

Report for VicRoads

Environment Protection & Biodiversity Conservation Act 1999
Preliminary Documentation (2017/8070) - South Gippsland Highway
Realignment, Koonwarra (BlackSpur)



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Indigenous Design Environmental Management
1635 Main Road, Research
www.iddesign.com.au

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1 Introduction

1.1 Project Background

The South Gippsland Highway is the main arterial route connecting South Gippsland with Melbourne and the rest of Victoria. The region is predominately used for agriculture, particularly food production, and has a variety of industries, including horticulture, forestry, fishing, boutique food and wine, retail trade, manufacturing and tourism. Approximately 10% of Victoria's dairy farms are located in South Gippsland and it is the largest employer in the Shire of South Gippsland. Approximately one million people visit South Gippsland tourist attractions annually (South Gippsland Shire Council , 2018).

VicRoads proposes to realign the South Gippsland Highway at Black Spur (the Project), approximately 500 metres east of the township of Koonwarra in South Gippsland, between Old Koonwarra-Meeniyar Road and extending 2.3 kilometres to the south east to 300 metres east of Minns Road. The location of the Project is shown in *Figure 1*.

This section has resulted in almost eight times as many crashes as would be expected from an 'A' class road elsewhere in Victoria. The proposed realignment will make safer one of the most dangerous stretches of road in Victoria, with 16 crashes along the Koonwarra bends between 2012 and 2017 resulting in 35 people being impacted by road trauma (VicRoads, 2016). Since January 2018, three crashes have occurred, including a recent fatality (VicRoads, 2018).

The Project area, as shown in *Figure 2*, comprises the existing highway, grazing farmland, the Great Southern Rail Trail and Tarwin River West Branch frontage. It is adjacent to the Black Spur Creek Wetlands and Koonwarra Fish Beds Geological Reserve and is near the Koonwarra-Tarwin River Crossing Strzelecki Gum *Eucalyptus strzeleckii* population on Old Koonwarra-Meeniyar Road (Strzelecki Gum National Recovery Plan) (Carter, 2006).

Parts of the Project area are either privately owned or Crown Land administered by VicRoads (road reserve), the Department of Environment, Land, Water and Planning (DELWP), the Great Southern Rail Trail Committee of Management and Crown Land subject to private licences.

On 9 January 2018, VicRoads was advised by the Department of the Environment and Energy (DoEE) that the Project to realign the highway was a controlled action under the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) and would require assessment by preliminary documentation. This decision was based on the likelihood of the Project having a significant impact on:

- Strzelecki Gum (*Eucalyptus strzeleckii*) - Vulnerable
- Australian Grayling (*Prototroctes maraena*) - Vulnerable

This report provides the additional information required by DoEE to assess the relevant impacts of the Project on matters of National Environmental Significance (NES) and has been a collaboration between Indigenous Design Environmental Management (Indigenous Design) and VicRoads to develop and provide the information as required.



Figure 1 – Project Locality plan

2 Description of the Action

The realignment of the South Gippsland Highway commences east of Old Koonwarra-Meenian Road, passing through farmland and crossing the existing Highway and Great Southern Rail Trail. It then follows an existing ridgeline before crossing the Tarwin River West Branch both upstream and downstream of its confluence with Black Spur Creek and ties into the existing highway, east of Minns Road.

The Project will involve extensive earthworks and bridgeworks.

Sections of the existing South Gippsland Highway will be either re-constructed and incorporated into the ultimate realignment, decommissioned and landscaped or declared as local road.

