13. Biodiversity and Habitat

A Biodiversity and Habitat Assessment was conducted between October 2010 and January 2012. This included preliminary assessments of native vegetation and habitat values, targeted surveys for nationally significant and State significant species and net gain assessments.

The assessment identified two species that are listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (which are also listed under the State *Flora and Fauna Guarantee Act 1988*) that would be impacted by the Project. These species are:

- The Golden Sun Moth (Critically Endangered); and
- The Trailing-hop Bush (Vulnerable).

The assessment also identified seven additional State listed species that could be impacted by the Project:

- Emerald-lip Greenhood (rare, on DSE advisory list);
- Rising Star Guinea-flower (rare, on DSE advisory list);
- Rosemary Grevillea (rare, on DSE advisory list);
- Barking Owl (FFG Act listed, endangered, on DSE Advisory list);
- Brown Toadlet (FFG Act listed, endangered, on DSE Advisory list);
- Brown Treecreeper (south-eastern ssp.) (near threatened, on DSE Advisory list); and
- Brush-tailed Phascogale (FFG Act listed, Vulnerable, on DSE Advisory list).

The assessment also found that the study area transects three bioregions (Goldfields bioregion (GB), Central Victorian Uplands bioregion (CVUB) and Wimmera bioregion (WB)) and would intersect five Ecological Vegetation Classes (EVCs) of varying quality. These are:

- Plains Grassy Woodland (endangered in all three bioregions);
- Grassy Woodland (Vulnerable, in GB, endangered in CVUP and WB);
- Creekline Grassy Woodland (endangered in all three bioregions);
- Grassy Dry Forest (depleted in all three bioregions); and
- Heathy Woodland (depleted in all three bioregions).

During the Options Assessment process, matters of National Environmental Significance (NES) and vegetation of Very High and High conservation significance were deemed to be of highest conservation value, and priority was given to avoiding and minimising impacts on these values where possible.

Through alignment design changes avoidance of significant amounts of matters of NES was achieved. However, it was not possible to entirely avoid impacts on matters on NES. It is expected that the Project would impact up to 21 Trailing-hop Bush plants and up to 29.92 hectares (ha) of confirmed and 99.94ha of potential Golden Sun Moth habitat.

In accordance with SEWPaC guidelines the Project would have a significant impact on Trailing Hop-bush and Golden Sun Moth habitat. However, for Golden Sun Moth the impact, as rated for the project area, was considered to be moderate as the Project would result in removal of greater than 1% of the project area population but less than 1% of the regional area population. For Trailing Hop-Bush the impact, as rated for the Project Area, was considered to be minor as the Project would result in removal of less than 1% of the project area population. The impact to Trailing Hop-bush from the Project would be further reduced as individuals of this species would be translocated.

It is considered that the impacts on State listed species would be minor as the Project would impact on less than 1% of the regional populations of these species. Mitigation measures including micro-alignment during detailed design and construction planning would be implemented to minimise the impact on State listed species.

There is also the potential for construction to encounter three fauna species listed on the DSE Advisory List (Fat-tailed Dunnart, Black-chinned Honeyeater and the Bearded Dragon).

The Project would impact on approximately 133.63ha of EVCs (of which approximately 116.62ha are of Very High conservation significance). This is considered to be a moderate impact as it would result in a loss of 0.1 - 1 % of the area of EVCs of Very High or High conservation significance within the relevant bioregions and the losses of EVCs are expected to be able to be offset in accordance with Victoria's Native Vegetation Management policy.

The Project could also result in the loss of up to 882 Large Old Trees (LOTs) within remnant native vegetation patches, 792 of which are of Very High conservation significance. An additional 79 scattered trees may be removed

as a result of the Project.

Mitigation measures including detailed design should reduce the number of LOTs within remnant native vegetation patches and scattered trees impacted by the Project. It is expected that the actual number of LOTs and scattered trees impacted would be less than these totals because management measures including micro-alignment during detailed design and construction planning would be implemented to minimise the number of LOTs and scattered trees impacted. It is expected that the impact on LOTs and scattered trees would be moderate.

Further minimisation of impact on matters of NES and State significance would also be able to be achieved through micro-realignment in the detailed design phase.

VicRoads would be required to obtain offsets for vegetation losses in accordance with Victoria's Native Vegetation Management – A Framework for Action and the EPBC Act Environmental Offsets Policy. Preliminary investigations indicate that offsets are available and that VicRoads could source appropriate offsets from one or a combination of BushBroker, Trust for Nature, the VicRoads Net Gain Bank and private offset brokers.

13.1 EES Objectives

The EES objective relevant to the biodiversity and habitat assessment is:

- *To avoid or minimise effects on flora and fauna species and ecological communities listed under the Flora and Fauna Guarantee Act 1988 or the Environment Protection and Biodiversity Conservation Act 1999 and to comply with requirements under Victoria's Native Vegetation Management - A Framework for Action;*

This chapter discusses the biodiversity and habitat values of the Project area, the potential impacts from the Project on these values and the management measures to be implemented to minimise these impacts. More specifically, this chapter addresses the following EES Scoping Requirements:

- "Characterise the native vegetation and terrestrial and aquatic habitat located in the project area. Such characterisation should include the existence or potential existence of any listed species or ecological communities under the FFG Act and EPBC Act and any declared weeds or pathogens. Such characterisation should be informed by relevant databases, literature and appropriate seasonal and targeted surveys;
- Provide evidence to demonstrate that adequate information (e.g. desktop database searches, targeted surveys and/or modelling) has been compiled on the potential presence of listed species and ecological communities having regard to the likelihood and consequence of impact. In the absence of positive identification, the precautionary approach should be taken for the potential existence of listed species and ecological communities, particularly under the EPBC Act;
- Identify and assess potential effects of the project and relevant alternatives on existing native vegetation, habitat (quality and continuity), listed species and ecological communities and weed and pathogen dispersal and distribution. Potential effects to be addressed should include but not be limited to: barriers to the movement of wildlife, fragmentation of habitat and vehicle road kills of fauna. Such assessment should address the relevant Potentially Threatening Process listed under the FFG Act;
- Assess any effect of the project on other conservation values, including areas of scientific or other special conservation significance;
- Identify and assess potential direct and indirect effects on aquatic habitat values, including on significant aquatic species, that may result from project and, in particular any proposed waterway crossings;
- Specify any measures to avoid, minimise and mitigate biodiversity impacts, especially on threatened or other listed species;
- Outline any obligations arising from *Victoria's Biodiversity Strategy and Victoria's Native Vegetation Management – A Framework for Action*. In particular, the EES should address how vegetation removal has been avoided and minimised by the proposed works;
- Outline an offset strategy in the context of both *Victoria's Native Vegetation Management – A Framework for Action and Policy Statement 4.1: Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999.* This offset strategy should describe proposed arrangements for the ongoing management of offsets, as well as details on the security of tenure and ownership of offsets;
- Identify methods of vegetation rehabilitation for both areas disturbed for construction purposes only and any sections of existing road to be made redundant;
- Describe the proposed approach and measures for long-term management of retained native vegetation and habitat areas within and adjacent to the road reservation along the duplicated highway; and

- Describe at a level of detail proportionate to the significance of potentially affected assets the likely residual effects of the project on biodiversity and habitat values."

This chapter is based on a Flora, Fauna and Net Gain assessment completed by Ecology and Heritage Partners Pty Ltd (EHP, 2012). The detailed assessment report is included in Appendix H.

13.2 Study Area

The study area, encompasses a corridor extending approximately 1500 metres (m) either side of the edge of the road reserve, except around Great Western where it extends up to 1800m (encompassing the extent of new alignment possibilities either side of the town) (Refer to Figure 13-1).

13.3 Methodology

The biodiversity and habitat assessment for the Project is based upon a number of assessments undertaken prior to the EES process, as well as the assessments completed as part of the EES process. A detailed description of the survey methods used and the species that were surveyed for is included in Technical Appendix H.

Table 13-1 provides a summary of the surveys completed for the Project that have informed the assessment of the biodiversity and habitat values.

The biodiversity and habitat assessment for the Project included the following tasks:

- Review of the following databases to obtain a list of species previously recorded within 10 kilometres (km) of the study area:
  - Flora Information System (FIS)
  - Victorian Biodiversity Atlas (VBA)
  - Atlas of Victorian Wildlife (AVW)
  - Biodiversity Interactive Maps (DSE, 2010)
  - Protected Matters Search Tool (SEWPaC, 2010);
- Review of relevant existing reports;
- Preliminary visual assessment of the study area to document flora species and vegetation types and to record the overall condition of vegetation;
- Preliminary habitat and fauna survey to identify fauna species present in the study area and identify habitats;
- Aquatic fauna surveys of suitable waterways;
- A preliminary Net Gain assessment of vegetation in accordance with the methodology described in the Vegetation Quality Assessment Manual (DSE, 2004); and
- Targeted surveys for species of conservation significance likely to occur within the study area (based on the findings of the desktop assessment). Refer to Table 13-1 for information on species targeted in survey and the timing of these surveys.

A map showing the location of the surveys is provided in Figure 13-2.

Table 13-1 Fieldwork timing summary

Activity / species	Date completed	Season
Preliminary visual assessment to document flora species and vegetation types and condition	15 – 18 and 28 – 30 June 2010	Winter
Habitat and fauna survey	15 – 17 June 2010	Winter
Targeted Fauna surveys (Nationally listed species)		
Striped Legless Lizard	Tile grids established on 2 September 2010. Tile grids monitored on 25 November and 14 and 21 December 2010, 5 January and 5 April 2011.	Spring Summer Autumn
Golden Sun Moth*	13, 14, 22 and 23 December 2010 and 5, 6 and 20 January 2011.	Summer
Southern Brown Bandicoot	25 November - 21 December 2010	Spring Summer
Dwarf Galaxias (aquatic)**	September 2010	Spring

Targeted Fauna surveys (State listed species)		
Fat-tailed Dunnart	Tile grids established on 2 September 2010. Tile grids monitored on 25 November and 14 and 21 December 2010, 5 January and 5 April 2011.	Spring Summer Autumn
Yellow Ochre Butterfly	13, 14 and 22 December 2010, 23 December, 5, 6 and 20 January 2011.	Summer
Elegant Parrot Brown Treecreeper Grey-crowned Babbler Chesnut-rumped Heathwren Speckled Warbler Painted Honeyeater Hooded Robin Diamond Firetail Black-chinned Honeyeater	25 November and 21 December 2010, 6 – 7 April and 18 – 19 April 2011.	Spring Summer Autumn
Lace Goanna	25 November and 21 December 2010, 6 – 7 April and 18 – 19 April 2011.	Spring Summer Autumn
Brown Toadlet	6 and 19 April 2011	Autumn
Powerful Owl Barking Owl	15 February, 2 March and 19 April 2011	Summer Autumn
Brush-tailed Phascogale	25 November to 21 December 2010, 6 April to 19 April 2011	Summer Autumn
Squirrel Glider	6 April to 19 April 2011	Autumn
Golden Perch (aquatic)	September 2010	Spring
River Blackfish (aquatic)	September 2010	Spring
Targeted Flora surveys (Nationally listed species)		
Spiny Rice-flower***	2 and 3 September 2010, 18 and 19 October 2010, 19 and 21 January 2011	Spring Summer
Trailing Hop-bush		
Tawny Spider Orchid		
Pomonal Leek-orchid		
Button Wrinklewort		
Large-headed Fireweed		
Targeted Flora Surveys (State listed species)		
Emerald-lip Greenhood	2 and 3 September 2010, 18 and 19 October 2010 and 19 and 21 January 2011.	Spring Summer
Fringed Sun-orchid		
Crimson Sun-orchid		
Rising Star Guinea-flower		

* A precautionary approach has been taken with regard to Golden Sun Moth habitat. Within the study area Golden Sun Moth habitat was mapped as either 'confirmed' or 'potential'. Details of how 'confirmed' and 'potential' Golden Sun Moth habitat was calculated is provided in Chapter 20 (Matters of NES).

** The EPBC publication Survey Guidelines for Australia's Threatened Fish (2011) states that "December through to April are the best months for sampling fishes in Victoria as water flows are lower." However, waterways between Ararat and Stawell are completely dry throughout the summer months and thus surveys were required to be undertaken outside the preferred survey period.

*** An initial flora assessment was undertaken during the optimum time for Spiny Rice-flower surveys. While targeted surveys were undertaken just outside the suggested period in early September, remnants of the Spiny Rice-flower flowers are still visible and easily distinguishable from other similar species at this time.

