melbourne.

Corangamite Catchment Management Authority 2006, *Corangamite Native Vegetation Plan 2003–2008*. Corangamite Catchment Management Authority, Colac.

Corr, K. 2003, *Revegetation techniques: a guide for establishing native vegetation in Victoria*. Greening Australia Victoria, Heidelberg, Victoria

DEWR 2007, EPBC Act protected matters search tool (online). Department of Environment and Water Resources, Canberra.

DNRE 2002, *Victoria's native vegetation management: a framework for action*. Department of Sustainability and Environment, East Melbourne.

DSE 2003a, Action Statement No. 17, Striped Legless Lizard *Demar impar*. Department of Sustainability and Environment, East Melbourne.

DSE 2003b, Action Statement No. 132, Spiny Rice-flower *Pimelea spinsecens* subsp. *spinescens*. Department of Sustainability and Environment, East Melbourne.

DSE 2004, Vegetation quality assessment manual: guidelines for applying the hha scoring method. Department of Sustainability and Environment, East Melbourne.

DSE 2005a, *Advisory list of rare or threatened flora in Victoria—2005*. Department of Sustainability and Environment, East Melbourne.

DSE 2005b, BioSites maps and reports-Port Phillip Region. Sites of biodiversity significance (BioSites) and ecological vegetation classes (EVCs). Department of Sustainability and Environment, East Melbourne.

DSE 2006, *Sustainable water strategy: central region*. Department of Sustainability and Environment, East Melbourne.

DSE 2007, *Advisory list of threatened vertebrate fauna in Victoria—2007*. Department of Sustainability and Environment, East Melbourne.

DSE 2007, Atlas of Victorian Wildlife. Department of Sustainability and Environment, East Melbourne.

DSE 2007, *Flora information system*. Department of Sustainability and Environment, East Melbourne.

KBR 2007, *Melbourne–Geelong interconnector pipeline—preliminary environmental assessment*. Prepared by Kellogg Brown & Root Pty Ltd on behalf of Barwon Region Water Authority.

Johnson, M., Reich, P. and MacNally, R. 2007, 'Bird assemblages of a fragmented agricultural landscape and the relative importance of vegetation structure and landscape pattern', *Wildlife Research*, 34(3).

Richardson, F.J., Richardson, R.G. and Shepherd, R.C.H. 2006, *Weeds of the south-east, an identification guide for Australia*. R.G. and F.J. Richardson, Victoria.

Simpson, K., Day, N. and Trusler, P. 2004, 7th Ed. *Field guide to the birds of Australia*. Viking, Ringwood, Victoria.

Walsh, N. G. and Entwisle, T. J. (Eds.) 1996, *Flora of Victoria: ferns and allied plants, conifers and monocotyledons*, Volume 2. Inkata Press, Melbourne.

Walsh, N. G. and Entwisle, T. J. (Eds.) 1996, *Flora of Victoria: dicotyledons: winteraceae to myrtaceae*, Volume 3. Inkata Press, Melbourne.

Walsh, N. G. and Entwisle, T. J. (Eds.) 1996, *Flora of Victoria: dicotyledons: cornaceae to asteraceae*, Volume 4. Inkata Press, Melbourne.

Appendix A

MAPS

DOHERTYS ROAD
DAVIS ROAD
TARNEIT ROAD
DRY CREEK
Biosite 4616: Skeleton Creek - upper reaches
Patch 8
Patch 6
Patch 7
Area 7
Patch 5
Patch 4
Five-spined saltbushscleroleana murticata
04.000KM
Patch 3
Area 6
Area 5
03.500KM
Patch 2
03.000KM
Area 4
Area 3
02.500KM
Area 2
Patch 1
Spiny rice-flower
Modified Northern Pipe
02.000KM
01.500KM
Five-spined saltbush
Area 1
01.000KM
LEAKES ROAD
EVC: 132 Plains Grassland
Biosite 4620: Sewells Road Dams - Leakes Road
BLUE JAY CRESCENT
MOCKINGBIRD DRIVE
KINGBIRD AVENUE
VESPER AVENUE
BLACKBIRD STREET
HUMMINGBIRD BOULEVARD
00.500KM
00.000KM
CRISSA STREET
LAURENCE WAY
EDMUND DRIVE
FELICITY DRIVE
GISELLE GROVE
HAMISH DRIVE
BONITA AVENUE
DANFIELD DRIVE
BILGA WALK
CARBINE AVENUE
RAMONA COURT

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

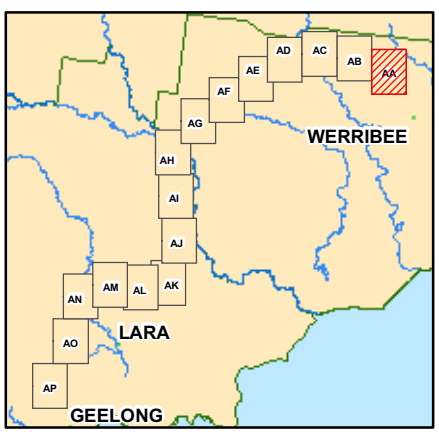
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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DATE Oct 23, 2009

Kellogg, Brown & Root Pty Ltd

KBR

Kellogg, Brown & Root Pty Ltd ABN 91 007 660 317

Level 3, 441 St Kilda Rd, Melbourne 3004

Prepared by Nerida Wilson

TITLE

Barwon Water Interconnector Project

Enviromental Assessment of the Modified Northern Pipeline Option

MAP No. AA

PROJECT No. MEG703

Map No. MEG703-G-MAP-032-B

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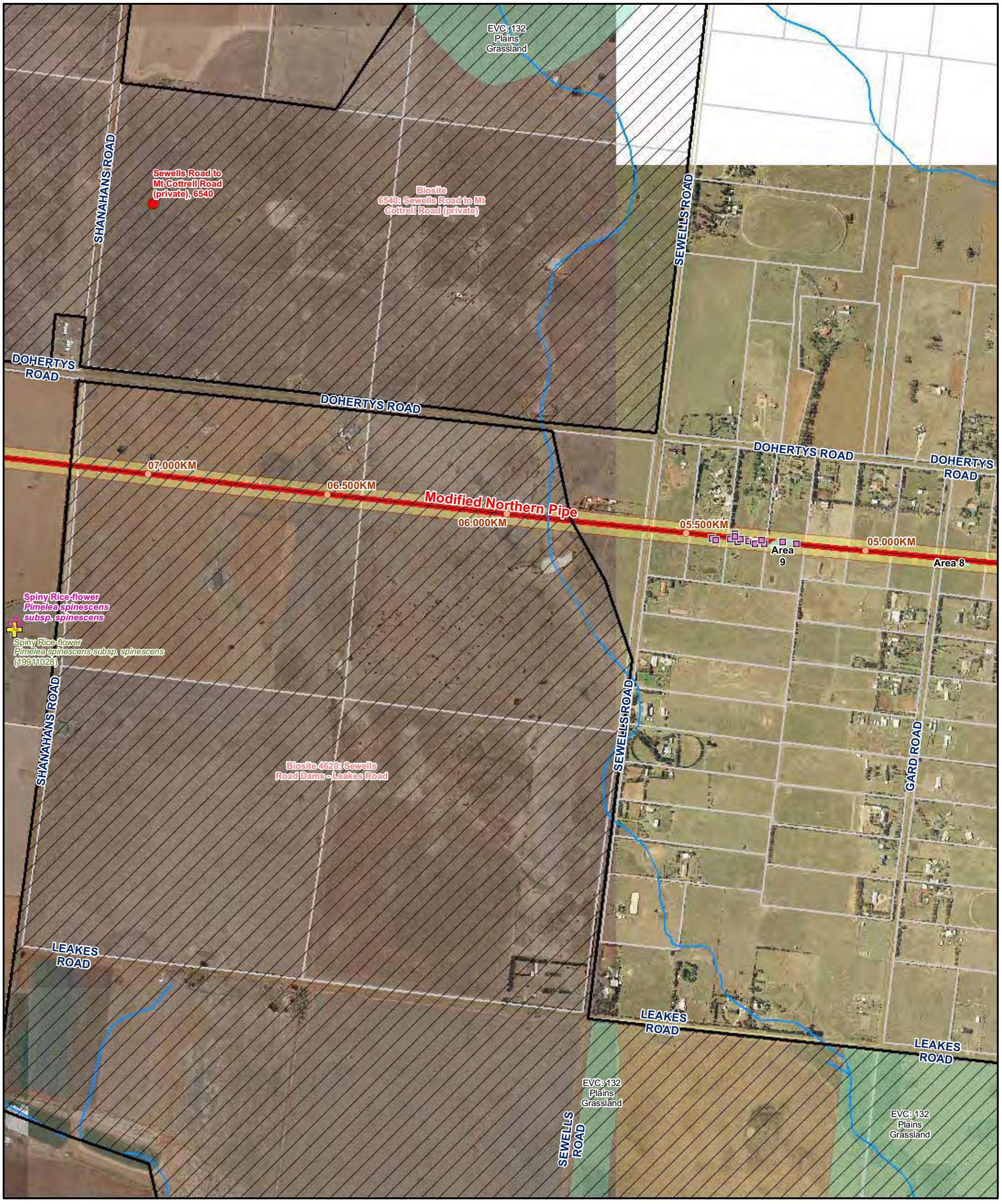


Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

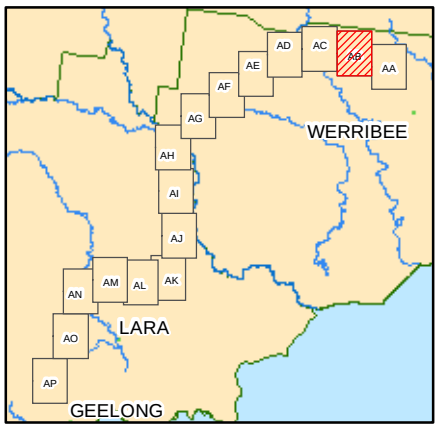
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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Map No. MEG703-G-MAP-032-B

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DUKELOWS ROAD
MOUNT COTTRELL ROAD
DOHERTYS ROAD
DOHERTYS ROAD
DOHERTYS ROAD
Biosite 6540: Sewells Road to Mt Cottrell Road (private)
10.000KM
09.500KM
09.000KM
08.500KM
08.000KM
07.500KM
Modified Northern Pipe
DUKELOWS ROAD
COBBLEDICKS FORD ROAD
EVC : 56 Floodplain Riparian Woodland
Fat-tailed Dunnart (*Sminthopsis crassicaudata*)
Biosite 4619: Werribee River - Cobbledick Ford (Old BioSite no. 1308 & -9, old site 07A247 & 8)
WERRIBEE RIVER
Buloke *Allocasuarina luehmannii* (19930801)