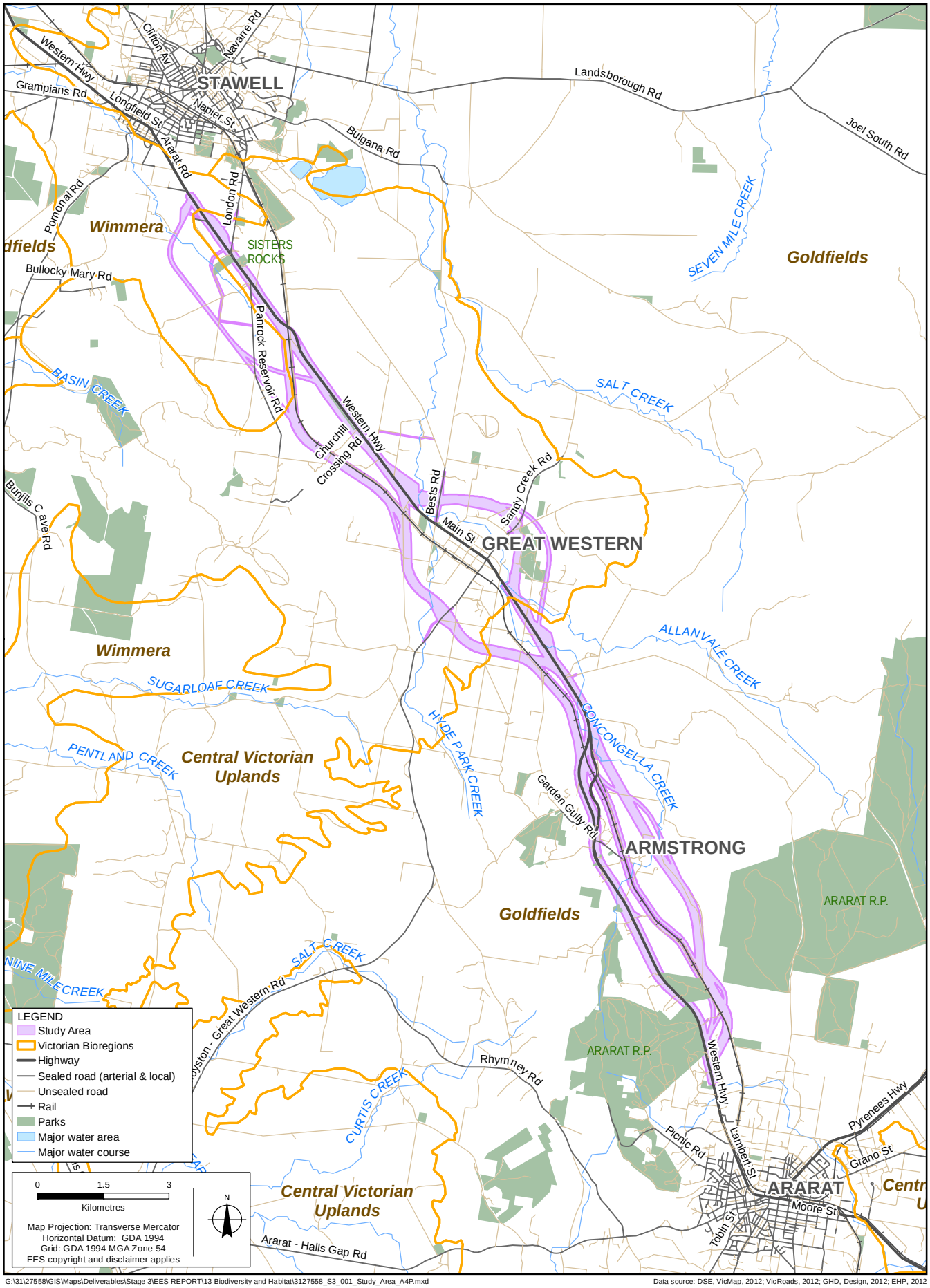


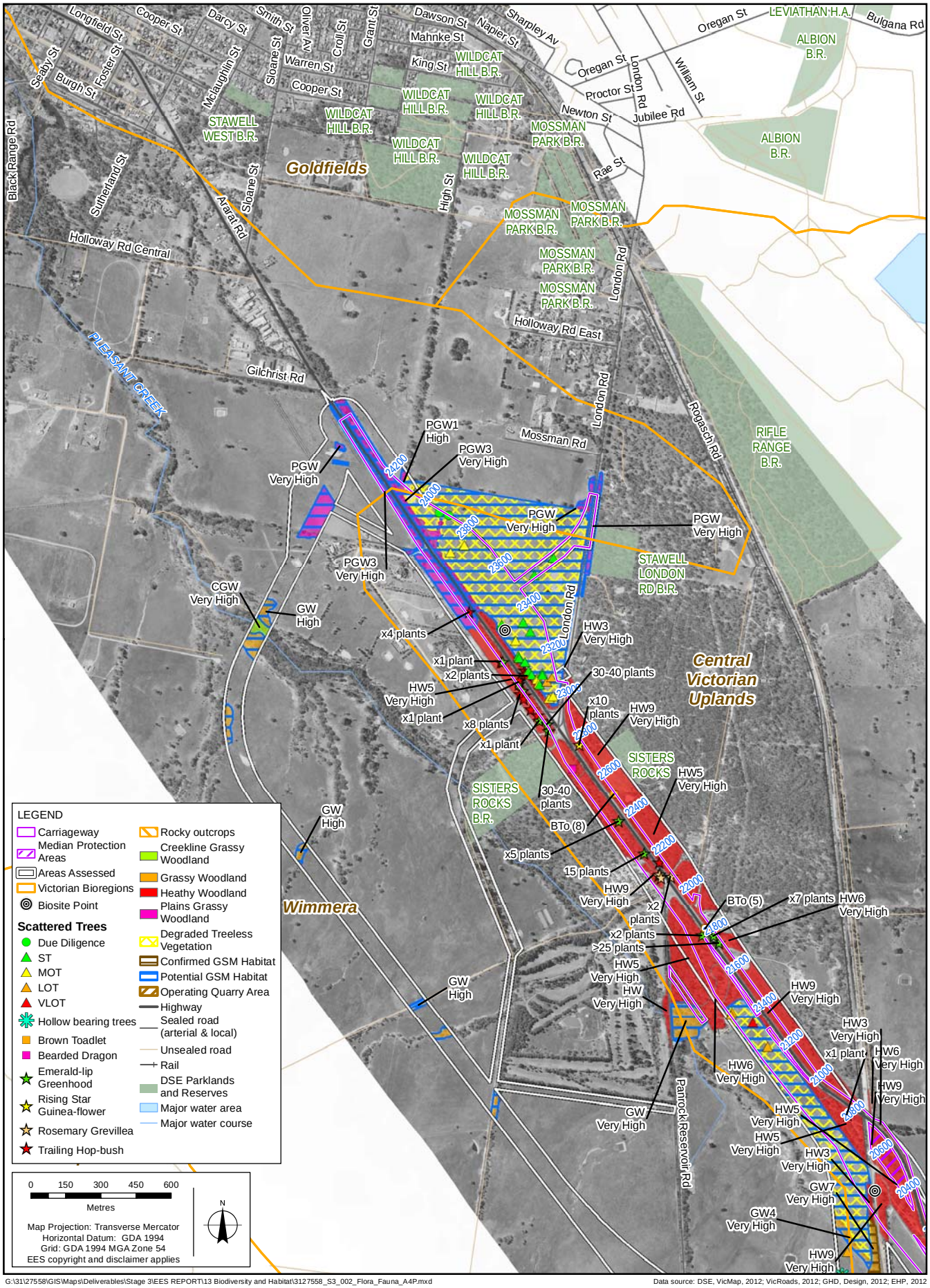
Figure 13-1 Biodiversity and Habitat Study Area and Bioregion Boundaries

13.4 Legislation and Policy

The relevant legislation and government policies for biodiversity and habitat are discussed in Table 13-2.

Table 13-2 Relevant Biodiversity and Habitat Legislation and Policies

Legislation / Policy	Description
Commonwealth	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The *Environment Protection and Biodiversity Conservation Act*, *1999* (EPBC Act) provides that certain actions – in particular, actions that are likely to have a significant impact on a Matter of National Environmental Significance (MNES) –are subject to a rigorous assessment and approval process. The MNES identified in the Act as triggers for the Commonwealth assessment and approval regime are: ▪ World Heritage Properties ▪ National Heritage places ▪ Ramsar Wetlands ▪ Threatened species and ecological communities ▪ Migratory species ▪ Commonwealth marine areas and Nuclear actions (including uranium mining). The Project has been designated as a controlled action under EPBC Act as there is a potential for a significant impact on listed threatened species and communities. More detail on matters of NES can be found in Chapter 20.
Victorian	
Flora and Fauna Guarantee Act *1988*	As the Project is occurring (partially) on public land and is being undertaken by a public authority (VicRoads), the Project is required to meet the objectives of the FFG Act, which require: ▪ Demonstrating that measures have been taken to avoid impacting on FFG Act listed species and communities. ▪ Potentially threatening processes, which may impact on FFG Act listed species and communities, have been avoided or minimised. ▪ Under the FFG Act, a permit would be required from the Department of Sustainability and Environment (DSE) for the removal or disturbance of FFG Act listed flora species and flora that form part of a listed community.
Planning and Environment Act 1987	A planning permit would be required for the removal or disturbance of native vegetation within the study area. This is discussed further in Chapter 8 (Planning and Land Use).
Wildlife Act 1975	The inspection, removal or relocation of fauna species for the Project would require a permit under the *Wildlife Act 1975*.
Fisheries Act 1995	A permit will be required under the *Fisheries Act 1995*, if the Project is going to injure or destroy species protected under the Act.
Catchment and Land Protection Act 1994	It is very likely that noxious weeds (declared under the CALP Act) will be present in the Project area. Therefore, the construction and maintenance of the highway will need to comply with the provisions of the Act, which protect against spreading of these weeds.
Victoria's Native Vegetation Management – A Framework for Action	In accordance with this policy, the alignment for the Project was selected to avoid impacting on native vegetation and where this wasn't possible, the aim was to minimise the impacts on native vegetation. A preliminary net gain assessment has been completed for the Project, to calculate the offsets potentially required for the areas of native vegetation and habitat that could not be avoided, where the removal of native vegetation and habitat would be required. Appendix 4 states that clearing of 'very high' conservation significance vegetation is not permitted unless exceptional circumstances apply (i.e. impacts are an unavoidable part of a development project, and approval is obtained from the Minister for Environment and Climate Change based on considerations of environmental, social and economic values from a State wide perspective).



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Data source: DSE, VicMap, 2012; VicRoads, 2012; GHD, Design, 2012; EHP, 2012

Figure 13-2a Ecological Values in the Study Area

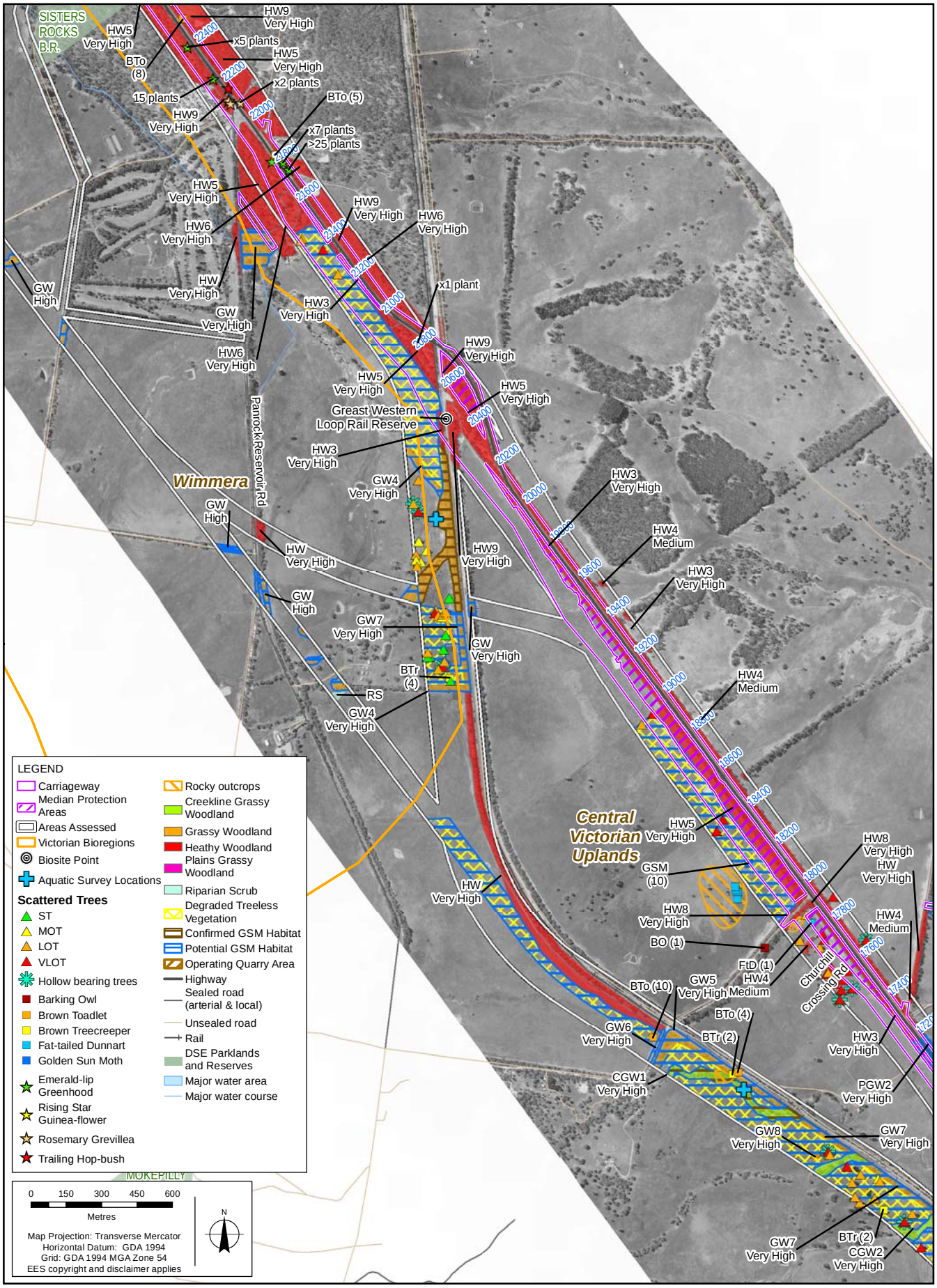
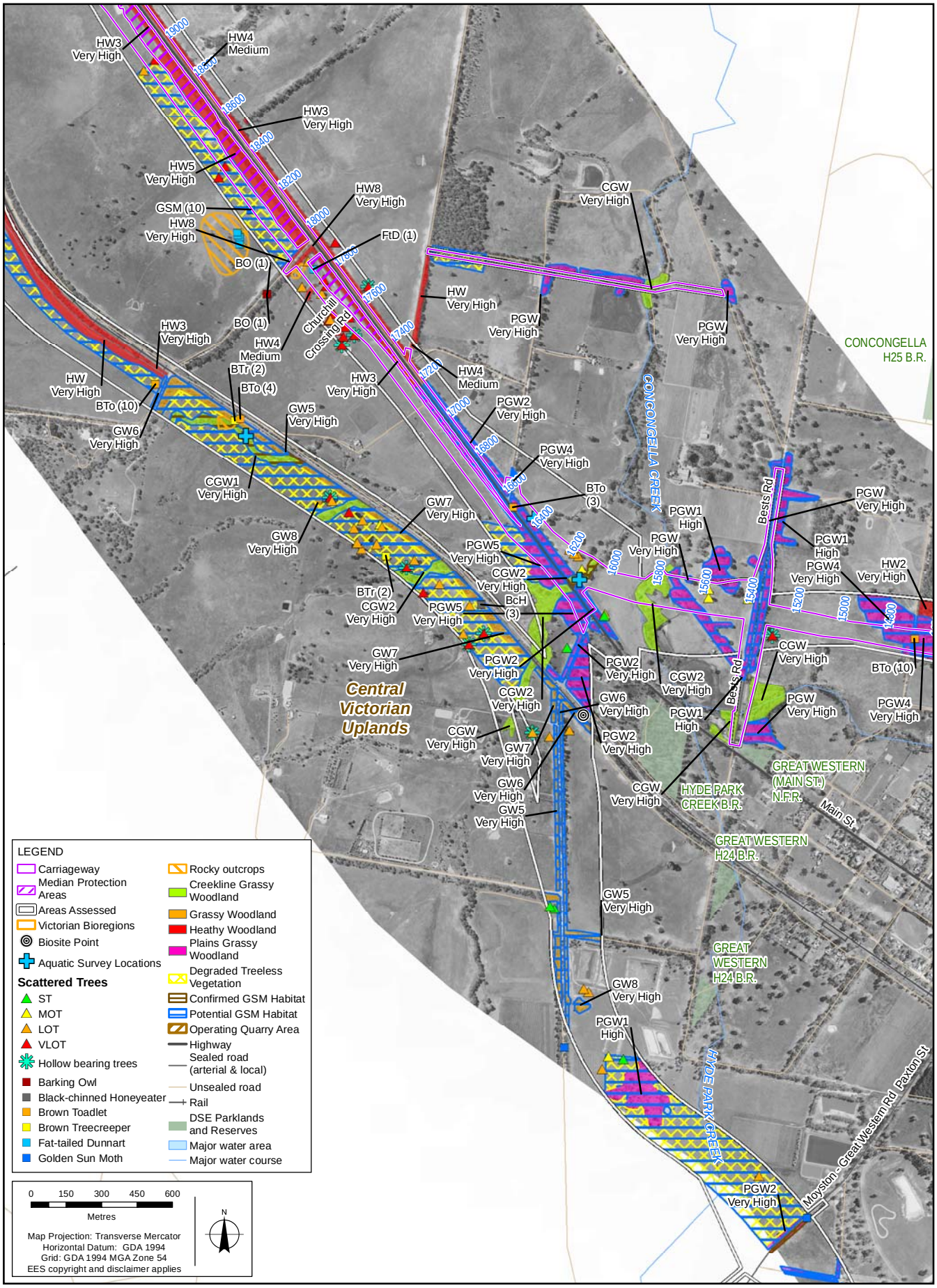


Figure 13-2b Ecological Values in the Study Area



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Data source: DSE, VicMap, 2012; VicRoads, 2012; GHD, Design, 2012; EHP, 2012