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

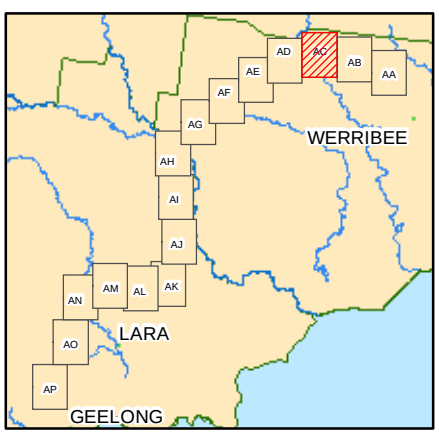
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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Biosite 5133: Green Hill (Mount Mary)

SPRINGHILL ROAD

Biosite 4517: Eynesbury Estate (old Biosite no. 3600,)

DOHERTYS ROAD

10.500KM

11.000KM

Patch 10

Shrub violet

Shrub violet

EVC: 55 Plains Grassy Woodland

EVC: 55 Plains Grassy Woodland

EVC: 55 Plains Grassy Woodland

EVC: 55 Plains Grassy Woodland

EVC: 851 Stream Bank Shrubland

11.500KM

EVC: 55 Plains Grassy Woodland

EVC: 55 Plains Grassy Woodland

Area 10

12.000KM

EVC: 851 Stream Bank Shrubland

Native tobacconative tobacco

Native tobacco native tobacco

Native tobacco native tobacco

WERRIBEE RIVER

Biosite 4619: Werribee River - Cobbledick Ford (Old BioSite no. 1308 & -9, old site 07A247 & 8)

12.500KM

Modified Northern Pipe

EVC: 56 Floodplain Riparian Woodland

13.000KM

EVC: 895 Escarpment Shrubland

13.500KM

COBBLEDICKS FORD ROAD

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

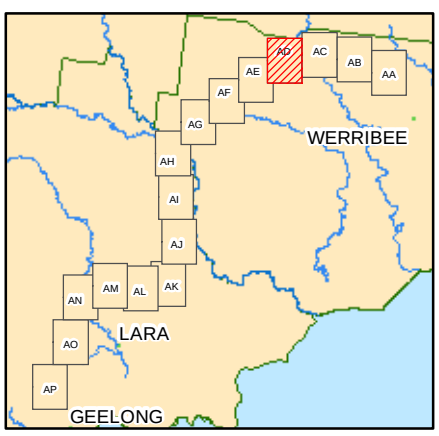
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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Biosite 5133: Green Hill (Mount Mary)

Biosite 4619: Werribee River - Cobbledick Ford (Old BioSite no. 1308 & -9, old site 07A247 & 8)

MT MARY ROAD

BALLAN ROAD

13.500KM

14.000KM

14.500KM

Modified Northern Pipe

Patch 11

Patch 12

15.000KM

RIPLEY ROAD

BALLAN ROAD

Plains-wanderer (*Pedionomus torquatus*)

15.500KM

16.000KM

Biosite 4595: Lollypop Creek - middle and upper reaches

BALLAN ROAD

16.500KM

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

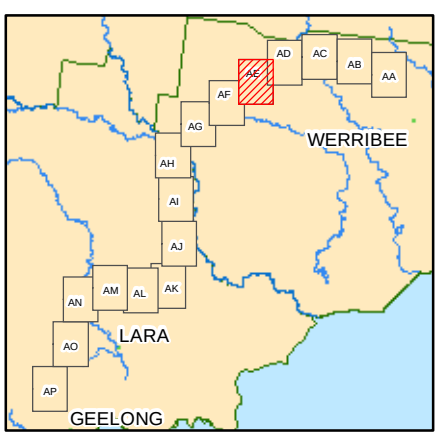
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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EDGARS ROAD
16.500KM
17.000KM
QUANDONG ROAD
QUANDONG ROAD
17.500KM
Modified Northern Pipe
18.000KM
LOLLYPOP CREEK
18.500KM
MIDDLE ROAD
19.000KM
19.500KM
Australasian Shoveler (*Anas rhynchotis*)
Black Falcon (*Falco subniger*)
Plains-wanderer (*Pedionomus torquatus*)
Fat-tailed Dunnart (*Sminthopsis crassicaudata*)
EVC: 74 Wetland Formation
Biosite 5147: Rabbiters Lake (GRASS VVP252)
Red-chested Button-quail (*Turnix pyrrhothorax*)
Rabbiters Lake (GRASS VVP252), 5147
EVC: 104 Lignum Wetland
EDGARS ROAD
Biosite 4595: Lollypop Creek - middle and upper reaches
Musk Duck (*Biziura lobata*)
Spotted Harrier (*Circus assimilis*)
Wetland Blown-grass *Lachnagrostis filiformis var. 2*
Wetland Blown-grass *Lachnagrostis filiformis var. 2* (19900619)
Wetland Blown-grass *Lachnagrostis filiformis var. 2* (19900619)
Biosite 5148: Rabbiters Swamp (GRASS VVP252)
EVC: 104 Lignum Wetland

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

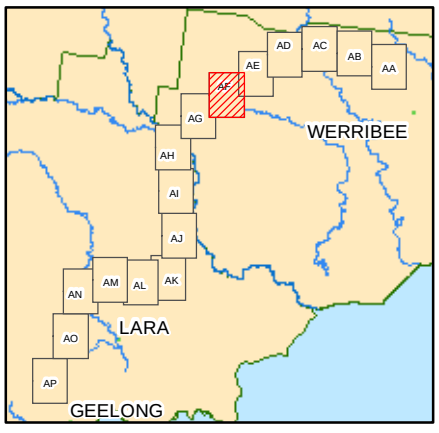
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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MAP No. AF

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MARTINS ROAD
MIDDLE ROAD
19.500KM
20.000KM
20.500KM
Modified Northern Pipe
21.000KM
21.500KM
22.000KM
Curved Rice-flower
Pimelea curviflora var. aff. subglabrata
(19900619)
EVC: 104
Lignum
Wetland
Biosite 5148:
Rabbiters Swamp
(GRASS VVP252)
Five-spined saltbush
Area 11
Area 12
ARGOONA ROAD
22.500KM
Area 13
Five-spined saltbush
Five-spined saltbush
Five-spined saltbush
Five-spined saltbush
MARTINS ROAD
ARGOONA ROAD

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

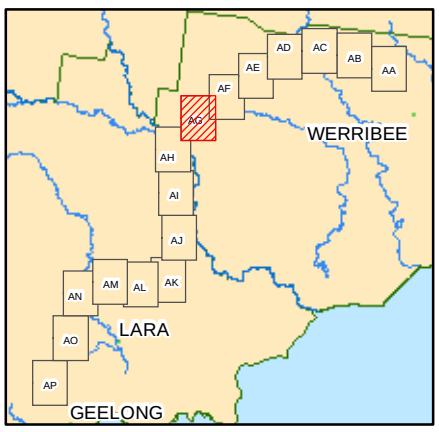
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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BALLIANG CREEK
LITTLE RIVER
ARGOONA ROAD
Area 12
22.500KM
Area 13
Five-spined saltbush
23.000KM
23.500KM
EVC: 68 Creekline Grassy Woodland
24.000KM
LITTLE RIVER
EVC: 68 Creekline Grassy Woodland
Area 14
Blackwood
Area 15
EVC: 132 Plains Grassland
24.500KM
LITTLE RIVER-RIPLEY ROAD
Modified Northern Pipe
EVC: 68 Creekline Grassy Woodland
25.000KM
Area 17
Five-spined saltbush
25.500KM
Growling Grass Frog (*Litoria raniformis*)
26.000KM
KIRKS BRIDGE ROAD

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

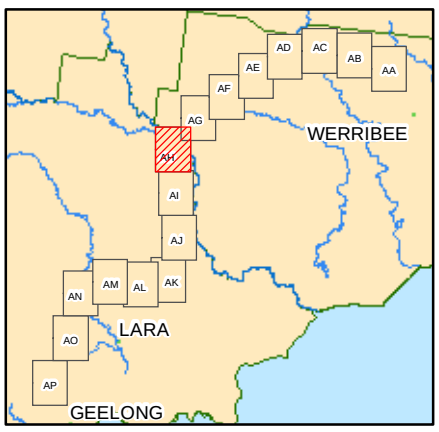
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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KBR

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TITLE

Barwon Water Interconnector Project

Enviromental Assessment of the Modified Northern Pipeline Option

MAP No. AH

PROJECT No. MEG703

Map No. MEG703-G-MAP-032-B

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LITTLE RIVER-RIPLEY ROAD
Patch 13
Area 67
27.000KM
Area 19
Golden wattle
Area 20
Area 21
Area 22
shrub violet
Area 23
27.500KM
shrub violet
Area 24
shrub violet
shrub violet
GIFKINS ROAD
28.000KM
Area 25
Red box regen
Area 26
28.500KM
Red box regen
Red box regen
Red box regen
Red box regen
Red box regen
LITTLE RIVER-RIPLEY ROAD
29.000KM
Golden wattle
Area 28
Area 27
29.500KM
DRYSDALE ROAD
EVC: 55 Plains Grassy Woodland
EVC: 58 Cleared/Severely Disturbed
EVC: 71 Hills Herb-rich Woodland
EVC: 72 Granitic Hills Woodland
Modified Northern Pipe
MOYONG ROAD
LITTLE RIVER
Biosite 1328: Little River Gorge
EVC: 68 Creekline Grassy Woodland
EVC: 132 Plains Grassland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
MOUYONG ROAD
EVC: 68 Creekline Grassy Woodland

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

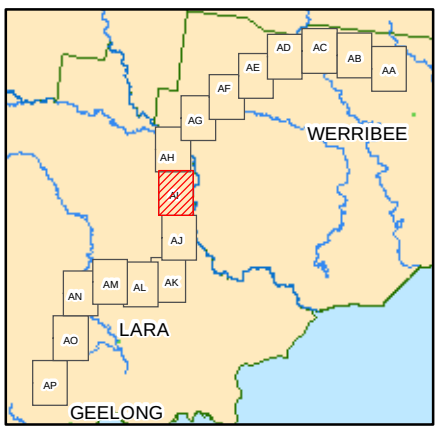
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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PROJECTION - MGA 55