Figure 13-2c Ecological Values in the Study Area

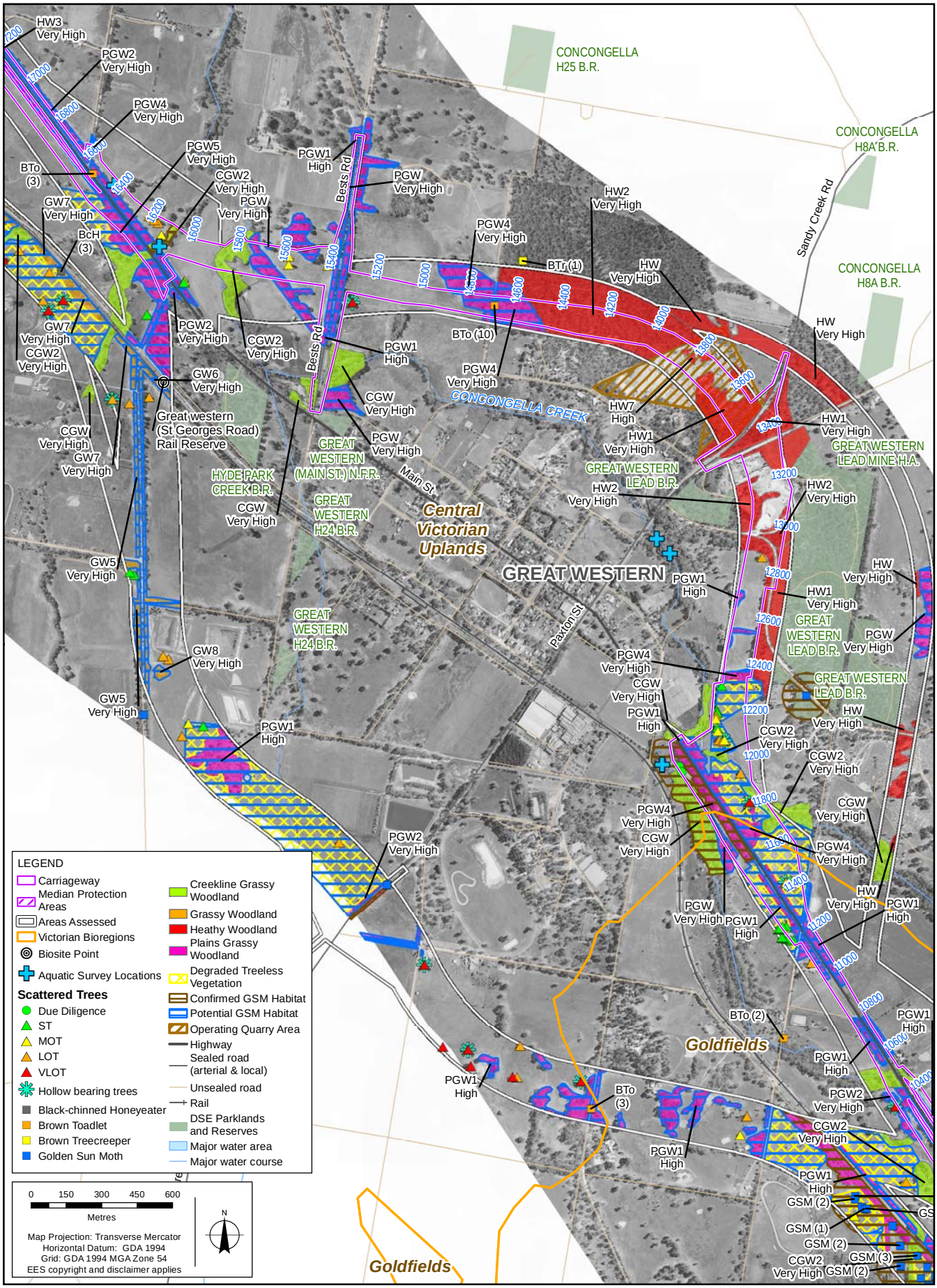

Figure 13-2d Ecological Values in the Study Area

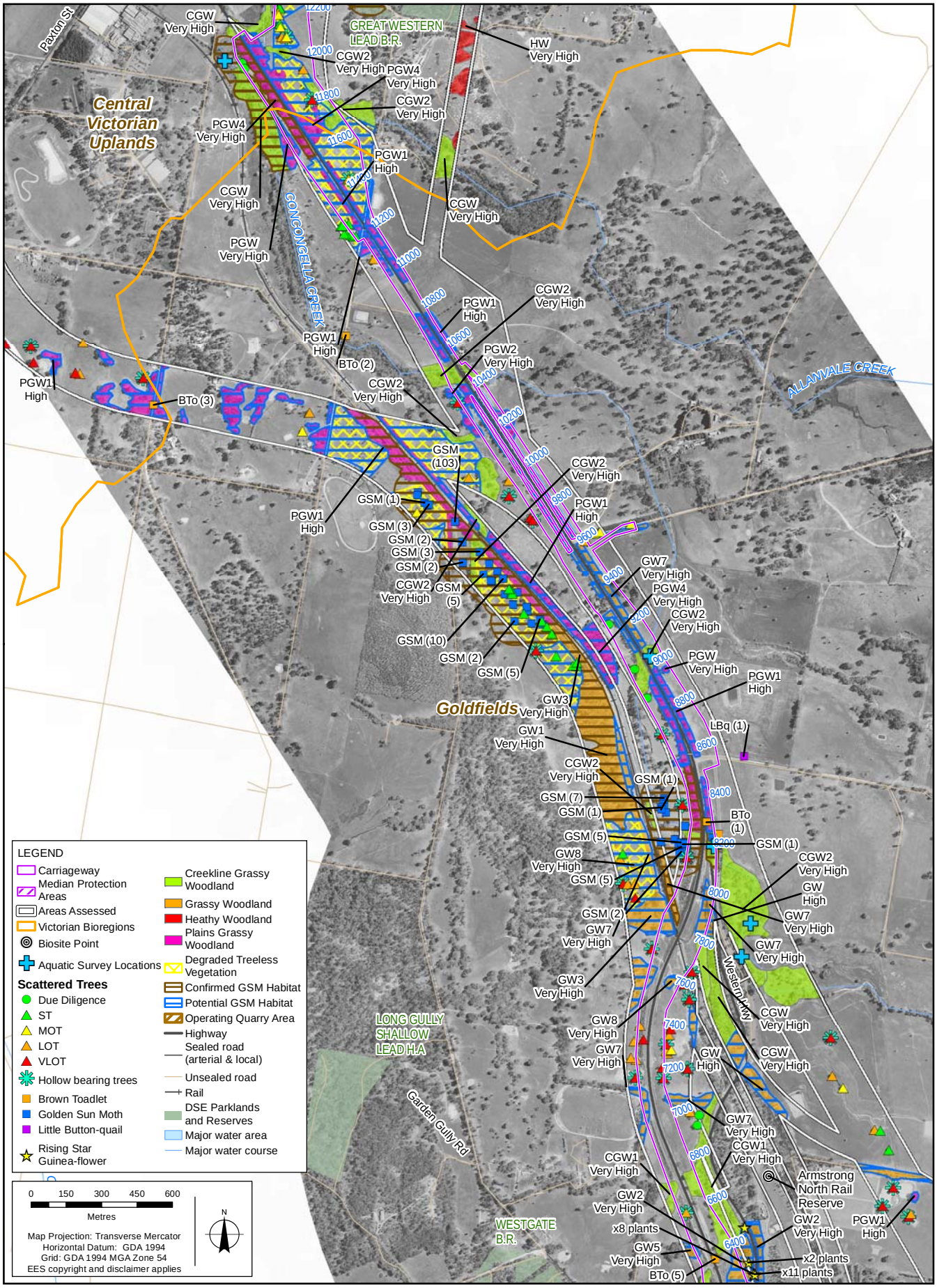

Figure 13-2e Ecological Values in the Study Area

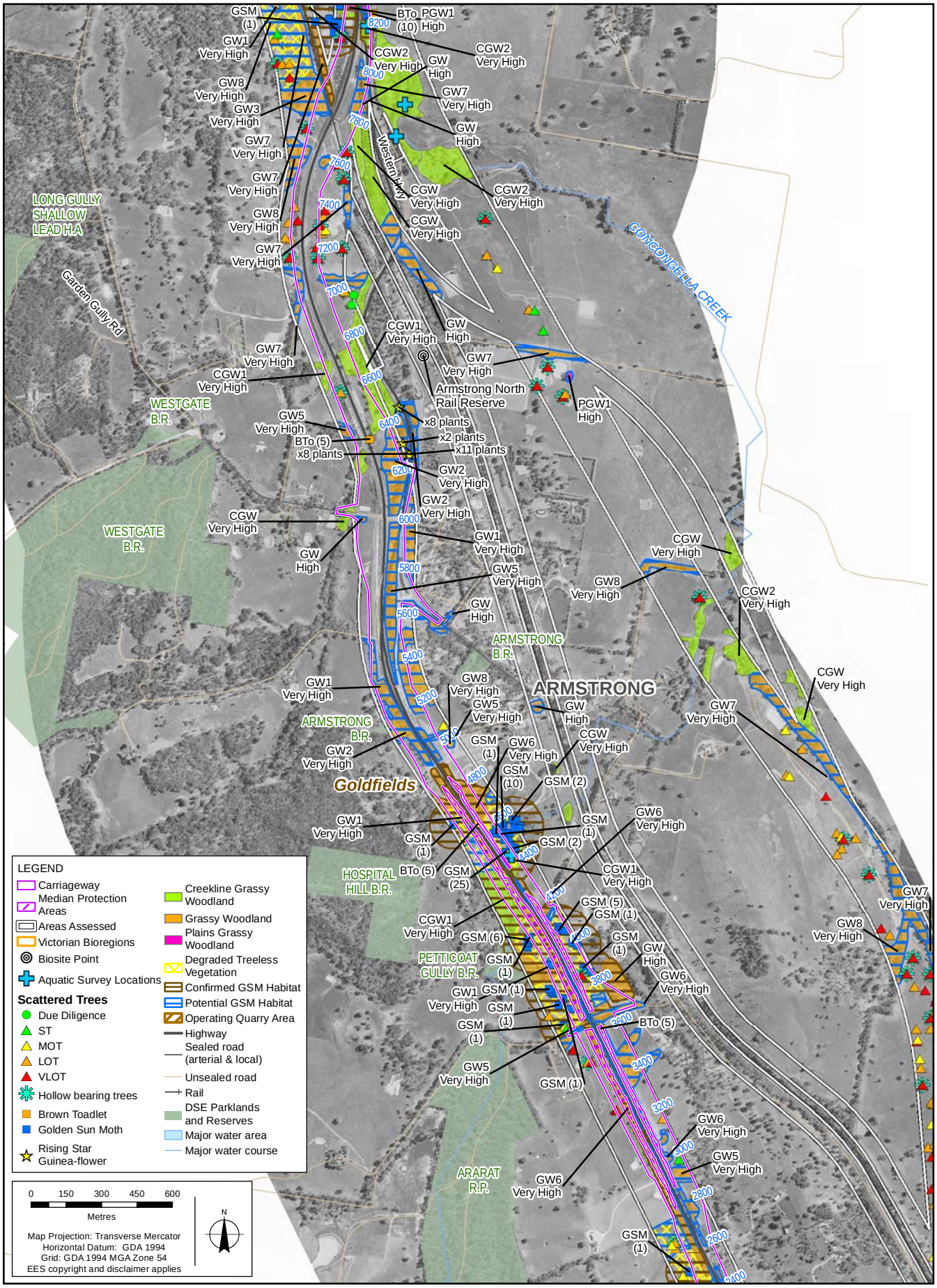

Figure 13-2f Ecological Values in the Study Area

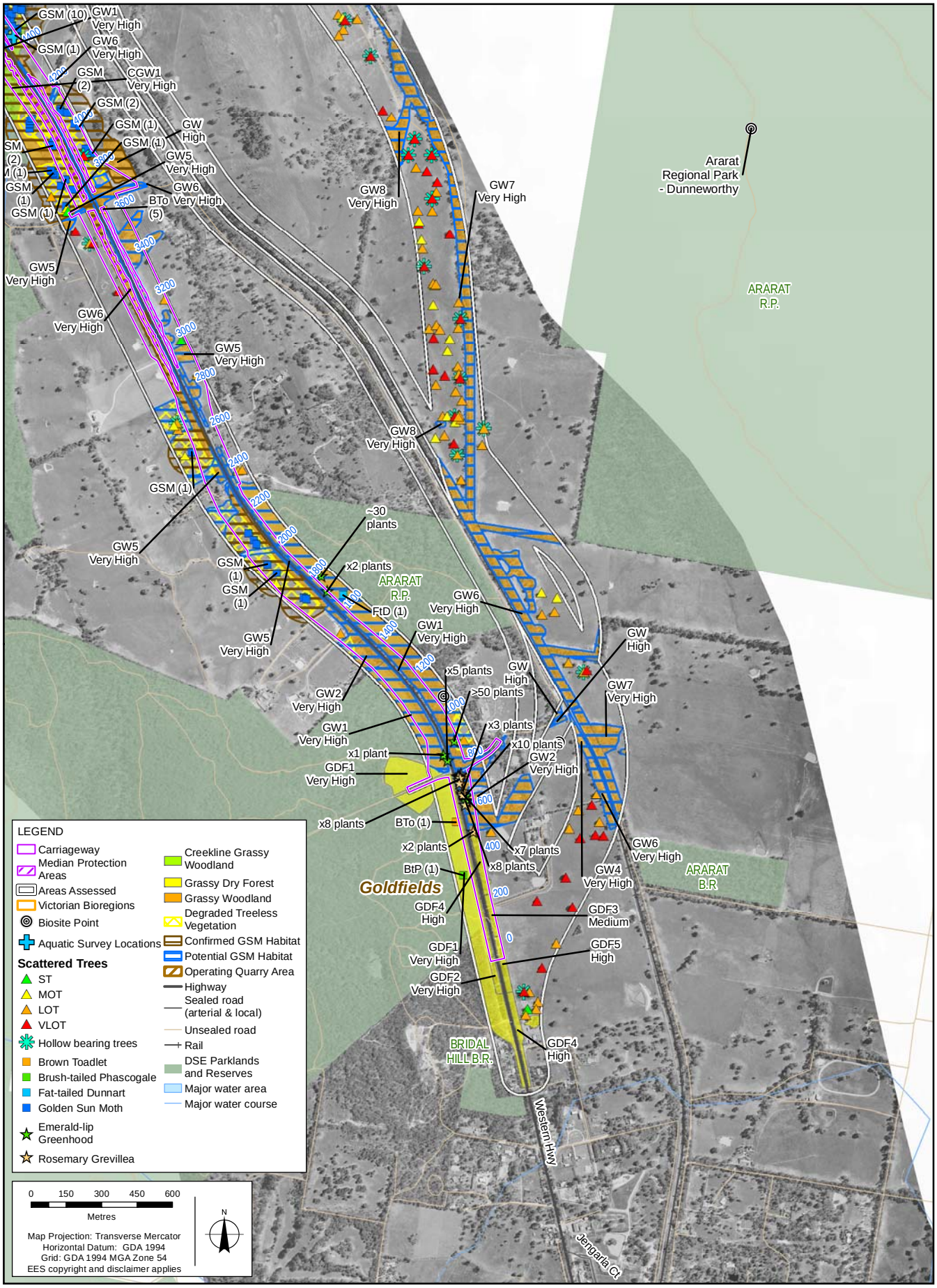

Figure 13-2g Ecological Values in the Study Area

13.5 Existing Conditions

Parts of the study area are considered to be of national and State conservation significance due to the presence of habitat for national and State significant flora and fauna species and State significant Ecological Vegetation Classes (EVCs).

The vegetation within the study area is mainly the Grassy Woodland EVC between Ararat and Great Western with large areas of Plains Grassy Woodland and Heathy Woodland between Great Western and Stawell (refer to Figure 13-2).

The southern half of the study area, which is located in the Goldfields bioregion, is dominated by Grassy Woodland in moderate to good condition. Within the southern half of the study area there are also remnants of Plains Grassy Woodland in poor to moderate condition, which are dominated by River Red-gum with Yellow Box and Yellow Gum and also Creekline Grassy Woodland.

The northern half of the study area, which is located within the Central Victorian Uplands and Wimmera bioregions, is dominated by Plains Grassy Woodland and Heathy Woodland in moderate to good condition and also small areas of Creekline Grassy Woodland in poor to moderate condition. Within many of the paddocks in this area there are large patches of native grasses amongst pasture which are likely to be classified as Degraded Treeless Vegetation by the DSE.

A total of 201 plant species (139 indigenous and 62 exotic) were recorded within the study area. There were 76 fauna species comprising four mammals (three native, one introduced), 64 birds (62 native, two introduced), two native frogs, three fish (two native, one introduced) and one freshwater crayfish species recorded in the study area during the flora and fauna survey.

13.5.1 Flora

The biodiversity and habitat assessment has identified significant communities and flora of State and national significance and EVCs within the study area. Figure 13-2 shows the location of EVCs and flora species of national and State conservation significance.

Nationally Significant Communities

There were no nationally significant vegetation communities (listed under the EPBC Act) recorded in the study area.

Flora Species of National Significance

Thirteen nationally significant flora species (listed under the EPBC Act) have previously been documented or predicted by the EPBC Act Protected Matters Search Tool to potentially occur within 10km of the study. These are:

- Trailing Hop-bush (Vulnerable EPBC Act, FFG Act listed);
- Pomonal Leek-orchid (Endangered);
- Button Wrinklewort (Endangered);
- Large-fruit Fireweed (Vulnerable);
- Metallic Sun-orchid (Endangered);
- McIvor Spider-orchid (Endangered);
- Ornate Pink-fingers (Vulnerable);
- Grampians Bitter-pea (Vulnerable);
- Purple Eyebright (Endangered);
- Tawny Spider-orchid (Endangered);
- Spiny Rice-flower (Critically Endangered);
- Clover Glycine (Vulnerable); and
- Spiral Sun-orchid (Vulnerable).

Trailing Hop-bush (listed as Vulnerable under the EPBC Act) was the only flora species of national significance identified in the study area during the surveys. The locations of the 67 identified Trailing Hop-bush plants are shown in Figure 13-2.

Flora Species of State Significance

Forty four flora species of State significance have been recorded within 10km of the study area. A full list of these species can be seen in Technical Appendix H. Of these 44 species, only Emerald-lip Greenhood (rare, DSE advisory list), Rising Star Guinea-flower (rare, DSE advisory list) and Rosemary Grevillea (rare, DSE advisory list) were identified in the study area during the surveys. The locations of these species are shown in Figure 13-2.

No FFG Act listed flora species except for Trailing Hop-bush were identified in the current flora and fauna survey.

Ecological Vegetation Classes (EVCs)

The DSE mapping of the study area pre-1750 indicates the area between Ararat and Stawell once supported:

- Grassy Woodland (EVC 175)
- Grassy Dry Forest (EVC 20)
- Heathy Woodland (EVC 48)
- Alluvial Terraces Herb-rich Woodland (EVC 67)
- Creekline Grassy Woodland (EVC 68)
- Plains Grassy Woodland (EVC 55)
- Riparian Scrub (EVC 191).

The flora and fauna assessment identified that the current vegetation in the study area is generally consistent with Grassy Woodland (EVC 175) between Ararat and Great Western and Plains Grassy Woodland (EVC 55) and Heathy Woodland (EVC 48) between Great Western and Stawell. However, areas of Grassy Dry Forest (EVC 175) and Creekline Grassy Woodland (EVC 68) were also identified in the study area.

The other two EVCs predicted to occur pre-1750 (Alluvial Terraces Herb-rich Woodland (EVC 67) and Riparian Scrub (EVC 191)) were not identified in the study area.

The locations of the five EVCs identified during the current assessment are shown in Figure 13-2. A description of each of these five EVCs is outlined in Table 13-3.

Table 13-3 EVCs in the Study Area

EVC Number	EVC Name	Description	Location in Study Area	Status in Bioregion
175	Grassy Woodland	Open, eucalypt to 15m tall over a diverse ground layer of grasses and herbs (DSE, 2004).	Between Ararat and Great Western	▪ Vulnerable (Goldfields bioregion) ▪ Endangered (Central Victorian Uplands bioregion and Wimmera Bioregion)
48	Heathy Woodland	Eucalypt-dominated low woodland to 10m tall lacking a secondary tree layer and supporting a diverse array of narrow leaved shrubs except where frequent fire has reduced this to a dense cover of bracken (DSE, 2004).	Great Western and Stawell	Depleted
55	Plains Grassy Woodland	Open, eucalypt woodland to 15m tall, containing a sparse shrub layer over a species-rich grassy and herbaceous ground layer (DSE, 2004).	Between Great Western and Stawell	Endangered
68	Creekline Grassy Woodland	Eucalypt-dominated woodland to 15m tall with an occasional scattered shrub layer over a mostly grassy/sedgy to herbaceous ground-layer (DSE, 2004).	Along major waterways and associated tributaries	Endangered
20	Grassy Dry Forest	Overstorey dominated by a low to medium height forest of eucalypts up to 20m tall, sometimes resembling and open woodland and an understorey characterised by a high diversity of drought-tolerant grasses and herbs (DSE, 2004).	Remnant patches in various locations in the study area (refer to Figure 13-2).	Depleted

13.5.2. Fauna

The biodiversity and habitat assessment has identified fauna species that are of national, State and regional significance and areas of fauna habitat.

Fauna Species of National Significance

Six nationally significant fauna species listed under the EPBC Act have previously been recorded within 10km of the study area or are predicted to occur within the study area. These fauna species are:

- Growling Grass Frog (Vulnerable);
- Plains-wanderer (Vulnerable);
- Regent Honeyeater (Endangered);
- Swift Parrot (Endangered);
- Southern Brown Bandicoot (Endangered); and
- Golden Sun Moth (Critically Endangered EPBC Act, FFG Act listed).

Targeted surveys of the Striped Legless Lizard, Golden Sun Moth, Southern Brown Bandicoot and Dwarf Galaxias were undertaken. During targeted surveys only the Golden Sun Moth was recorded in the study area. The locations of these recordings are shown in Figure 13-2. However, it is considered that there is the potential for the Regent Honeyeater, the Swift Parrot and the Southern Brown Bandicoot to be present in the study area.

There are five previous records of Growling Grass Frog from the local area, the most recent in 1963. The majority of drainage lines within the study area were dry at the time of assessment, and local residents indicate they rarely flow. In addition, the majority of farm dams within the study area supported little or no vegetation.

Given the lack of recent records and suitable habitat there is a low likelihood that the Growling Grass Frog would be present in the study area. However, given the transient nature of this species, it would be prudent to apply the precautionary principle when undertaking work around certain waterways. Where construction works are likely to impact areas within 20m of Robinsons Creek or Donald Creek a pre-construction survey would be undertaken. If Growling Grass Frogs are identified, a salvage and translocation plan would be prepared and implemented.

It is also considered unlikely that the Plains-wanderer would be present as the study area would only provide superficial habitat for this species and the species is usually confined to the northern areas of Victoria and the southern areas of New South Wales.

Fauna Species of State Significance

Twenty six State significant fauna species listed under the FFG Act have previously been documented within 10km of the study area. Refer to Technical Appendix H for a list of these species. Of these 26 species, four were identified in the targeted surveys. These were:

- Barking Owl (Endangered);
- Brown Toadlet (Endangered);
- Brown Treecreeper (south-eastern ssp.) (Near Threatened); and
- Brush-tailed Phascogale (Vulnerable).

However, due to the presence of potentially suitable habitat and previous records within 10km of the study area, it is considered the following species may also be present in the study area:

- Powerful Owl (Vulnerable) (moderate likelihood);
- Hooded Robin (Near Threatened) (low likelihood);
- Chestnut-rumped Heathwren (Vulnerable) (low likelihood);
- Speckled Warbler (Vulnerable) (low likelihood);
- Painted Honeyeater (Vulnerable) (low likelihood);
- Diamond Firetail (Vulnerable) (low likelihood);
- Lace Goanna (Vulnerable) (low likelihood); and
- Elegant Parrot (Vulnerable) (low likelihood).

No significant aquatic fauna species were identified in the targeted surveys and due to the lack of suitable habitat for the aquatic species targeted as part of this assessment (Dwarf Galaxias, Golden Perch and River Blackfish) it is considered unlikely that these species would be present in the study area.

One additional State-significant species (Yellow Ochre Butterfly, FFG listed) has been sighted by a local resident of the Great Western township. However, despite targeted surveys undertaken in suitable habitat, this species was not recorded in the study area and it is considered unlikely that this species would be present in the study area.

It is also considered that the Brolga (Vulnerable) species may forage in ploughed fields in the study area.

State Significant Fauna Communities

One FFG Act listed fauna community, the Victorian Temperate Woodland Bird Community, is likely to be present in the study area. Habitat for this community is widespread throughout the study area in most riparian habitats that support hollow-bearing River Red Gums or Yellow Box.

Fauna Species of Regional Significance

Nine regionally significant fauna species listed on the DSE Advisory List of Threatened Vertebrate in Victoria have previously been documented within 10km of the study area. These species are:

- Fat-tailed Dunnart;
- Eastern Pygmy-possum;
- Spotted Harrier;
- Pied Cormorant;
- Whiskered Tern;
- Brown Quail;
- Black-eared Cuckoo;
- Black-chinned Honeyeater; and
- Woodland Blind Snake.

Four regionally significant fauna species (Bearded Dragon, Black-chinned Honeyeater, Fat-tailed Dunnart and Little Button-quail) were identified in the study area during the flora and fauna assessment.

One deceased Bearded Dragon was recorded in roadside vegetation at the intersection between London Rd and Western Highway, Stawell during the targeted fauna survey.

The Black-chinned Honeyeater was recorded during both the preliminary and targeted assessments foraging in eucalypts on the boundary of private property abutting the railway between St Georges Road and Churchill Crossing Road.

Eleven Fat-Tailed Dunnarts and numerous nests were recorded in the rocky knolls near the intersection of Churchill Crossing Road and Western Highway on the southern site of Western Highway during the targeted survey. The proposed alignment is located approximately 50 metres from the rocky knoll.

One female Little Button-quail was recorded on Military Bypass Road whilst undertaking Brown Toadlet surveys. This is outside the proposed alignment.

It is expected that on occasions the Spotted Harrier may forage or fly over the study area. It is also a possibility that drainage lines may be occasional habitat for Platypus. It is unlikely the Little Button-quail would utilise habitat within the proposed alignment.

Fauna Habitat

There are five major habitat types that occur in the study area. These habitat types are:

- Woodlands;
- Farm dams and drainage lines;
- Native grasslands;
- Scattered trees; and
- Introduced pasture/grassland.

The condition of these habitat areas ranges from low to high. A summary of these fauna habitat areas is outlined in Table 13-4.

Table 13-4 Fauna Habitat area descriptions

Fauna Habitat	Corresponding EVC	Description
Woodland	Grassy Dry Forest, Grassy Woodland, Heathy Woodland, Plains Grassy Woodland	Areas of remnant woodland occur as roadside vegetation as well as remnant patches. Remnant woodlands provide an important habitat for a range of fauna, particularly within the study area where woodland has been mostly cleared for agricultural purposes.
Farm dams and drainage lines	Creekline Grassy Woodland	There are a number of water bodies and dry creeks in the study area that are considered to be of high value for riparian dwelling fauna. Drainage lines may provide habitat for common aquatic and semi-aquatic fauna when flowing. However they have a high level of exotic vegetation encroachment.
Native grassland	Plains Grassland	Much of the study area supports scattered patches of moderate quality Plains Grassland remnants. This grassland supports a number of native flora species, including Kangaroo Grass, Wallaby-grasses Austrodanthonia spp. and Blue Devil Eryngium ovinum. Whilst these patches are not continuous through the study area, they are in areas large enough to support a suite of native fauna.
Scattered trees	NA	Scattered trees in the study area range from low habitat value for small trees, to moderate habitat value for mature specimens and large stands of trees. Scattered trees comprise an assortment of Yellow Box, Red Stringybark, River Red Gum, Yellow Gum, Bundy and Messmate. Many of these trees are mature and reach a height of up to 15m, often supporting hollows.
Introduced pasture/grassland	NA	Introduced pasture is the predominant habitat type within the study area, where remnant vegetation has been removed. This habitat type is considered to be of low habitat value for fauna.

Wildlife Corridors

The remnant vegetation along the roadsides (particularly the Western Highway) as well as creeks, acts as wildlife corridors. Wildlife corridors allow species to move throughout the landscape and this:

- Provides shelter for a range of fauna that either live within the corridors or are moving through the landscape.
- Provides for the immigration of animals to supplement declining populations, reducing the likelihood of local extinction of a species.
- Provides for connectivity to maintain the demographics of a population of a species.
- Allows fauna to move through modified landscapes to find better quality habitat.

Wildlife corridors in the project area include at Ararat Regional Park (Ch. 0 – 2300) and Sisters Rocks (Ch. 21000 – 23000), as well as numerous riparian and roadside corridors. Refer to Technical Appendix H for more information on wildlife corridors.

BioSites

A BioSite is an area of land or water identified on the DSE database containing biological assets with particular attributes, such as the presence of rare or threatened flora, fauna or habitat required for their survival and/or rare or threatened vegetation communities. There are numerous BioSites of national, State, regional and local significance within and adjacent to the study area. Refer to Technical Appendix H for a list of these BioSites.

Refer to Figure 13-2 for the location of BioSites within the study area.

Approval from DSE is required to impact a BioSite, however there are no further legal implications for inspecting these areas.

13.6 Avoidance and Minimisation of Impact

The Project Alignment Options Assessment and selection of the proposed alignment is described in Chapter 5 (Project Alternatives). The impacts on biodiversity and habitat values for all alignments considered are outlined in both Technical Appendix B (Options Assessment Report) and Technical Appendix H (Biodiversity and Habitat Assessment Report).

In the EES process, alignments were proposed taking into consideration safety, cost, potential social impacts, and potential ecological impacts amongst others. The Options Assessment process (refer to Chapter 5) sought to select an alignment that balanced impacts to biodiversity, social and cultural heritage values.

As outlined in Chapter 5 (Project Alternatives), some of the key evaluation objectives were:

- *"To avoid or minimise effects on species and ecological communities listed under the Environment Protection and Biodiversity Conservation Act 1999 and Flora and Fauna Guarantee Act 1988."*
- "*To comply with requirements and best meet the objectives of 'Victoria's Native Vegetation Management – A Framework for Action' and to minimise impacts on wildlife corridors*".

Due to the size of the Project and its linear nature, some impacts on native vegetation and habitat are unavoidable. As such, priority was given to avoiding impacts on native vegetation and fauna habitat that are EPBC Act listed or of Very High or High conservation significance (refer to Table 13-5); however it was still considered important to reduce impacts on as many ecological values as possible within the study area.

Within the project area, the Ararat Regional Park and Sisters Rocks were considered unacceptable areas to accommodate the Project due to the presence of high quality, contiguous remnant vegetation and habitat for flora and fauna species, and were therefore excluded.

A key consideration was to minimise the impacts to significant flora, fauna and ecological communities. In some cases, the protection of one area supporting significant ecological values required a compromise through impacting another area that also supported significant ecological values. Where possible, the effects were mitigated by the avoidance of alternative vegetation or habitat. The rational for selection of the proposed alignment is described in Chapter 5 (Project Alternatives).

The process of avoidance and minimisation of impacts is on-going with fine-scale micro-siting of the alignment expected to occur during the detailed design phase of the Project.

The locations at which the final alignment was refined to further minimise impacts during the options assessment process are outlined in Table 13-5.