DATE Oct 23, 2009

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Brittle Greenhood *Pterostylis truncata*
Brittle Greenhood *Pterostylis truncata*
Brittle Greenhood *Pterostylis truncata*
shrub violet
shrub violet
30.500KM
shrub violet
shrub violet
shrub violet
shrub violet
EVC: 68 Creekline Grassy Woodland
Little River Gorge, 1328
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 132 Plains Grassland
EVC: 68 Creekline Grassy Woodland
EVC: 72 Granitic Hills Woodland
Brittle Greenhood *Pterostylis truncata*
Brittle Greenhood *Pterostylis truncata*
Brittle Greenhood *Pterostylis truncata*
31.000KM
Area 30
Area 31
Biosite 1328: Little River Gorge
LITTLE RIVER
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland
Black-chinned Honeyeater (*Melithreptus gularis*)
Area 32
31.500KM
Modified Northern Pipe
LITTLE RIVER-RIPLEY ROAD
Brittle Greenhood *Pterostylis truncata* (19240331)
MCNAUGHTON DRIVE
EVC: 132 Plains Grassland
EVC: 68 Creekline Grassy Woodland
Melbourne Yellow-gum *Eucalyptus leucoxylon subsp. connata* (19761029)
Large-fruit Fireweed *Senecio macrocarpus* (0)
32.000KM
Area 34
Button Wrinklewort *Rutidosis leptorhynchoides*
Brittle Greenhood *Pterostylis truncata*
Area 35
32.500KM
EVC: 55 Plains Grassy Woodland
TOYNES ROAD
Spotted Harrier (*Circus assimilis*)
Brittle Greenhood *Pterostylis truncata*
Brittle Greenhood *Pterostylis truncata*
Growling Grass Frog (*Litoria raniformis*)
33.000KM
YOU YANGS ROAD
EVC: 132 Plains Grassland
Brittle Greenhood *Pterostylis truncata*
Area 37
Patch 14
FARRARS ROAD
33.500KM
EVC: 132
EVC: 55 Plains Grassland
Plains Grassy Woodland

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

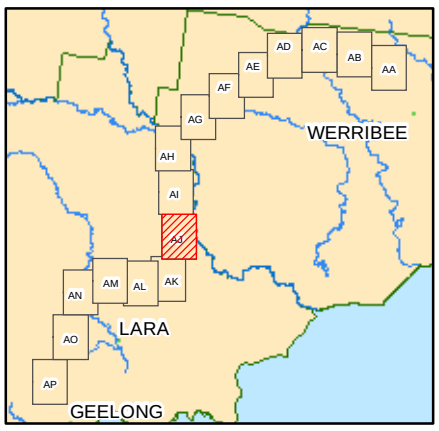
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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EVC: 58 Cleared/Severely Disturbed
EVC: 55 Plains Grassy Woodland
EVC: 58 Cleared/Severely Disturbed
EVC: 55 Plains Grassy Woodland
EVC: 55 Plains Grassy Woodland
EVC: 132 Plains Grassland
BRANCH ROAD
Area 42
FARRARS ROAD
34.000KM
Patch 15
Ares 45
Area 46
Area 47
34.500KM
Modified Northern Pipe
Area 48
EVC: 132 Plains Grassland
Spiny rice-flower
A. richardsoni
Area 49
35.000KM
Lightwood
Spiny rice-flower
Patch 16
Spiny rice-flower
FARRARS ROAD
35.500KM
Area 50
Area 51
Spiny rice-flower
spiny rice-flower
Spiny rice-flower
Area 53
Spiny rice-flower
Area 54
Spiny rice-flower
PEAK SCHOOL ROAD
Area 55
Area 56
36.500KM
Area 57
Swamp Diuris *Diuris palustris*
Patch 18
Spiny rice-flowe
Area 60
Spiny rice-flower
Lightwood
37.500KM
Lightwood
Patch 19
Lightwood
Area 59
Area 58
Lightwood
Lightwood
Lightwood
Cape Barren Goose (*Cereopsis novaehollandiae*)
PEAK SCHOOL ROAD
MILL ROAD
Large-fruit Fireweed *Senecio macrocarpus* (19840417)
Button Wrinklewort *Rutidosis leptorhynchoides*
Button Wrinklewort *Rutidosis leptorhynchoides* (19840417)
Biosite 1194: Peak School Road Rail Reserve (2.4)
Biosite 1261: Mill Road Rail Reserve (2.3)
Large-headed Fireweed *Senecio macrocarpus*
Large-fruit Fireweed *Senecio macrocarpus* (19840417)

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

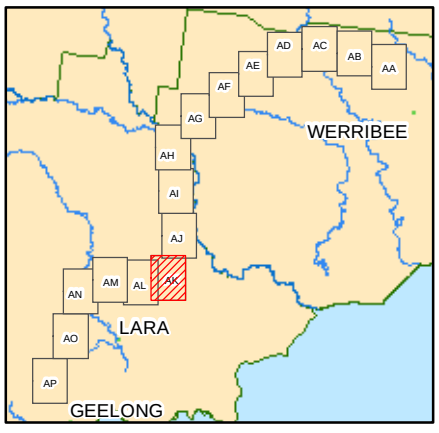
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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TITLE
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MAP No. AK
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Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

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- Vulnerable
- not applicable
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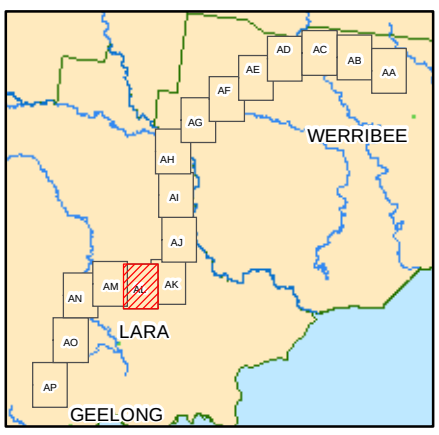

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Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

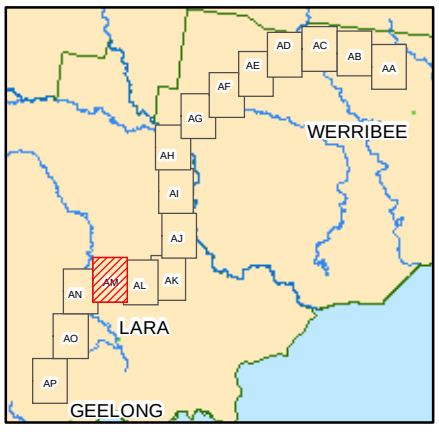
Field Assessment Data

- Native Vegetation
- Weeds
- Scattered Trees
- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

EVC

- Endangered
- Vulnerable
- not applicable
- Property Boundary



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MAP No. AM

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PEAK SCHOOL ROAD
EVC: 58 Cleared/Severely Disturbed
43.500KM
PEAK SCHOOL ROAD
43.000KM
A. richardsoni
Lightwood
42.500KM
Area 74
river red gum
river red gum
black wattle
Modified Northern Pipe
44.000KM
Diamond Firetail (*Stagonopleura guttata*)
44.500KM
DUGGANS LANE
EVC: 55 Plains Grassy Woodland
EVC: 132 Plains Grassland
EVC: 132 Plains Grassland
45.000KM
CHISHOLM ROAD
HOVELLS CREEK
EVC: 55 Plains Grassy Woodland
EVC: 132 Plains Grassland
EVC: 132 Plains Grassland
45.500KM
EVC: 68 Creekline Grassy Woodland
EVC: 55 Plains Grassy Woodland
BREGUET ROAD
46.000KM
EVC: 68 Creekline Grassy Woodland
EVC: 55 Plains Grassy Woodland
EVC: 68 Creekline Grassy Woodland
DUGGANS LANE
EVC: 68 Creekline Grassy Woodland
46.500KM
EVC: 68 Creekline Grassy Woodland
DUGGANS LANE
EVC: 68 Creekline Grassy Woodland
EVC: 68 Creekline Grassy Woodland

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
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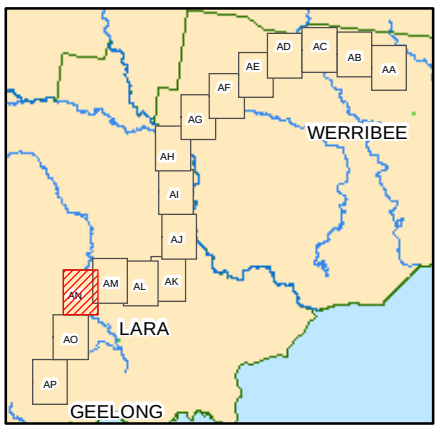

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Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

Field Assessment Data

- Native Vegetation
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- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

- Watercourses
- Northern Pipe
- 30m Buffer From Pipe
- Road

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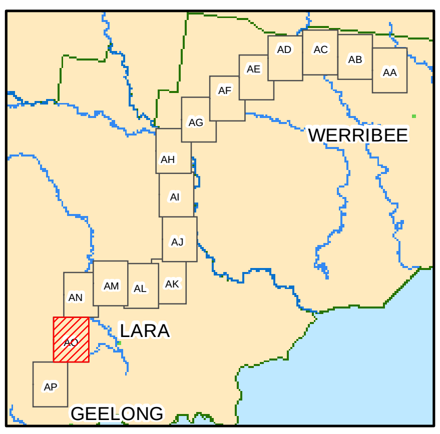

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Enviromental Assessment of the Modified Northern Pipeline Option