Table 13-5 Locations where Biodiversity and Habitat Values have been Avoided

Location Description	Biodiversity and habitat value avoided	Conservation significance of vegetation	Conservation status of vegetation	Status of species
From approximately 200m south to approximately 400m north west of The Majors Road/ Main Divide Road (Ch. 400 – 1000)	Siting new south-bound carriageway to north of current road reserve in predominantly cleared land to reduce impacts on Grassy Dry Forest EVC in road reserve and Ararat Regional Park to south. Also, placement of median to reduce impacts on Rosemary Grevillea and Emerald-lip Greenhood (Ch. 500 – 800) and use of cleared track beside powerline for service road (Ch. 900 – 1400) to reduce impact on Grassy Woodland EVC in Ararat Regional Park.	Grassy Dry Forest EVC ▪ Medium / High/ Very High Grassy Woodland EVC ▪ Very High	Grassy Dry Forest EVC ▪ Depleted Grassy Woodland EVC ▪ Vulnerable	Rosemary Grevillea ▪ Rare (DSE Advisory List) Emerald-lip Greenhood ▪ Rare (DSE Advisory List)
Approximately 900m north west from Ararat Regional Park towards Petticoat Gully Road (Ch. 1400 – 2300)	Siting new north-bound carriageway in predominantly cleared land to south of current road reserve to minimise impacts on Grassy Woodland EVC and Ararat Regional Park on the north side of the current highway.	Grassy Woodland EVC ▪ Very High	Grassy Woodland EVC ▪ Vulnerable	-

Location Description	Biodiversity and habitat value avoided	Conservation significance of vegetation	Conservation status of vegetation	Status of species
From approximately 900m east of Petticoat Gully Road to approximately 1,100m north west of Old Brewery Road (Ch. 2800 – 4800)	Siting a wide central median between the current highway and the new south-bound carriageway and a wide median between the current highway and proposed service road on the south side (both medians outside of construction area) to minimise impact on Grassy Woodland EVC and Creekline Grassy Woodland EVC.	Grassy Woodland EVC ▪ Very High Creekline Grassy Woodland EVC ▪ Very High	Grassy Woodland EVC ▪ Vulnerable Creekline Grassy Woodland EVC ▪ Endangered	-
Approximately 500m south east from Eaglehawk Road (Ch. 5000 – 5500)	Siting a wide median between the existing highway and the proposed service road to the south to minimise impacts on Grassy Woodland EVC.	Grassy Woodland EVC ▪ Very High	Grassy Woodland EVC. ▪ Very High	-
Approximately 800m north west from Allanvale Road (Ch. 9600 – 10400)	Siting wide medians (outside construction area) between the main carriageways and the south-bound carriageway and service road to minimise impact on Plains Grassy Woodland EVC.	Plains Grassy Woodland EVC ▪ Very High	Plains Grassy Woodland EVC ▪ Endangered	-
For approximately 1km between St Ethels Road and edge of Great Western township	Siting of service road to south of current road reserve to minimise clearing of Plains Grassy Woodland EVC within current road reserve.	Plains Grassy Woodland EVC ▪ High / Very High	Plains Grassy Woodland EVC ▪ Endangered	-
For approximately 600m adjacent to Great Western Bushland Reserve, north-east of Great Western township (Ch. 12400 – 13000)	Siting new highway on predominantly cleared land to the west of Heathy Woodland EVC to avoid impacts on this vegetation and on Bushland Reserve.	Heathy Woodland EVC ▪ High / Very High	Heathy Woodland EVC ▪ Depleted	-
From approximately 400m south east to approximately 500m north west of Metcalfe Road, north of Great Western township (Ch. 13000 – 13900)	Siting new road through a disused quarry, part of a former landfill site and a currently operating quarry to minimise impacts on Heathy Woodland EVC.	Heathy Woodland EVC ▪ High / Very High	Heathy Woodland EVC ▪ Depleted	-
For approximately 3.7km from opposite Briggs Lane to near Harvey Lane (Ch. 16500 – 20200)	Siting new north-bound carriageway on cleared land to the south of the existing road reserve and providing a wide median outside of the construction area to minimise impacts on Plains Grassy Woodland EVC and Heathy Woodland EVC.	Plains Grassy Woodland EVC ▪ Very High Heathy Woodland ▪ Very High	Plains Grassy Woodland EVC ▪ Endangered Heathy Woodland ▪ Depleted	-
For approximately 1.1km from opposite Hurst Road to current intersection with London Road (Ch. 21800 – 22900)	Having a minimum width median with wire rope barriers between carriageways to minimise impacts on Heathy Woodland EVC.	Heathy Woodland ▪ Very High	Heathy Woodland ▪ Depleted	-

Location Description	Biodiversity and habitat value avoided	Conservation significance of vegetation	Conservation status of vegetation	Status of species
For approximately 1.1km north west from the current intersection with London Road (Ch. 22900 – 24000)	Siting the entire new highway and new intersection with London Road on cleared land to the north of the existing highway and utilising the existing highway as a service road in order to avoid clearing of all Emerald-lip Greenhood and Trailing Hop-bush plants in this locality and minimising clearance of Heathy Woodland EVC in this locality.	Heathy Woodland ▪ Very High	Heathy Woodland ▪ Depleted	Emerald-lip Greenhood ▪ Rare (DSE Advisory List) Trailing Hop-bush ▪ Vulnerable (EPBC Act) ▪ Listed (FFG Act) ▪ Vulnerable (DSE Advisory List)

13.7 Net Gain Assessment

Net Gain is an overall outcome where native vegetation and habitat gains are greater than vegetation and habitat losses. Victoria's Native Vegetation Management – A Framework for Action (the Framework) has defined a three step approach for applying Net Gain to protection and clearance decisions. Emphasis is placed on the first two steps, and only after these two steps have been taken should offsets (actions undertaken to achieve commensurate gains) be considered (NRE, 2002). The three step approach is:

1. To avoid adverse impacts, particularly through vegetation clearance.
2. If impacts cannot be avoided, to minimise impacts through appropriate consideration in planning processes and expert input to project design or management.
3. Identify appropriate offset options.

A preliminary Net Gain Assessment has been conducted at sites proposed to be disturbed, based on the proposed alignment option. A final Net Gain Assessment would be conducted once detailed design has been completed.

13.7.1 Preliminary Net Gain Assessment Results

A summary of the estimated losses and Net Gain targets for remnant native vegetation patches is outlined in Table 13-6.

A detailed breakdown of estimated vegetation losses by EVC is available in Technical Appendix H.

It is important to note that approximately half of the Very High conservation significance vegetation comes from EVCs that have been elevated to a higher conservation significance based on providing "Best of Remaining 50% of habitat in the bioregion for threatened flora or fauna". Several patches of Heathy Woodland, Plains Grassy Woodland, Grassy Dry Forest, Grassy Woodland and Creekline Grassy Woodland have been elevated to Very High conservation significance based on the presence of significant fauna species. Principally, these species include Barking Owl, Brush-tailed Phascogale and Brown Toadlet (listed as Endangered, Vulnerable and Endangered respectively on the DSE Advisory List), which were recorded during targeted surveys and have suitable habitat throughout the proposed alignment. Areas of suitable habitat for these species typically comprise high quality vegetation with some connectivity to other areas of suitable habitat within the landscape.

Although connective woodland should be retained where possible, there are numerous examples of suitable habitat for these species within the local area (e.g. Sister's Rocks, Ararat State Park, roadside reserves, riparian vegetation) with the overall potential impact to fauna species under the FFG Act and DSE Advisory list defined as minor (within the context of the broader landscape and after mitigation measures have been applied).

If the Best or Remaining 50% assessment is excluded from the offset calculations, then the total amount of Very high conservation significance vegetation decreases from 116.63ha (64.54 Habha) to 55.53ha (28.81Habha), while the total amount of High conservation significance vegetation increases from 16.52ha (5.19Habha) to 57.72 ha (30.30Habha).

Up to 79 scattered indigenous trees may be removed as a result of the Project. When applying the protect and recruit offset, 130 trees would be protected and 650 recruited.

Trailing Hop-bush is listed as Vulnerable under the EPBC Act, and as such there are not likely to be any offsets required for impacts to this species. However, individuals that are impacted would be salvaged and translocated in accordance with an approved Salvage and Conservation Management Plan, with translocated individuals managed and secured in perpetuity.

Table 13-6 Summary of Estimated Vegetation Losses and Net Gain Targets within the Proposed Alignment

Conservation Significance	Vegetation Losses			Large Old Trees*		
	Total Losses (Ha)	Total Losses (HabHa)	Net Gain Target (HabHa)	LOT Total Losses	LOT to be protected as offset	Trees to be recruited as offset
Very High	116.62	64.54	129.08	792	6336	31680
High	16.52	5.19	7.79	86	344	1720
Medium	0.49	0.17	0.17	4	8	40
Low	-	-	-			
Total	**133.63**	**69.90**	**137.04**	**882**	**6688**	**33440**

* Large Old Tree – LOT: defined by EVC classification and the tree diameter at breast height

13.7.2 Potential strategies to achieve Net Gain

An offset strategy for the Project that addresses offset requirements under the EPBC Act Environmental Offsets Policy is provided in Technical Appendix H. VicRoads will undertake the following steps to achieve Net Gain:

1. A final alignment would be adopted in order for all vegetation losses to be identified.
2. The vegetation offset requirements would be calculated.
3. Project timeframes and timing of vegetation removal would be estimated.
4. Secure offsets.

Offsets would be sourced in accordance with the 'like for like' criteria set out in the Framework.

VicRoads could source offsets from the following sources:

- The VicRoads Net Gain Bank which currently has 6.42 Habitat hectares (HabHa) of Very High Conservation Significance Plains Grassland in the Victoria Volcanic Plain bioregion and 1.63Habha of Very High Conservation Significance Grassy Dry Forest in the Central Victorian Upland bioregion.
- BushBroker has significant quantities of offsets on its register of landowners willing to sell offset credits. The offset credits potentially available from BushBroker for the Project are outlined in Table 13-7.
- Trust For Nature currently has 13HabHa available within the Victorian Volcanic Plains bioregion and 3HabHa available within the Central Victorian Uplands bioregion. The Trust also has approximately 500 potential offset sites across the Central Victorian Uplands bioregion, the Goldfields bioregion and the Victorian Volcanic Plain bioregion and across many different EVCs which can be investigated further once the final offset requirements for the Project are determined.
- Acquisition of adjacent land – VicRoads could secure suitable offsets through acquisition of land adjacent to or close by the Project alignment. This potentially includes areas of road reserve along the Western Highway where offsets involving long term management of vegetation may be negotiated between DSE and VicRoads via the Recognition of Roadside Vegetation Memorandum of Understanding. VicRoads would not *compulsorily* acquire land for the purpose of native vegetation offsets. This would likely require investigation of potential offset by VicRoads or nominated representative.
- Private Offset Brokers – VicRoads could engage private offset brokers in order to locate offsets. VicRoads would require that any potential offset sources were secured with a Section 69 agreement under the *Conservation Forests and Lands Act 1987* or a Trust for Nature Covenant under the *Victorian Conservation Trust Act 1972.*
- Local Councils – VicRoads could seek availability of offsets from councils.

In summary, the required Net Gain offsets for the Project would be achievable through a combination of the aforementioned offset sources.

Table 13-7 Available offset credits from BushBroker as of May 2011

Bioregion	Very High (HabHa)	High (HabHa)	Medium (HabHa)	Low (HabHa)
Central Victoria Uplands	37.82	6.07	6.61	1.43
Goldfields	20.57	28.14	9.72	2.42
Victorian Volcanic Plain	190.31	98.23	3.2	0.16

13.8 Impact Assessment

The impact assessment was conducted on the proposed alignment option.

13.8.1 Key issues

Losses of ecological values should be viewed in the context of overall ongoing loss, fragmentation and deterioration in the quality of remnant vegetation within the study area and surrounding landscape.

One of the main impacts on ecological values would arise from the removal of remnant native vegetation, including the threatened flora populations that have been recorded in the study area.

Potential impacts to significant fauna would arise from the removal of remnant native vegetation resulting in the direct loss of significant fauna, of habitat supporting significant fauna and of corridors and 'stepping stones' that facilitate the movement of significant fauna.

13.8.2 Removal of Remnant Native Vegetation

Construction of the Project would result in the removal of native vegetation including parts of EVCs of Very High and High conservation significance. These are:

- Grassy Dry Forest;
- Grassy Woodland;
- Creekline Grassy Woodland;
- Plains Grassy Woodland; and/or
- Heathy Woodland.

Refer to Table 13-3 for the conservation status of these EVCs and to Figure 13-2 for boundaries of the bioregions and for location of the EVCs.

The proposed alignment has been selected to minimise impact on native vegetation, however the Project would still impact approximately 133.63 hectares (ha) of EVCs (equating to 69.9Habha), of which approximately 116.62ha (equating to 64.54 Habha) are of Very High conservation significance. The bypass of Great Western has been located in areas already disturbed by existing quarries and identified for quarry expansion.

With the application of management measures including micro-alignment during the detailed design phase and revegetation with species appropriate to the local area, it is expected that this would be a moderate overall impact based on the consequence guidelines developed for this EES (refer to Technical Appendix H). It is considered to be a moderate impact as it would result in a loss of 0.1 - 1 % of the area of EVCs of Very High or High conservation significance within the relevant bioregions and the losses of EVCs are expected to be able to be offset in accordance with Victoria's Native Vegetation Management policy.

Consent from the Minister for Environment and Climate Change is required for the removal of vegetation of 'Very High' conservation significance.

The Project has been estimated to also result in the removal of up to 882 Large Old Trees (LOTs) within remnant native vegetation patches, 792 of which are of Very High conservation significance. An additional 79 scattered trees may also be removed as a result of the Project.