MAP No. AO

PROJECT No. MEG703

Map No. MEG703-G-MAP-032-B

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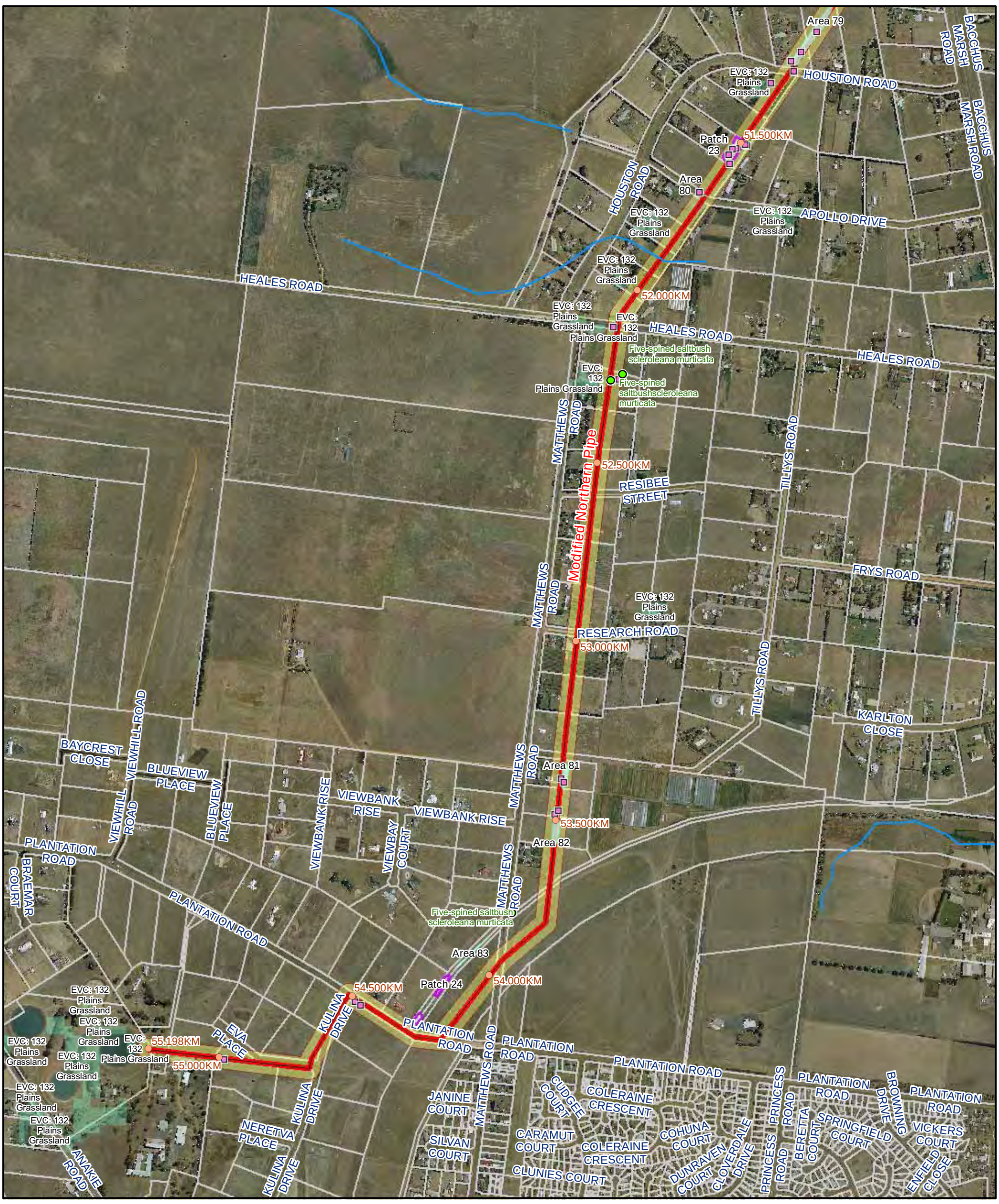

Legend

- Biosites 1:100k
- Threatened Flora 1:100k
- Threatened Fauna 1:100k
- Biosites 1:25k

Field Assessment Data

- Native Vegetation
- Weeds
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- Areas of Vegetation
- Areas of Vegetation
- Remnant Patches

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Appendix B

FAUNA SPECIES RECORDED WITHIN THE STUDY AREA

Appendix B

Flora and fauna species recorded within the study area

Table B1 Flora and fauna species recorded within the study area

Exotic *	Scientific name	Common name
	INDIGENOUS SPECIES	
	BIRDS	
	Acanthiza chrysorrhoa	Yellow-rumped thornbill
	Acanthiza pusilla	Brown thornbill
	Anas superciliosa	Pacific black duck
	Anthochaera carunculata	Red wattlebird
	Anthus australis	Australian pipit
	Aquila audax	Wedge-tailed eagle
	Ardea pacifica	White-necked heron
	Cacatua galerita	Sulpher-crested cockatoo
	Circus approximans	Swamp harrier
	Colluricincla harmonica	Grey shrike-thrush
	Corvus coronoides	Australian raven
	Chenonetta jubata	Australian wood duck
	Decalo novaeguineae	Laughing kookaburra
	Eolophus roseicapillus	Galah
	Falco berigora	Brown falcon
	Falco peregrinus	Peregrine falcon
	Grallina cyanoleuca	Australian magpie-lark
	Gymnorhyna tibicen	Australian magpie
	Haliastur sphenurus	Whistling kite
	Hieraaetus morphnoides	Little eagle
	Hirundo neoxena	Welcome swallow
	Malurus splendens	Superb fairy-wren
	Manorina melanocephala	Noisy miner
	Ocyphaps lophotes	Crested pigeon
	Pardalotus punctatus	Spotted pardalote
	Petrochelidon ariel	Fairy martin
	Petroica phoenicae	Flame robin
	Phylidonyris novaehollandiae	New Holland honeyeater
	Platycercus eximius	Eastern rosella
	Psephotus haematonotus	Red-rump parrot
	Rhipidura leucophrys	Willie wagtail
	Sericornis frontalis	White-browed scrubwren
	Threskiornis molucca	Australian white ibis

Table B1 Continued

Exotic *	Scientific name	Common name
	Threskiornis spinicollis	Straw-necked ibis
	Vanellus miles	Masked lapwing
	MAMMALS	
	Hydromys chysogaster	Water rat
	Macropus giganteus	Eastern grey kangaroo
	Tachyglossus aculeatus	Echidna
	REPTILES	
	Lampropholis guichenoti	Garden skink
	AMPHIBIANS	
	Limnodynastes dumerilii	Eastern banjo frog
	Litoria ewingii	Brown tree frog
	INTRODUCED SPECIES	
	MAMMALS	
*	*Lepus capensis*	European hare
*	*Oryctolagus cuniculus*	European rabbit
	BIRDS	
*	*Acridotheres tristis*	Common myna
*	*Passer domesticus*	House sparrow
*	*Streptopelia chinensis*	Spotted turtle-dove
*	*Sturnus vulgaris*	Common starling
*	*Turdus merula*	Common blackbird

Appendix C

QUANTIFICATION AND SIGNIFICANCE OF LOSSES IN PATCHES OF NATIVE VEGETATION

Appendix C

Quantification and significance of losses in patches of native vegetation

Table 1.1– Quantification and Significance of Losses in Patches of Native Vegetation

Habitat Zone			HZ1	HZ2	HZ3	HZ4	HZ5	HZ6	HZ7	HZ8	HZ9	HZ10	HZ11	HZ12	HZ13	HZ14	HZ15	HZ16	HZ17	HZ18	HZ19	HZ20	HZ21	HZ22	HZ23	HZ24	HZ25	HZ26(Alt)	HZ27(Alt)	HZ28(Alt)
EVC Name (initials)			***HS* PG**	***HS* PG**	***HS* PG**	***HS* PG**	***HS* PG**	***HS* PG**	***HS* PG**	***HS* PG**	***HS* PG**	**SBS**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**	**PG/PGW**	**PG/PGW**	**PG/PGW**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**	***LR* PG**
EVC Number			**132_61**	**132_61**	**132_61**	**132_61**	**132_61**	**132_61**	**132_61**	**132_61**	**132_61**	**851**	**132_63**	**132_63**	**132_63**	**132_63**	**132_63**	**132_63**	**132_63**	**897**	**897**	**897**	**132_63**	**132_63**	**132_64**	**132_65**	**132_66**	**132_68**	**132_69**	**132_70**
		Max Score	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
Site Condition	Large Old Trees	10	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Canopy Cover	5	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Understorey	25	5	5	5	5	10	15	5	5	5	10	15	5	5	15	5	15	5	15	5	15	5	5	5	5	5	15	15	5
	Lack of Weeds	15	9	9	7	6	9	13	9	9	7	4	9	13	9	6	9	9	7	9	9	9	6	9	4	6	6	9	6	9
	Recruitment	10	3	3	0	0	6	3	0	0	0	0	6	10	3	0	3	6	3	6	3	3	0	3	6	3	3	6	0	6
	Organic Matter	5	4	5	2	2	3	5	5	5	3	2	5	4	2	4	2	4	4	4	4	4	2	4	4	4	4	4	4	3
	Logs	5	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Site Score	75	21	22	14	13	28	36	19	19	15	34	35	32	19	25	19	34	19	34	21	31	13	21	19	18	18	34	25	23
	Site score out of?	eg 55	55	55	55	55	55	55	55	55	55	75	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
	Adjusted Site Score		29	30	19	18	38	49	26	26	20	34	48	44	26	34	26	46	26	46	29	42	18	29	26	25	25	46	34	31
Landscape value	Patch Size	10	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Neighbourhood	10	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distance to Core	5	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1
Habitat points out of 100		**100**	**30**	**31**	**20**	**19**	**39**	**50**	**27**	**27**	**21**	**36**	**49**	**45**	**30**	**36**	**28**	**48**	**28**	**48**	**31**	**44**	**20**	**31**	**27**	**26**	**26**	**48**	**36**	**33**
Habitat Score (hab points/100)		**0.##**	**0.30**	**0.31**	**0.20**	**0.19**	**0.39**	**0.50**	**0.27**	**0.27**	**0.21**	**0.36**	**0.49**	**0.45**	**0.30**	**0.36**	**0.28**	**0.48**	**0.28**	**0.48**	**0.31**	**0.44**	**0.20**	**0.31**	**0.27**	**0.26**	**0.26**	**0.48**	**0.36**	**0.33**
Area of zone to be cleared (ha)		(#.#)	0.2	0.1	0.2	0.1	0.1	0.4	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.0
Habitat Hectares of loss		(#.#)	0.04	0.03	0.05	0.01	0.03	0.18	0.02	0.03	0.05	0.03	0.04	0.04	0.03	0.03	0.01	0.10	0.03	0.08	0.04	0.03	0.02	0.04	0.05	0.01	0.02	0.02	0.04	0.01
Total area of the Zone Ha)		(#.#)	0.2	0.1	0.2	0.1	0.1	0.4	0.1	0.1	0.2	0.1	0.1	0.1	2.0	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.0	0.0	0.0
Total HHA in the zone		(#.#)	0.04	0.03	0.05	0.01	0.03	0.18	0.02	0.03	0.05	0.03	0.04	0.04	0.60	0.03	0.01	0.10	0.03	0.08	0.04	0.03	0.02	0.04	0.05	0.01	0.02	0.00	0.00	0.00
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC Conservation Status			E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Conservation Significance	**BCS x Habitat Score**		High	High	High	High	High	Very High	High	High	High	High	Very High	Very High	High	High	High	Very High	High	Very High	High	Very High	High	High	High	High	High	Very High	High	High
	Threatened Species		High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	High	N/A	N/A	N/A	N/A	N/A	Very High	N/A	Very High	N/A	High	N/A	N/A	N/A	N/A	N/A	High	N/A	N/A
	Other Site Attributes		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
No. of Large Old Trees to be removed			0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* For Non-forest or woodland vegetation or other vegetation types where some elements of the score are not relevant

* Best habitat for *Pimelea spinescens* ssp. *spinescens* , patches 16, 18
* Remaining habitat for Pimelea spinescens ssp. spinescens in patch 1, 20
* Remaining habitat for growling grass frog in patch 10

Appendix D

INDIGENOUS SPECIES IN DEGRADED TREELESS VEGETATION

Appendix D
Indigenous species in degraded treeless vegetation

Table D1 Indigenous species in degraded treeless vegetation

Area	Species name	Common name
1	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa curticoma	Spear-grass
2	*Austrodanthonia pilosa*	Velvet wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
3	*Austrodanthonia pilosa*	Velvet wallaby-grass
	Convolvulus erubescens	Blushing bindweed
4	*Austrodanthonia pilosa*	Velvet wallaby-grass
	Convolvulus erubescens	Blushing bindweed
	Whalleya proluta	Rigid panic
5	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia eriantha	Hill wallaby-grass
	Austrodanthonia pilosa	Velvet wallaby-grass
	Convolvulus erubescens	Blushing bindweed
	Scleroleana murticata var. *murticata*	Five-spined saltbush
6	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia pilosa	Velvet wallaby-grass
	Convolvulus erubescens	Blushing bindweed
	Whalleya proluta	Rigid panic
7	*Atriplex semibaccata*	Berry saltbush
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia eriantha	Hill wallaby-grass
	Austrodanthonia pilosa	Velvet wallaby-grass
	Austrostipa curticoma	Spear-grass
	Austrostipa oligostachya	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Crassula sieberiana	Sieber crassula
	Oxalis perennans	Wood-sorrel
	Themeda triandra	Kangaroo grass
8	*Austrodanthonia auriculata*	Lobed wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Convolvulus erubescens	Blushing bindweed
9	*Austrodanthonia pilosa*	Velvet wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed

Table D1 Continued

Area	Species name	Common name
10	*Austrostipa scabra*	Rough spear-grass
	Bothriochloa macra	Red-leg grass
	Bulbine sp.	Bulbine lily
	Chielanthes austrotenuifolia	Rock fern
	Correa glabra	Rock correa
	Dichondra repens	Kidney weed
	Einadia nutans	Nodding saltbush
	Nicotiana sp. *aff nicotiana*	Native tobacco
	Pelargonium australe	Austral storks-bill
11	*Austrodanthonia racemosa*	Slender wallaby-grass
	Austrostipa curticoma	Spear-grass
	Austrostipa sp.	Spear-grass
	Chloris truncata	Windmill grass
12	*Austrostipa curticoma*	Spear-grass
13	*Austrostipa curticoma*	Spear-grass
14	*Melicytus dentatus*	Shrub violet
15	*Bolboschoenus medianus*	Marsh club-rush
	Mimulus repens	Creeping monkey-flower
	Phragmites australis	Common reed
	Scheonoplectus validus	River club-rush
	Triglochin striatum	Streaked arrow-grass
16	*Austrodanthonia eriantha*	Hill wallaby-grass
17	*Acaena* sp.	Sheep's burr
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa curticoma	Spear-grass
	Bothriochloa macra	Red-leg grass
	Convolvulus erubescens	Blushing bindweed
	Mariena enchylaenoides	Wingless bluebush
	Whalleya proluta	Rigid panic
18	*Acaena* sp.	Sheep's burr
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia duttoniana	Brown-back wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Mariena enchylaenoides	Wingless bluebush
	Whalleya proluta	Rigid panic
19	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
	Oxalis perennans	Wood-sorrel

Table D1 Continued

Area	Species name	Common name
20	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
	Chloris truncata	Windmill grass
	Whalleya proluta	Rigid panic
21	*Austrodanthonia racemosa*	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
	Enchyleana tomentosa	Ruby saltbush
	Mariena enchylaenoides	Wingless bluebush
	Oxalis perennans	Wood-sorrel
22	*Austrodanthonia racemosa*	Slender wallaby-grass
23	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
24	*Austrodanthonia racemosa*	Slender wallaby-grass
25	*Austrodanthonia racemosa*	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
26	*Austrostipa nodosa*	Spear-grass
27	*Austrodanthonia racemosa*	Slender wallaby-grass
28	*Austrodanthonia caespitosa*	Common wallaby-grass
29	*Austrodanthonia duttoniana*	Brown-back wallaby-grass
	Austrodanthonia caespitosa	Common wallaby-grass
30	*Austrodanthonia caespitosa*	Common wallaby-grass
31	*Austrostipa scabra*	Spear-grass
32	*Eleocharis acuta*	Common spike-rush
	Marselia costulifera	Narrow-leaf nardoo
33	*Atriplex semibaccata*	Berry saltbush
	Austrostipa scabra	Spear-grass
	Scleroleana murticata var. *murticata*	Five-spined saltbush
34	*Austrodanthonia caespitosa*	Common wallaby-grass
35	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Scleroleana murticata var. *murticata*	Five-spined saltbush
36	*Austrodanthonia caespitosa*	Common wallaby-grass
37	*Austrodanthonia racemosa*	Slender wallaby-grass
38	*Austrodanthonia caespitosa*	Common wallaby-grass
39	*Asperula conferta*	Common woodruff
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Convolvulus erubescens	Blushing bindweed
40	*Austrodanthonia racemosa*	Slender wallaby-grass

Table D1 Continued

Area	Species name	Common name
41	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa bigeniculata	Spear-grass
42	*Acacia implexa*	Lightwood
	Atriplex semibaccata	Berry saltbush
	Austrostipa bigeniculata	Spear-grass
43	*Austrodanthonia racemosa*	Slender wallaby-grass
44	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa bigeniculata	Spear-grass
45	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
46	*Austrostipa bigeniculata*	Spear-grass
	Convolvulus erubescens	Blushing bindweed
47	*Asperula conferta*	Common woodruff
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia eriantha	Hill wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Chloris truncata	Windmill grass
	Convolvulus erubescens	Blushing bindweed
48	*Acaena* sp.	Sheep's burr
	Asperula conferta	Common woodruff
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia duttoniana	Brown-back wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Calotis anthemoides	Cut-leaf burr-daisy
	Chloris truncata	Windmill grass
	Haloragis heterophylla	Varied raspwort
	Oxalis perennans	Wood-sorrel
	Themeda triandra	Kangaroo grass
49	*Acacia implexa*	Lightwood
	Acaena sp.	Sheep's burr
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Dianella revoluta	Black-anther flax-lily
	Eryngium ovinum	Blue devil
	Lomandra micrantha	Small-flowered mat-rush
	Themeda triandra	Kangaroo grass
50	*Asperula conferta*	Common woodruff
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Einadia nutans	Nodding saltbush

Table D1 Continued

Area	Species name	Common name
51	*Asperula conferta*	Common woodruff
	Austrodanthonia sp.	Wallaby-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Haloragis heterophylla	Varied raspwort
	Pimelea spinescens ssp. *spinescens*	Spiny rice-flower
52	*Austrostipa nodosa*	Spear-grass
	Austrostipa sp.	Spear-grass
	Calocephalus citreus	Lemon beauty-heads
	Convolvulus erubescens	Blushing bindweed
	Poa labillardieri	Common tussock-grass
	Themeda triandra	Kangaroo grass
53	*Acaena* sp.	Sheep's burr
	Asperula conferta	Common woodruff
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia duttoniana	Brown-back wallaby-grass
	Austrodanthonia sp. *richardsonii*	Wallaby-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Haloragis heterophylla	Varied raspwort
	Pimelea spinescens ssp. *spinescens*	Spiny rice-flower
54	*Acaena* sp.	Sheep's burr
	Austrostipa curticoma	Spear-grass
	Calocephalus citreus	Lemon beauty-heads
	Convolvulus erubescens	Blushing bindweed
	Eryngium ovinum	Blue devil
	Pimelea spinescens ssp. *spinescens*	Spiny rice-flower
55	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrostipa curticoma	Spear-grass
	Austrostipa sp.	Spear-grass
	Convolvulus erubescens	Blushing bindweed
56	*Austrodanthonia racemosa*	Slender wallaby-grass
	Austrostipa bigeniculata	Spear-grass
57	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa nodosa	Spear-grass
	Austrostipa scabra	Rough spear-grass
	Austrostipa sp.	Spear-grass
	Convolvulus erubescens	Blushing bindweed
58	*Acacia implexa*	Lightwood
	Acacia pycnantha	Golden wattle
	Acaena sp.	Sheep's burr
	Asperula conferta	Common woodruff
	Austrodanthonia caespitosa	Common wallaby-grass

Table D1 Continued

Area	Species name	Common name
	Austrostipa nodosa	Spear-grass
	Austrostipa sp.	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Dianella revoluta	Black-anther flax-lily
	Einadia nutans	Nodding saltbush
	Eutaxia diffusa	Shrub eutaxia
	Lomandra filiformis	Wattle mat-rush
59	*Acacia pycnantha*	Golden wattle
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrostipa nodosa	Spear-grass
	Eryngium ovinum	Blue devil
	Eutaxia diffusa	Shrub eutaxia
60	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Austrostipa curticoma	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Oxalis perennans	Wood-sorrel
	Themeda triandra	Kangaroo grass
61	*Asperula conferta*	Common woodruff
	Atriplex semibaccata	Berry saltbush
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrostipa curticoma	Spear-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Haloragis heterophylla	Varied raspwort
	Pimelea spinescens ssp. *spinescens*	Spiny rice-flower
	Themeda triandra	Kangaroo grass
62	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Lobelia pratiodes	Poison lobelia
63	*Acaena* sp.	Sheep’s burr
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia eriantha	Hill wallaby-grass
	Austrodanthonia geniculata	Kneed wallaby-grass
	Austrostipa curticoma	Spear-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Themeda triandra	Kangaroo grass
64	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia duttoniana	Brown-back wallaby-grass
	Austrostipa nodosa	Spear-grass