Mitigation measures including alignment refinements during detailed design should reduce the number of LOTs within remnant native vegetation patches and scattered trees impacted by the Project, however it would not be possible to avoid all LOTs and scattered trees. With the application of management measures to minimise the number of LOTs and scattered trees impacted, it is expected that the impact would be moderate. The number of LOTs and scattered trees is a conservative estimate. It is expected that the actual number of LOTs and scattered trees impacted would be less than these totals.

The losses of native vegetation would be offset in accordance with Victoria's Native Vegetation Management – A Framework for Action. This framework is outlined in Section 13.7.

Removal of native vegetation during construction may also result in the death or injury of fauna species where habitat is impacted, including:

- The Golden Sun Moth (Critically Endangered – EPBC Act, FFG Act Listed, Critically Endangered – DSE Advisory List);
- The Brown Toadlet (FFG Act Listed, endangered DSE Advisory List);
- Brown Treecreeper (near threatened DSE Advisory List); and/or
- The Barking Owl (FFG Act listed endangered, DSE Advisory list).

Construction would also result in the removal or disruption to wildlife corridors, particularly at Ararat Regional Park and Sisters Rocks (refer to Figure 13-2). This could result in fragmentation of habitat for the Brown Toadlet, Brown Treecreeper and Brush-tailed Phascogale.

A reduction in the areas of native vegetation removed is likely to be achieved through detailed design and construction planning. Detailed design coupled with mitigation measures such as pre-clearing of fauna species in areas to be impacted would reduce the impacts on EVCs and areas of habitat.

13.8.3 Listed Flora Species

13.8.3.1 Nationally Listed

Approximately 67 Trailing Hop-bush plants were recorded during the targeted survey. There is the potential for the Project to impact up to 21 Trailing Hop-bush plants south of Stawell. All plants identified for removal would be translocated in accordance with an approved salvage and translocation plan, with translocated individuals managed and secured in perpetuity.

VicRoads has undertaken micro-alignment of the proposed alignment to minimise the impacts on this species, and it is expected that the Project would have a minor impact on this nationally listed species.

13.8.3.2 State Listed

Approximately 250 Emerald-lip Greenhoods were recorded during the targeted survey. Approximately 203 of these fall within the proposed alignment footprint.

Forty Rising Star Guinea-flower plants were recorded during the targeted survey. Eleven of these plants fall within the proposed alignment footprint.

Rosemary Grevillea was also recorded in the study area. Thirty-seven plants of this species fall within the proposed alignment footprint.

It is considered that the impacts on State listed species would be minor as the Project would impact on less than one per cent of the regional populations of these species.

13.8.4 Listed Fauna Species

13.8.4.1 Nationally Listed

The Golden Sun Moth has been found at various locations in the study area with the highest concentration of the species being found in the paddocks east of St. Ethels Road and Grellet Road and in paddocks to the east and west of the junction of Old Brewery Road and the existing Western Highway. Removal of Golden Sun Moth habitat may result in the death or injury to individuals of this species. The proposed alignment intersects habitat for this species and it is expected that the Project would have a significant impact on the species due to the area of habitat that would be removed (up to 29.92ha confirmed habitat and 99.94ha of potential habitat). Detailed design and construction planning to avoid impacts at known habitat locations is expected to reduce this impact slightly.

13.8.4.2 State Listed

The Brown Toadlet has been identified as being widespread within the study area, especially in areas including drainage lines and culverts. The proposed alignment intersects habitat for this species and it is expected that the species would be impacted upon. However following implementation of mitigation measures, any impacts on this species are expected to be minor.

The Barking Owl was recorded within the study area (near Churchill Crossing Road) on one occasion during the flora and fauna assessments. The Project may intersect habitat for this species, however it is expected that the impacts on this species would be minor following implementation of mitigation measures. Mitigation measures include preparing a salvage and translocation plan if the Barking Owl is identified during pre-construction surveys.

The Brown Treecreeper has been identified as being widespread within the study area, mostly within riparian habitats that support hollow-bearing River Red Gum and Yellow Box trees. The proposed alignment intersects habitat of the Brown Treecreeper and it is expected that the Project would have an impact on this species, although it is expected that any impacts on this species would be minor following implementation of mitigation measures.

The Brush-tailed Phascogale was recorded on the edge of the Ararat Regional Park. The proposed alignment may intersect habitat used by this species, although the impact on this species is expected to be minor following implementation of mitigation measures.

There is also the possibility that construction could encounter unexpected fauna species that were not identified in the targeted surveys. However, with the application of proposed mitigation measures, such a pre-clearance survey of construction areas, the impacts of this are expected to be minor.

13.8.4.3 Fauna Species of Regional Significance

There is the potential for construction to encounter three fauna species listed of the DSE Advisory List (Fat-tailed Dunnart, Black-chinned Honeyeater and the Bearded Dragon). Following implementation of mitigation measures, any impacts on these species are considered to be minor.

13.8.5 Barriers to fauna movement

The Project could result in the increase in the amount and frequency of hostile habitats for native fauna (including construction zones and the highway itself). These elements of the Project could act as barriers for the movement of fauna species. Following implementation of mitigation measures, any impacts from this are expected to be minor.

Any impacts (including death) of fauna species within the construction footprint would be recorded and provided to the Department of Sustainability and Environment.

13.8.6 Road Kill

The Project could result in an increase in fauna species killed by vehicles using the highway as the Project would provide an extra carriageway, and therefore a greater distance for fauna species to cross the highway, increasing the risk of being hit by a vehicle.

It is expected that with the implementation of mitigation measures the impacts from road kill would be minor. Mitigation measures include installation of warning signs for potential fauna crossings, potential for micro alignment at known habitats and installation of fauna sensitive road design features.

13.8.7 Waterway crossings and bridge structures

Waterway crossings at Concongella Creek could result in local destabilisation of waterway banks and channel profile, degradation of river health values and a reduction of key aquatic and associated terrestrial habitat within the study area.

It is expected that with mitigation measures, including no bridge piers within a waterway and constructing during times of low or no flow, only minor impacts to waterways would result.

13.8.8 Sediment discharge to waterways

Construction could result in the discharge of sediment from soil erosion and earthworks to waterways. This could result in short term negative impacts to local aquatic ecosystems both within and downstream from the study area. It is expected that management measures including the installation of sediment fencing would mean the impacts of this would be minor.

13.8.9 Noise and Vibration

Noise from construction and operation (traffic) could result in stress and ultimately displacement of native fauna from affected habitat areas. However, impacts from noise and vibration are expected to be minor.

13.8.10 Light disturbance

There is a possibility that additional lighting during operation, for example street lights at intersections, could impact on native fauna species causing stress and ultimately the displacement of native fauna species from affected habitat areas. However, it is expected that any impacts from lighting would be minor due to the limited areas affected.

13.8.11 Construction dust and pollutants

Dust arising from construction activities has the potential to have short term negative impacts on native flora, fauna and local aquatic ecosystems.

Similarly, pollutants including smoke, dust, petrochemicals and litter emitted during operation of the Project could negatively impact native fauna, flora and aquatic ecosystems. Management measures including dust suppression methods, regular maintenance and best practice stormwater management would manage this risk and the impacts from this risk are expected to be minor.

13.9 Risk Assessment

An environmental risk assessment was undertaken on the proposed alignment to identify key environmental issues associated with the construction and operation of the Project. The methodology for this risk assessment has been described in Chapter 21 (Environmental Management Framework). A risk assessment report that explains the process in detail and contains the complete project risk register is included in Technical Appendix Q. Table 13-8 outlines the impact pathways related to Biodiversity and Habitat and the consequence descriptions that were determined during the risk assessment process.

Table 13-8 Biodiversity and Habitat Risks

Risk No.	Impact Pathway	Consequence Description
FF1	Potential removal of individuals of a known population of EPBC listed flora - South of Stawell (Ch. 22900-23600).	A population of Trailing Hop-bush is present south of Stawell. 21 plants intercept the proposed alignment.
FF2	Potential removal of individuals of a known population of the DSE advisory listed flora (Ch. 500-2300, 20900-23500).	Emerald-lip Greenhood, Rising Star Guinea Flower and Rosemary Grevillea are present throughout alignment. See targeted flora map for exact locations.
FF3	Construction encounters unexpected listed flora species (species not known to be present from targeted survey).	Removal of small number of unknown listed flora species during pre-clearance / clearance work
FF4	Construction encounters EPBC listed Golden Sun Moth from known habitats. (Recorded locations at Ch. 1800-2800, 3700-5000).	Removal of fauna habitat, possible injury/death to listed fauna species individuals during construction.
FF5	Construction encounters FFG and DSE Advisory Act-listed Brush-tailed Phascogale, Brown Toadlet, Fat-tailed Dunnart, Black-chinned Honeyeater and Brown Treecreeper, as well as FFG listed Victorian Temperate Woodland Bird community (Recorded locations at Ch. 300, 600, 3700, 4700, 6300, 8300, 14700, 17300, 18000, 18200, 21800, 22600).	Removal of fauna habitat, possible injury/death to listed fauna species individuals during construction.
FF6	Construction encounters unexpected listed fauna species (species not known to be present from targeted survey).	Removal/disturbance to small number an unknown number of listed fauna species during pre-clearance / clearance work

Risk No.	Impact Pathway	Consequence Description
FF7	The duplication removes or disrupts wildlife corridors or fauna habitat. This is evident at the Ararat Regional Park (Ch. 0-2300) and Sisters Rocks (Ch. 21000-23000), as well as numerous riparian and roadside corridors.	Impacts on habitat or wildlife corridors may affect Brown Toadlet, Brown Treecreeper and Brush-tailed Phascogale, as well as numerous locally common fauna species.
FF8	Increased road kill and injury rates to arboreal native fauna from traffic on additional / new carriageway, particularly where the carriageway passes through wooded areas away from the existing road (e.g. quarry area north of Great Western).	The proposed carriageway would create an additional barrier to the movement of aquatic and terrestrial fauna. This would result in a reduction of fauna populations due to increased mortality, particularly for predatory birds, reptiles, amphibians, and mammals. It is likely that fauna are more susceptible to vehicle collision during the dusk and dawn period, where the highway intercepts wildlife corridors (e.g. near and along key waterways) and in areas away from existing roads where fauna are unaccustomed to road traffic hazards.
FF9	Construction encounters Ecological Vegetation Communities (EVCs) (Native vegetation and fauna habitat)	Removal of EVCs of high and very high conservation significance including: Grassy Dry Forest, Grassy Woodland, Creekline Grassy Woodland, Plains Grassy Woodland and Heathy Woodland.
FF10	Construction encounters Large and Very Large Scattered Trees/Hollow-bearing trees/fauna habitat	Removal of scattered trees
FF11	Construction of waterway crossings at Concongella Creek and confluence of creeks north of Great Western, and other works associated with the waterway crossing.	Local destabilisation of waterway banks and channel profile. Degraded river health values, reduction of key aquatic and associated terrestrial habitat.
FF12	Placement of bridge structures within a minor waterway (e.g.culverts).	Degraded river health values, reduction of key aquatic and associated terrestrial habitat . Construction creates temporary barrier to movement of aquatic fauna.
FF13	Construction activities occur outside of agreed construction zone.	Potential loss or modification of native vegetation and/or fauna habitat that was intended to retained
FF14	Weeds and/or pathogens introduced or spread through construction activities.	Displacement/invasion of native vegetation and/or fauna habitat and increased spread of weed species or pathogens. Potential pathogens include Cinnamon Fungus Phytophthora cinnamomi, Bovine Johne's Disease *Mycobacterium paratuberculosis*, Grape phylloxera *Daktulosphaira vitifoliae*, Potato Cyst *Nematode Globodera rostochiensis* and Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis*.
FF15	Sediment discharge to waterways resulting from soil erosion or spoil earthworks.	Impacts to aquatic ecosystems at the site and downstream of the site.
FF16	Construction modifies hydrological/surface water flows	Impact to retained native vegetation and fauna habitats
FF17	Noise or vibration disturbance to native fauna during construction (daytime) and operation (traffic).	Potential for stress, and ultimately displacement of native fauna from affected habitats.
FF18	Light disturbance to native fauna (e.g., artificial light sources from street construction lights).	Potential for stress, and ultimately displacement of native fauna from affected habitats.
FF19	Construction creates dust impacting on native fauna, native flora and surface water ecosystems.	Impact to retained native vegetation and fauna habitats
FF20	Creation of pollutants (including smoke, dust, petrochemicals, litter etc.) during construction and operation.	Impact to retained native vegetation and fauna habitats.

13.9.1 Residual risk

As outlined in Table 13-9, the majority of the residual risk ratings are rated as negligible or low. There are however three risks with a residual risk rating of high (FF4, FF9 and FF10) and five risks with a residual risk rating of medium (FF1, FF2, FF5, FF7 and FF11).