Table D1 Continued

Area	Species name	Common name
	Austrostipa sp.	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Lomandra micrantha	Small-flowered mat-rush
65	*Enchyleana tomentosa*	Ruby saltbush
66	*Austrostipa* sp.	Spear-grass
	Einadia nutans	Nodding saltbush
	Eleocaris acuta	Common spike-rush
	Lythrum hysoppifolium	Small-flowered loose-strife
	Marselia drummondii	Nardoo
67	*Acacia implexa*	Lightwood
	Asperula conferta	Common woodruff
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Dianella revoluta	Black-anther flax-lily
	Enchyleana tomentosa	Ruby saltbush
	Eryngium ovinum	Blue devil
	Haloragis heterophylla	Varied raspwort
	Oxalis perennans	Wood-sorrel
	Themeda triandra	Kangaroo grass
68	*Austrodanthonia* sp.	Wallaby-grass
	Austrostipa sp.	Spear-grass
	Einadia nutans	Nodding saltbush
	Marselia drummondii	Nardoo
	Muelenbeckia florulenta	Tangled lignum
69	*Atriplex semibaccata*	Berry saltbush
	Austrostipa sp.	Spear-grass
	Dianella revoluta	Black-anther flax-lily
	Themeda triandra	Kangaroo grass
70	*Acacia pycnantha*	Golden wattle
	Asperula conferta	Common woodruff
	Atriplex semibaccata	Berry saltbush
	Austrodanthonia sp.	Wallaby-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Eutaxia diffusa	Shrub eutaxia
	Oxalis perennans	Wood-sorrel
	Pimelea spinescens ssp. *spinescens*	Spiny rice-flower
	Themeda triandra	Kangaroo grass
71	*Austrostipa curticoma*	Spear-grass
	Austrostipa scabra	Rough spear-grass
	Chloris truncata	Windmill grass
	Crassula sieberiana	Sieber crassula
72	*Austrostipa nodosa*	Spear-grass
	Chloris truncata	Windmill grass
	Dianella revoluta	Black-anther flax-lily

Table D1 Continued

Area	Species name	Common name
73	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia duttoniana	Brown-back wallaby-grass
	Chloris truncata	Windmill grass
	Convolvulus erubescens	Blushing bindweed
	Eryngium ovinum	Blue devil
74	*Austrodanthonia eriantha*	Hill wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrodanthonia sp.	Wallaby-grass
	Austrostipa curticoma	Spear-grass
	Bothriochloa macra	Red-leg grass
	Convolvulus erubescens	Blushing bindweed
	Oxalis perennans	Wood-sorrel
75	*Austrodanthonia pilosa*	Velvet wallaby-grass
	Convolvulus erubescens	Blushing bindweed
76	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodantonia duttoniana	Brown-back wallaby-grass
	Austrodanthonia sp.	Wallaby-grass
77	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodantonia duttoniana	Brown-back wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Enchyleana tomentosa	Ruby saltbush
78	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodantonia duttoniana	Brown-back wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
79	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodantonia duttoniana	Brown-back wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
80	*Austrodantonia duttoniana*	Brown-back wallaby-grass
	Austrodanthonia richardsonii	Wallaby-grass
	Chloris truncata	Windmill grass
81	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
82	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrodanthonia pilosa	Velvet wallaby-grass
83	*Austrodanthonia caespitosa*	Common wallaby-grass
	Austrodantonia duttoniana	Brown-back wallaby-grass
	Austrodanthonia racemosa	Slender wallaby-grass

Table D1 Continued

Area	Species name	Common name
	FARRAS ROAD (TARGETED SURVEY)	
84Alt.	*Acaena* sp.	Sheep's burr
	Asperula conferta	Common woodruff
	Atriplex semibaccata	Berry saltbush
	Austrodanthonia pilosa	Velvet wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Chloris truncata	Windmill grass
	Einadia nutans	Nodding saltbush
	Haloragis heterophylla	Varied raspwort
	Oxalis perennans	Wood-sorrel
	Whalleya proluta	Rigid panic
85Alt.	*Acacia pycnantha*	Golden wattle
	Asperula conferta	Common woodruff
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia pilosa	Velvet wallaby-grass
	Austrostipa scabra	Rough spear-grass
	Chloris truncata	Windmill grass
	Convolvulus erubescens	Blushing bindweed
	Haloragis heterophylla	Varied raspwort
	Whalleya proluta	Rigid panic
86Alt.	*Acaena* sp.	Sheep's burr
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia eriantha	Hill wallaby-grass
	Austrodantonia duttoniana	Brown-back wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Austrostipa curticoma	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Haloragis heterophylla	Varied raspwort
87Alt.	*Asperula conferta*	Common woodruff
	Atriplex semibaccata	Berry saltbush
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrostipa bigeniculata	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Einadia nutans	Nodding saltbush
	PEAK SCHOOL ROAD (TARGETED SURVEY)	
88Alt.	*Atriplex semibaccata*	Berry saltbush
	Austrodanthonia racemosa	Slender wallaby-grass
	Austrostipa curticoma	Spear-grass
	Bothriochloa macra	Red-leg grass
	Chloris truncata	Windmill grass
	Convolvulus erubescens	Blushing bindweed
	Eleocaris acuta	Common spike-rush
	Themeda triandra	Kangaroo grass
	Whalleya proluta	Rigid panic

Table D1 Continued

Area	Species name	Common name
89Alt.	*Asperula conferta*	Common woodruff
	Austrodanthonia caespitosa	Common wallaby-grass
	Austrodanthonia pilosa	Velvet wallaby-grass
	Austrostipa curticoma	Spear-grass
	Austrostipa nodosa	Spear-grass
	Convolvulus erubescens	Blushing bindweed
	Dianella revoluta	Black-anther flax-lily
	Einadia nutans	Nodding saltbush
	Enchyleana tomentosa	Ruby saltbush
	Eryngium ovinum	Blue devil
	Pimelea spinescens ssp. *spinescens*	Spiny rice-flower
	Themeda triandra	Kangaroo grass
90Alt.	*Acaena* sp.	Sheep's burr
	Asperula conferta	Common woodruff
	Atriplex semibaccata	Berry saltbush
	Austrodanthonia pilosa	Velvet wallaby-grass
	Chloris truncata	Windmill grass
	Einadia nutans	Nodding saltbush
	Haloragis heterophylla	Varied raspwort
	Oxalis perennans	Wood-sorrel
	Whalleya proluta	Rigid panic

Appendix E

SPECIES, SITES AND COMMUNITIES OF FLORA AND FAUNA SIGNIFICANCE IN THE GENERAL STUDY AREA

Appendix E

Species, sites and communities of flora and fauna significance in the general study area

Table E1 Flora and fauna species of significance in the general study area of Passing Lane 5 (National and Victorian)

		EPBC Act*				Records	
Taxa	Common name	Status	Habitat	Victorian conservation status	FFG Act†	Likely occurrence	Habitat requirements
BIRDS							
Apus pacificus	Fork-tailed swift	OM	✓			Low	Aerial, over a variety of habitats. Nil impact on the species.
Ardea alba	Great egret, white egret	OM	✓	v	L	Low to Medium	Rivers, wetlands, intertidal mudflats.
Ardea ibis	Cattle egret	OM	✓			Low to Medium	Pasture, occasionally shallows of wetlands.
Burhinus grallarius	Bush stone curlew			e	L	Low	Large, sparsely vegetated woodland.
Cereopsis novaehollandiae	Cape Barren goose			nt		Low	Improved pastures on the mainland.
Circus assimilis	Spotted harrier			nt		Low to Medium	Open grassland, crops and windbreaks.
Falco subniger	Black falcon			v		Low to Medium	Woodland, shrubland and grassland in arid and semi-arid zones.
Gallinago hardwickii	Latham's snipe, Japanese snipe	M OM	✓	n		Low	Wet grasslands, open wooded swamps.
Grus rubicunda	Brolga			v	L	Low	Ephemeral wetlands, salt marshes and grasslands.
Haliaeetus leucogaster	White-bellied sea-eagle	M	✓			Low to Medium	Large rivers, fresh saline lakes, coastal sea. Possibly around Werribee River
Hirundapus caudacutus	White-throated needletail	M OM	✓			Low	Mainly aerial, coastal. Nil impact on the species.

Table E1 Continued

Taxa	Common name	EPBC Act*		Victorian conservation status	FFG Act†	Records	
		Status	Habitat			Likely occurrence	Habitat requirements
Ixobrychus minutus	Little bittern			e	L	Low	Dense vegetation of freshwater swamps and creeks.
Lathamus discolor	Swift parrot	E OM	✓	e	L	Low	Drier open forests, woodlands, parks, gardens.
Melanodryas cucullata	Hooded robin			r	L	Medium	Open woodland with woody debris.
Melithreptus gularis	Black-chinned honeyeater			nt		Low	Woodland.
Merops ornatus	Rainbow bee-eater	M OM	✓			Low	Open country. Along watercourses.
Myiagra cyanoleuca	Satin flycatcher	M OM	B_1			Low	Tall, medium open forests.
Neophema chrysogaster	Orange-bellied parrot	CE M OM	✓	ce	L	Low	Salt marshes, dunes and damp grasslands on the mainland.
Neophema elegans	Elegant parrot			v		Low	Open country and semi-arid shrubland.
Oxyura australis	Blue-billed duck			e	L	Low	Large, deep freshwater bodies with dense vegetation.
Pedionomus torquatus	Plains wanderer	V	✓	v	L	Low	Low, sparsely vegetated native grasslands.
Platalea regia	Royal spoonbill			v		Low	Fresh and saltwater wetlands.
Porzana pusilla	Ballion's crake			v	L	Low	Swamps and marshes
Pyrrholeamus sagittatus	Speckled warbler			v	L	Low	Ground litter of open woodland.
Rhipidura rufifrons	Rufous fantail	M OM	B_2			Low	Wet forests, occasionally more open forests.
Rostratula australis	Australian painted snipe	V	✓			Low	Shallow inland wetland, freshwater or brackish, may be ephemeral.
Rostratula benghalensis s. lat.	Painted snipe	M OM	✓			Low	Marsh with moderate cover.
Staganopleura guttata	Diamond firetail			v	L	Medium	Open woodland with a grassy understorey.
Strictonetta naevosa	Freckled duck			e	L	Low	Densely vegetated freshwater swamps.

Table E1 Continued

		EPBC Act*				Records	
Taxa	Common name	Status	Habitat	Victorian conservation status	FFG Act†	Likely occurrence	Habitat requirements
Turnis pyrrhothorax	Red-chested button-quail			v	L	Low	Grasslands.
Tyto novaehollandiae	Masked owl			e	L	Low	Forests and woodlands, near caves and hollows.
Xanthomyza phrygia	Regent honeyeater	E	✓			Low	Open lowland forests and woodlands, often near water.
FROGS							
Litoria raniformis	Growling grass frog	V	✓	e	L	Medium	In water or wet areas in woodlands, shrublands, open and disturbed areas. Needs still water to breed. Potential habitat surrounding Werribee River.
MAMMALS							
Dasyurus maculatus maculatus (SE mainland population)	Spotted-tail quoll, tiger quoll	E	✓			Low	Woodland.
Isooden obesulus obesulus	Southern brown bandicoot	E	✓	nt	I	Low	Woodland with dense understorey.
Potorous tridactylus tridactylus	Long-nosed potoroo	V	✓	e	L	Low	Coastal woodland and heath with dense understorey.
Pseudomys fumeus	Smoky mouse	E	✓	ce	L	Low	Heaths and dry forest.
Pteropus poliocephalus	Grey-headed flying-fox	V	✓	v	L	Low	Rainforests and tall forests and woodlands.
FISHES							
Galaxiella pusilla	Dwarf galaxias	V	✓	v	L	Low	Shallow, stagnant water of swamps and creeks, with dense aquatic vegetation.
Prototroctes maraena	Australian grayling	V	✓	v	L	Low	Migrates between ocean and streams with a gravel bottom.

Table E1 Continued

Taxa	Common name	EPBC Act*		Victorian conservation status	FFG Act†	Records	
		Status	Habitat			Likely occurrence	Habitat requirements
REPTILES							
Delma impar	Striped legless lizard	V	✓	e	L	Low	Grassland habitats—areas with dense and continuous structural habitat elements (tussocks, rocks, soil cracks) for shelter.
Tympanocryptis pinguicolla	Grassland earless dragon	E	✓	ce	L	Low	Grasslands with bare ground, rocks and spider holes for shelter.
INSECTS							
Synemon plana	Golden sun moth	CE	✓	e	L	Low	Open temperate grasslands dominated by wallaby grass tussocks (*Austrodanthonia* spp.)
PLANTS							
Carex tasmanica	Curly sedge	V	✓	v	L	Low	Upper margins of saline drainage lines and marshes on basalt soils.
Glycine latrobeana	Purple clover, clover glycine	V	✓			Low	Stony knoll grassland, box-red gum woodland and various other habitats.
Rutidosis leptorrhyncoides	Button wrinklewort	E	✓	e	L	Low	Grasslands and grassy wetlands.
Pimelea spinescens ssp. *spinescens*	Spiny rice-flower	CE	✓	v	L	High	Grasslands on basalt plains.
Prasophyllum frenchii	Maroon leek-orchid	E	✓	e	L	Low	Grassland and grassy woodland.
Pterostylis truncata	Brittle greenhood			e	L	Low	Rocky areas of grasslands and valley forests.
Senecio macrocarpus	Large-fruit fireweed	V	✓	e	L	Low	Plains grassland.

B_1 = breeding likely to occur in area
B_2 = breeding may occur within area
CE = critically endangered
E = endangered
I = ineligible
k = insufficiently known
L = listed under FFG Act
M = migratory
n = nominated for listing under FFG Act
OM = may overfly area
R = rare
V = vulnerable

* EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)

† FFG Act: *Flora and Fauna Guarantee Act 1988* (Vic.)

Table E2 Sites and communities of flora and fauna significance in the general study area

RAMSAR WETLANDS	
Port Phillip Bay (western shoreline) and Bellarine	Within 10 km of a Ramsar site.

ECOLOGICAL VEGETATION CLASSES (EVC)		
EVC	Bioregion	Conservation status
Plains Grassland	Victorian Volcanic Plains	Endangered (all)
Stream Bank Shrubland	Victorian Volcanic Plains	Endangered

HERITAGE SITES OF SIGNIFICANCE

Heritage Place	Location	National Heritage List	Register of National Estate	Commonwealth Heritage List	Victorian Heritage Register	Potential impact
Mount Rothwell			✓			None
Elcho Homestead			✓			None
Pirra			✓			None

Appendix C

EPBC PROTECTED MATTERS SEARCH

Australian Government
Department of the Environment, Water, Heritage and the Arts

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

23 October 2009 10:43

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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Search Type:	Line
Buffer:	5 km
Coordinates:	-37.83594,144.65763, -37.81839,144.66114, -37.80646,144.58883, -37.81839,144.58532, -37.82050,144.57690, -37.81629,144.55794, -37.86613,144.47370, -37.90544,144.46738, -37.93492,144.47019, -37.98336,144.46598, -37.97704,144.36770, -38.02408,144.36208, -38.04654,144.34594, -38.06128,144.34383, -38.06760,144.33681, -38.06549,144.32909

Report Contents:

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	1
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	2
Threatened Species:	35
Migratory Species:	33

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	2

Commonwealth Heritage Places:	None
Places on the RNE:	15
Listed Marine Species:	27
Whales and Other Cetaceans:	8
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Other Commonwealth Reserves:	None
Regional Forest Agreements:	1

Details

Matters of National Environmental Significance

Wetlands of International Significance [Dataset Information]
(Ramsar Sites)

PORT PHILLIP BAY (WESTERN SHORELINE) AND BELLARINE

Threatened Ecological Communities [Dataset Information]	Status	Type of Presence
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered	Community likely to occur within area
Natural Temperate Grassland of the Victorian Volcanic Plain	Critically Endangered	Community likely to occur within area

Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater	Endangered	Species or species habitat may occur within area
Diomedea epomophora epomophora Southern Royal Albatross	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora sanfordi Northern Royal Albatross	Endangered	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel	Endangered	Species or species habitat may occur within area
Macronectes halli	Vulnerable	Species or species habitat may

Northern Giant-Petrel		occur within area
Neophema chrysogaster Orange-bellied Parrot	Critically Endangered	Migration route likely to occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta salvini Salvin's Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross	Vulnerable	Species or species habitat may occur within area
Frogs		
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	Vulnerable	Species or species habitat known to occur within area
Insects		
Synemon plana Golden Sun Moth	Critically Endangered	Species or species habitat known to occur within area
Mammals		
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Eubalaena australis Southern Right Whale	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale	Vulnerable	Species or species habitat likely to occur within area
Miniopterus schreibersii bassanii Southern Bent-wing Bat	Critically Endangered	Species or species habitat may occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pseudomys fumeus Konoom, Smoky Mouse	Endangered	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox	Vulnerable	Species or species habitat likely to occur within area
Ray-finned fishes		
Galaxiella pusilla Eastern Dwarf Galaxias, Dwarf Galaxias	Vulnerable	Species or species habitat likely to occur within area
Prototroctes maraena Australian Grayling	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Delma impar Striped Legless Lizard	Vulnerable	Species or species habitat known to occur within area

Tympanocryptis pinguicolla Grassland Earless Dragon	Endangered	Species or species habitat may occur within area
Sharks		
Carcharodon carcharias Great White Shark	Vulnerable	Species or species habitat may occur within area
Plants		
Carex tasmanica Curly Sedge	Vulnerable	Species or species habitat likely to occur within area
Glycine latrobeana Clover Glycine, Purple Clover	Vulnerable	Species or species habitat likely to occur within area
Pimelea spinescens subsp. spinescens Plains Rice-flower, Spiny Rice-flower, Prickly Pimelea	Critically Endangered	Species or species habitat known to occur within area
Prasophyllum frenchii Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid	Endangered	Species or species habitat likely to occur within area
Rutidosis leptorrhynchoides Button Wrinklewort	Endangered	Species or species habitat likely to occur within area
Senecio macrocarpus Large-fruit Fireweed, Large-fruit Groundsel	Vulnerable	Species or species habitat likely to occur within area
Thelymitra epipactoides Metallic Sun-orchid	Endangered	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Neophema chrysogaster Orange-bellied Parrot	Migratory	Migration route likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat may occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Calidris acuminata Sharp-tailed Sandpiper	Migratory	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper	Migratory	Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint	Migratory	Species or species habitat likely to occur within area
Charadrius bicinctus Double-banded Plover	Migratory	Species or species habitat likely to occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area

Migratory Marine Birds

Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross	Migratory	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross	Migratory	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross	Migratory	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel	Migratory	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Migratory	Species or species habitat may occur within area
Sterna albifrons Little Tern	Migratory	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross	Migratory	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross	Migratory	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Migratory	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross	Migratory	Species or species habitat may occur within area

Migratory Marine Species

Mammals

Balaenoptera edeni Bryde's Whale	Migratory	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale	Migratory	Species or species habitat may occur within area
Eubalaena australis Southern Right Whale	Migratory	Species or species habitat known to occur within area
Lagenorhynchus obscurus Dusky Dolphin	Migratory	Species or species habitat may occur within area

Megaptera novaeangliae Humpback Whale	Migratory	Species or species habitat likely to occur within area
Sharks		
Carcharodon carcharias Great White Shark	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper	Listed	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper	Listed - overfly marine area	Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint	Listed - overfly marine area	Species or species habitat likely to occur within area
Charadrius bicinctus Double-banded Plover	Listed - overfly marine area	Species or species habitat likely to occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross	Listed	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross	Listed	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross	Listed	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Listed - overfly marine area	Species or species habitat likely to occur within area

Macronectes giganteus Southern Giant-Petrel	Listed	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Listed	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Neophema chrysogaster Orange-bellied Parrot	Listed - overfly marine area	Migration route likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Sterna albifrons Little Tern	Listed	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross	Listed	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross	Listed	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Listed	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross	Listed	Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri New Zealand Fur-seal	Listed	Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal	Listed	Species or species habitat may occur within area
Whales and Other Cetaceans [Dataset Information]	Status	Type of Presence
Balaenoptera edeni Bryde's Whale	Cetacean	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale	Cetacean	Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin	Cetacean	Species or species habitat may occur within area
Eubalaena australis	Cetacean	Species or species habitat known to

Southern Right Whale		occur within area
Lagenorhynchus obscurus Dusky Dolphin	Cetacean	Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale	Cetacean	Species or species habitat likely to occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin	Cetacean	Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin	Cetacean	Species or species habitat may occur within area

Commonwealth Lands [Dataset Information]

Defence

Unknown

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Historic

Cowie Creek Rail Bridge (Moorabool) VIC

Cowie Creek Rail Bridge VIC

Craigton VIC

Elcho Homestead VIC

Eynesbury Homestead VIC

Little River Railway Station and Goods Shed VIC

Moorabool Railway Station VIC

Morongo Girls College VIC

Mount Rothwell Homestead and Garden VIC

Pirra VIC

Rothwell Road Bridge VIC

Wooloomanata VIC

Indigenous

Mount Rothwell Declared Archaeological Area VIC

Werribee River Burial Site VIC

Natural

Eynesbury Grey Box Woodlands VIC

Extra Information

State and Territory Reserves [Dataset Information]

Cobbledicks Natural Features Reserve - Streamside Reserve, VIC

Werribee River Natural Features Reserve - Streamside Reserve, VIC

Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.