All five of the medium risks had an initial risk rating of high; however through the application of mitigation measures outlined in Table 13-9, these risks have been reduced.

The residual consequence rating of three of the risks (FF4, FF9 and FF10) is moderate, however as these risks are either likely or almost certain to occur the residual risk rating remains high.

As outlined in Section 13.6, efforts have been made to avoid and minimise both matters of NES and other ecological values, however not all impacts are able to be avoided. During the detailed design phase the areas of impact are expected to be reduced. However, it is not considered possible to reduce the residual risk of these eight risks further. Refer Table 13-9 for the management measures that would be applied to manage risks.

13.10 Environmental Management Measures

VicRoads has a standard set of environmental management measures which are typically incorporated into its construction contracts for road works and bridge works. These measures have been used as the starting point for the assessment of construction related risks and are described in detail in Chapter 21 (Environmental Management Framework). In some instances, such as for Biodiversity and Habitat, additional project specific environmental management measures have been proposed to reduce environmental risks.

Management measures specific to each identified Biodiversity and Habitat risk, and the residual risk rating after these environmental management measures have been applied are outlined in Table 13-9.

Table 13-9 Biodiversity and Habitat Environmental Management Measures and Residual Risk

Risk No.	Environmental Management Measures	Residual Risk Rating
FF1	Comply with section 1200.13 Flora and Fauna of the VicRoads contract specification. Further targeted survey to be completed on final alignment prior to construction to identify all existing individuals. Potential for detailed design or construction planning to avoid impact at known locations (e.g. micro alignment change to construction corridor). Prepare and implement a Conservation Management Plan, including a Salvage and Translocation Plan, approved by the Department of Sustainability, Environment, Water, Populations and Communities (SEWPac), which would include post-translocation monitoring. To protect populations during construction, protective fencing would be supplemented with a high-visibility component to indicate the sensitivity of the area.	Medium
FF2	Comply with section 1200.13 Flora and Fauna of the VicRoads contract specification. Further targeted survey to be completed on final alignment following completion of detailed design and prior to construction to identify all existing individuals. Potential for detailed design or construction planning to avoid impact at known locations (e.g. micro alignment change to construction corridor). Prepare and implement a Conservation Management Plan, including a Salvage and Translocation Plan, approved by the Department of Sustainability and Environment (DSE), which would include post-translocation monitoring. To protect populations during construction, protective fencing would be supplemented with a high-visibility component to indicate the sensitivity of the area.	Medium
FF3	Comply with section 1200.13 Flora and Fauna of the VicRoads contract specification. Avoid impacts if possible, by altering the construction area. Otherwise, prepare and implement a Conservation Management Plan, including a Salvage and Translocation Plan (where applicable), approved by the Department of Sustainability and Environment (DSE), which would include post-translocation monitoring.	Low
FF4	Comply with section 1200.13 Flora and Fauna of the VicRoads contract specification. Potential for detailed design or construction planning to avoid impact at known locations/habitats (e.g. micro alignment change to construction corridor). Revegetate Right of Way (ROW) with grassland species favoured as a food source by GSM (e.g. *Austrodanthonia sp*.) where GSM populations are known to be present.	High

Risk No.	Environmental Management Measures	Residual Risk Rating
FF5	Comply with section 1200.13 Flora and Fauna of the VicRoads contract specification. Conduct further targeted surveys for Brown Toadlet within final alignment. Potential for detailed design or construction planning to avoid impact at known locations/habitats (e.g. micro alignment change to construction corridor). Prepare and implement a Conservation Management Plan (CMP), including a salvage and translocation plan. Where potential habitat for listed fauna species is identified to be removed a qualified ecologist would need to conduct a pre-clearance survey and attempt relocation where necessary/possible. To protect populations during construction, protective fencing would be supplemented with a high-visibility component to indicate the sensitivity of the area.	Medium
FF6	As per Risk FF3.	Low
FF7	Comply with section 1200.13 Flora and Fauna of the VicRoads contract specification. Potential for detailed design or construction planning to avoid impact at known locations/habitats (e.g. micro alignment change to construction corridor). Install warning signs for potential fauna crossings. Investigate appropriate design response and implement recommendations, for example: ▪ Installation of fauna sensitive road design features at wildlife corridors. ▪ Implement before/after comparison study for fauna road mortality to investigate a) the impact of the road; b) the efficacy of crossing structures. ▪ Use the results of the above study to determine whether additional crossing structures should be installed.	Medium
FF8	As for FF7	Low
FF9	Comply with section 1200.13 Flora and Fauna of the VicRoads contract specification. Potential for detailed design or construction planning to avoid impact at known locations/habitats (e.g. micro alignment change to construction corridor). Revegetation or landscape plantings to include species appropriate to the local EVC. Where possible retain appropriate habitat features/structure within the construction alignment. Shrubs and other understorey species would be retained or re-established (to the allowable height limit) post-construction. Logs and any felled trees would be left in the area to provide additional fauna habitat. Trees would be lopped or trimmed rather than removed where possible. All contractors would be aware of areas of ecological value through a site induction by a qualified botanist (see figures attached for locations of remnant native vegetation) to minimise the likelihood for damage to areas scheduled to be retained and include EVC polygons (areas of sensitivity) on detailed surveying drawings and check for accuracy. The study area would be rehabilitated and revegetated in accordance with Section 9 of Technical Appendix H.	High
FF10	Comply with section 1200.13 Flora and Fauna of the VicRoads contract specification. Detailed design and construction planning to minimise loss of trees, particularly Medium Old Trees, Large Old Trees and Very Large Old Trees and those which are hollow bearing, with the advice of an arborist.	High
FF11	Implementation of a Construction EMP detailing: ▪ Erosion and sediment control measures. ▪ Fuel and chemical management procedures. No structures within the stream, and consistent with CMA requirements. Fish sensitive design of structures to provide safe fish passage. Schedule construction to no-flow or low-flow periods. Establish a water quality monitoring regime to assess and limit any construction impacts. This would include a before/after sampling design, including several upstream and downstream sites. Establish a set of site specific criteria that would trigger intervention of works in the event of a noticeable deterioration in habitat, water quality or observed direct death or injury of aquatic fauna. Establish appropriate response actions in case of such an event based on these site specific criteria. Sedimentation and pollution control measures are to be implemented at all times, in accordance with EPA guidelines, to prevent impacts to waterways and wetlands. All waterways disturbed during project construction are to be revegetated and restored (to a condition equal to or better than pre-construction) after completion of construction. Any snags and/or logs that are removed from any waterways to be replaced in similar locations after completion of construction. The storage of fuel and chemicals (including the refuelling of vehicles and machinery) at a minimum of 50 metres away from all waterways; Site toilets to be a minimum of 50 metres away from all waterways; and, Schedule construction to no-flow or low-flow periods.	Medium

Risk No.	Environmental Management Measures	Residual Risk Rating
FF12	Implementation of a Construction EMP detailing: ▪ Erosion and sediment control measures. ▪ Fuel and chemical management procedures. Implement fish sensitive design of structures to provide for safe fish passage. Schedule construction to no-flow or low-flow periods.	Low
FF13	Existing vegetation and native fauna habitat identified in the Contract to be retained, would be identified as 'No Go Zones' and protected by temporary fencing and signage erected outside the limit of the canopy of the vegetation or the habitat site. In areas of known, or possible, habitat for listed threatened flora and fauna species, protective fencing should be supplemented with a high-visibility component to indicate the sensitivity of the area. Plant, equipment, material or debris not to be placed or stored within the limit of the root zone of vegetation to be retained.	Low
FF14	The Contractor would develop a procedure to prevent the spread of declared weeds, pests and diseases within the Site and off-site. A weed management and control program would be prepared prior to construction and would be implemented for a period of no less than two years after the completion of the project. Weed management procedures are detailed in Section 9 of Technical Appendix H. Pathogen management procedures as outlined in Section 9 of Technical Appendix H would be developed to prevent pathogen spread.	Low
FF15	Implementation of a Construction EMP detailing erosion and sediment control measures. Installation of sediment fencing adjacent to waterways. Routine maintenance of sediment fences, particularly after large rain events. Maintain as much of the natural vegetation filter strip as possible.	Low
FF16	Implementation of a Construction EMP detailing: ▪ Erosion and sediment control measures. ▪ Fuel and chemical management procedures. Installation of appropriate drainage systems. Schedule construction to no-flow or low-flow periods.	Low
FF17	Traffic noise levels would not exceed the objectives specified in VicRoads Traffic Noise Reduction Policy for new and improved roads within and outside of the limit of works.	Low
FF18	Risk is low and therefore there are no mitigation measures recommended to manage the risk.	Low
FF19	Implementation of a Construction EMP detailing air quality control measures and strict monitoring procedures Implement methods and management systems consistent with EPA Best Practice Environmental Management: 'Environmental Guidelines for Major Construction Sites' (EPA, 1996). Minimise land disturbance by using phased approach, rehabilitate cleared areas promptly. Keep vehicles to well-defined haul roads, limit vehicle speed and seal haul roads and other exposed areas by means of concrete or paving where necessary. Employ dust suppression methods such as watering down the ROW	Negligible
FF20	Implementation of a Construction EMP detailing: ▪ Erosion and sediment control measures. ▪ Fuel and chemical management procedures.	Negligible

13.11 Conclusion

Parts of the study area are considered to be of both national and State conservation significance.

During the Options Assessment process, matters of National Environmental Significance (NES) and vegetation of Very High and High conservation significance were deemed to be of highest conservation value, and priority was given to avoiding and minimising impacts on these values where possible.

Efforts were also made to avoid and minimise impacts on State and regionally significant flora and fauna values. However, due to the long linear nature of the Project, it would not be possible to avoid all impacts on flora and fauna values.

The Project would impact upon 21 Trailing-Hop Bush plants (Vulnerable under the EPBC Act, FFG Act listed) which were unable to be avoided during the design of the Project. This is considered to be a minor impact.

The Project would require the removal of up to 29.92ha of confirmed and 99.94 ha of potential Golden Sun Moth habitat (Critically Endangered under the EPBC Act, FFG Act listed). It would therefore result in a significant impact to this species according to SEWPaC guidelines. It is expected that the area of impact could be reduced slightly through the detailed design phase of the Project, however even with the application of management measures, the impact would still be considered significant.

The Project would also impact upon some State listed species. These are:

- Rising Star Guinea-flower (13 plants);
- Emerald-lip Greenhood (203 plants);
- Rosemary Grevillea (37 plants);
- Barking Owl;
- The Brown Toadlet;
- Brown Treecreeper; and
- Brush-tailed Phascogale.

With the avoidance and minimisation measures applied at the design phase of the Project, and with the implementation of the mitigation measures outlined in Table 13-9, the Project would have only a minor impact on the State listed species.

The Project would impact on five EVCs of varying quality and conservation significance. These are:

- Plains Grassy Woodland;
- Grassy Woodland;
- Creekline Grassy Woodland;
- Grassy Dry Forest; and
- Heathy Woodland.

The Project would impact on approximately 133.63ha of EVCs (of which approximately 116.62ha are of Very High conservation significance). This is considered to be a moderate impact as it would result in a loss of 0.1 - 1 % of the area of EVCs of Very High or High conservation significance within the region and the losses of EVCs are expected to be able to be offset in accordance with Victoria's Native Vegetation Management policy.

Consent from the Minister for Environment and Climate Change is required for the removal of vegetation of 'Very High' conservation significance.

The Project could also result in the loss off up to 882 Large Old Trees (LOTs) within remnant native vegetation patches, 792 of which are of Very High conservation significance. An additional 79 scattered trees may be removed as a result of the Project.

Mitigation measures including detailed design should reduce the number of LOTs within remnant native vegetation patches and scattered trees impacted by the Project. It is expected that the actual number of LOTs and scattered trees impacted would be less than these totals because management measures including micro-alignment during detailed design and construction planning would be implemented to minimise the number of LOTs and scattered trees impacted. It is expected that the impact on LOTs would be moderate.

Further minimisation of impact on of matters of NES and State significance would be able to be achieved through micro-realignment in the detailed design phase.

The impacts on the Trailing Hop-bush and Golden Sun Moth habitat would be offset in accordance with the EPBC Act Environmental Offsets Policy. Offsets would be determined through negotiations with the Department of Sustainability, Environment, Water, Populations and Communities and in the case of Trailing Hop-bush, would include salvage and translocation of plants impacted by the proposed alignment.

VicRoads would be required to obtain offsets for vegetation losses in accordance with Victoria's Native Vegetation Management – A Framework for Action and the EPBC Act Environmental Offsets Policy. Preliminary investigations indicate that offsets are available and that VicRoads could source appropriate offsets from one or a combination of BushBroker, Trust for Nature, the VicRoads Net Gain Bank and private offset brokers.