West Victoria RFA, Victoria

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

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- Department of Sustainability and Environment, Victoria
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- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

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Appendix D

QUANTIFICATION AND SIGNIFICANCE OF LOSSES IN PATCHES OF NATIVE VEGETATION

Quantification and significance of losses in patches of Native Vegetation

Habitat Zone			HZ1	HZ2	HZ3	HZ4	HZ5	HZ6	HZ7	HZ8	HZ9	HZ10	HZ11	HZ12	HZ13	HZ14	HZ15	HZ16	HZ17	HZ18	HZ19	HZ20	HZ21
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			132_61	132_63	132_63	132_63	132_63	132_63	132_63	132_63	897	897	132_63	132_63	897	897	897	897	132_63	132_63	132_63	132_63	132_63
EVC Bioregional Conservation Status			E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Max Score		Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10														9							
	Canopy Cover	5														2							
	Understorey	25	5	5	5	5	5	5	5	5	5	15	10	5	5	6	10	10	10	10	10	10	10
	Lack of Weeds	15	6	4	2	6	2	2	6	2	6	6	6	2	6	15	6	6	9	6	6	6	6
	Recruitment	10	3	6	0	0	3	3	3	3	3	6	6	3	3	3	3	3	1	6	6	6	6
	Organic Matter	5	5	4	2	2	2	2	3	4	4	5	3	4	4	3	3	3	3	3	3	3	3
	Logs	5														0							
	Total Site Score	75	19	19	9	13	12	12	17	14	18	32	25	14	18	38	22	22	23	25	25	25	25
	EVC standardiser (e.g. 75/55) [1]		55	55	55	55	55	55	55	55	55	55	55	55	55	75	55	55	55	55	55	55	55
	Adjusted Site Score		26	26	12	18	16	16	23	19	25	44	34	19	25	38	30	30	31	34	34	34	34
Landscape value	Patch Size	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Neighbourhood	10	0	0	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Distance to Core	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Habitat Score		100	28	28	14	20	19	19	26	21	27	47	37	22	28	41	33	33	34	37	37	37	37
Habitat points = #/100		1	0.28	0.28	0.14	0.20	0.19	0.19	0.26	0.21	0.27	0.47	0.37	0.22	0.28	0.41	0.33	0.33	0.34	0.37	0.37	0.37	0.37
Habitat Zone area (ha)		(#.#)	0.06	0.17	0.23	0.08	0.13	0.37	0.11	0.04	0.04	0.76	0.09	0.04	0.06	0.04	0.18	0.13	0.32	0.12	0.16	0.19	0.08
Habitat Hectares		(#.#)	0.02	0.05	0.03	0.02	0.03	0.07	0.03	0.01	0.01	0.35	0.03	0.01	0.02	0.02	0.06	0.04	0.11	0.04	0.06	0.07	0.03
Conservation Significance	Conservation status x Habitat Score		H	H	H	H	H	H	H	H	H	VH	H	H	H	VH	H	H	H	H	H	H	H
	Threatened Species Rating							H	H				VH					VH	VH	H	H	H	
	Other Site Attribute Rating																						
	Overall Conservation Significance (highest rating)		H	H	H	H	H	H	H	H	H	VH	VH	H	H	VH	H	VH	VH	H	H	H	H
Net Outcome			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2	1.5	1.5	2	1.5	2	2	1.5	1.5	1.5	1.5
Gain Target (Hha)			**0.03**	**0.08**	**0.05**	**0.03**	**0.05**	**0.11**	**0.05**	**0.02**	**0.02**	**0.70**	**0.06**	**0.02**	**0.03**	**0.04**	**0.09**	**0.08**	**0.22**	**0.06**	**0.09**	**0.11**	**0.05**
No. of Large Old Trees to be removed in each Habitat Zone																							
Tree protection multiplier																							
Large Old Trees to be protected																							

[1] For non-forest or woodland vegetation or other vegetation types where some elements of the score are not relevant

HZ22	HZ23	HZ24	HZ25	HZ26	HZ27	HZ28	HZ29	HZ30	HZ31	HZ32	HZ33	HZ34	HZ35	HZ36	HZ37	HZ38	HZ56	HZ60	HZ61	HZ62	HZ63	HZ64	HZ65	HZ66
VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	55_61	132_62	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63
E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
													0											
													2											
5	5	15	15	5	5	5	5	5	15	15	15	5	15	5	5	5	15	15	5	5	5	5	5	5
11	11	9	6	9	9	7	7	6	6	6	6	13	6	2	2	2	9	9	11	11	9	11	7	9
3	3	6	0	6	6	6	6	3	6	6	6	6	5	6	6	6	6	6	6	6	3	6	0	3
5	5	4	4	3	3	3	3	5	3	3	3	2	5	3	3	3	5	5	4	4	5	4	3	5
													0											
24	24	34	25	23	23	21	21	19	30	30	30	26	33	16	16	16	35	35	26	26	22	26	15	22
55	55	55	55	55	55	55	55	55	55	55	55	55	75	55	55	55	55	55	55	55	55	55	55	55
33	33	46	34	31	31	29	29	26	41	41	41	35	33	22	22	22	48	48	35	35	30	35	20	30
1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1	1
1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	1	1	1	1	1	1	1
36	36	49	37	34	34	31	31	28	44	44	44	39	36	27	27	27	53	52	39	38	33	38	22	32
0.36	0.36	0.49	0.37	0.34	0.34	0.31	0.31	0.28	0.44	0.44	0.44	0.39	0.36	0.27	0.27	0.27	0.53	0.52	0.39	0.38	0.33	0.38	0.22	0.32
0.07	0.09	0.07	0.10	0.03	0.03	0.03	0.15	0.05	0.06	0.13	0.04	0.23	0.10	0.04	0.07	0.46	0.10	0.60	0.57	0.60	0.27	0.45	0.65	0.28
0.03	0.03	0.03	0.04	0.01	0.01	0.01	0.05	0.01	0.03	0.06	0.02	0.09	0.04	0.01	0.02	0.12	0.05	0.31	0.22	0.23	0.09	0.17	0.15	0.09
H	H	VH	H	H	H	H	H	H	VH	VH	VH	H	H	H	H	H	VH	VH	H	H	H	H	H	H
		H										H					H	H						
H	H	VH	H	H	H	H	H	H	VH	VH	VH	H	H	H	H	H	VH	VH	H	H	H	H	H	H
1.5	1.5	2	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	1.5	1.5	1.5	1.5	1.5	2	2	1.5	1.5	1.5	1.5	1.5	1.5
0.05	**0.05**	**0.06**	**0.06**	**0.02**	**0.02**	**0.02**	**0.08**	**0.02**	**0.06**	**0.12**	**0.04**	**0.14**	**0.06**	**0.02**	**0.03**	**0.18**	**0.10**	**0.62**	**0.33**	**0.35**	**0.14**	**0.26**	**0.23**	**0.14**

HZ67	HZ68	HZ69	HZ70	HZ71	HZ72	HZ73	HZ74	HZ75	HZ76	HZ77	HZ78	HZ79	HZ80	HZ81	HZ82	HZ83	Alt. A	Alt. B	Alt. C	Alt. D
VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63	132_63
E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
5	5	5	5	15	5	5	5	5	5	5	5	15	5	5	5	5	5	5	5	5
9	9	9	13	9	7	9	9	9	9	9	9	9	7	7	7	6	2	2	2	2
3	0	0	3	6	0	3	3	3	3	3	3	3	6	3	3	6	3	3	3	3
5	5	5	5	3	2	5	5	5	5	5	5	4	3	3	3	3	4	4	4	4
22	19	19	26	33	14	22	22	22	22	22	22	31	21	18	18	20	14	14	14	14
55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
30	26	26	35	45	19	30	30	30	30	30	30	42	29	25	25	27	19	19	19	19
1	1	1	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	2	2	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	1	1	1	1
33	30	30	42	52	26	33	33	33	33	32	32	44	33	29	29	31	21	21	21	21
0.33	0.30	0.30	0.42	0.52	0.26	0.33	0.33	0.33	0.33	0.32	0.32	0.44	0.33	0.29	0.29	0.31	0.21	0.21	0.21	0.21
0.42	0.16	0.13	0.30	0.30	0.55	0.16	0.26	0.60	0.24	0.06	0.22	0.22	0.03	0.04	0.02	0.03	0.11	0.04	0.06	0.02
0.14	0.05	0.04	0.13	0.16	0.14	0.05	0.09	0.20	0.08	0.02	0.07	0.10	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.00
H	H	H	VH	VH	H	H	H	H	H	H	H	VH	H	H	H	H	H	H	H	H
			H	H	H							H					H			
H	H	H	VH	VH	H	H	H	H	H	H	H	VH	H	H	H	H	H	H	H	H
1.5	1.5	1.5	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
0.21	**0.08**	**0.06**	**0.26**	**0.32**	**0.21**	**0.08**	**0.14**	**0.30**	**0.12**	**0.03**	**0.11**	**0.20**	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**	**0.02**	**0.02**	**0.00**