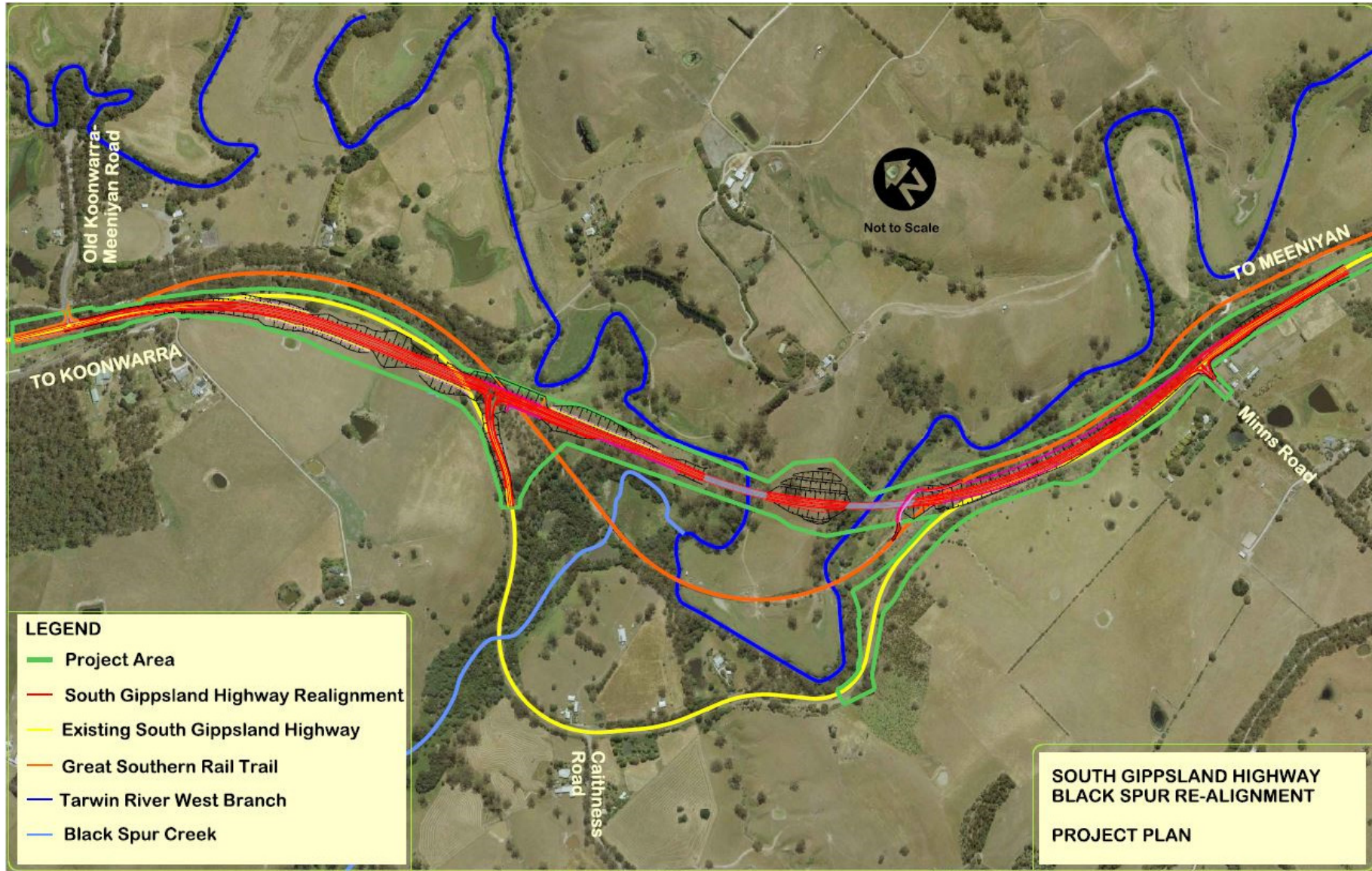


Figure 2 – South Gippsland Highway Black Spur re-alignment Project Plan

2.1 Disturbance Footprint

The disturbance footprint of the highway realignment (the Project area) comprises private farmland, existing road reserve and Crown Land, and extends from Old Koonwarra - Meeniyar Road to east of Minns Road.

The location and boundaries of the affected land is shown in *Figure 3*, and the corresponding area, including the area of impact to native vegetation, is provided in *Table 1*.

Ancillary work areas including site offices, compounds and hard stand areas for material and equipment storage and parking will be within the disturbance footprint. Access to the Project area will be via the existing South Gippsland Highway, with light vehicle access along Buckingham and Fowler's Road and the Great Southern Rail Trail.

The Public Acquisition Overlay (PAO8) (over private and Crown Land) totals 13 hectares, although the current defined Project area has now been reduced to 11.4 hectares.

Table 1 - Disturbance Footprint Area

Land	Area (hectares)	Vegetation Impacts (hectares)
Government Road (South Gippsland Highway reserve)	6.72	1.30
Private Property (Public Acquisition Overlay, PAO8)	5.13	0.36
Crown Land (Public Acquisition Overlay, PAO8)	6.27	3.10
TOTAL	18.12	4.76

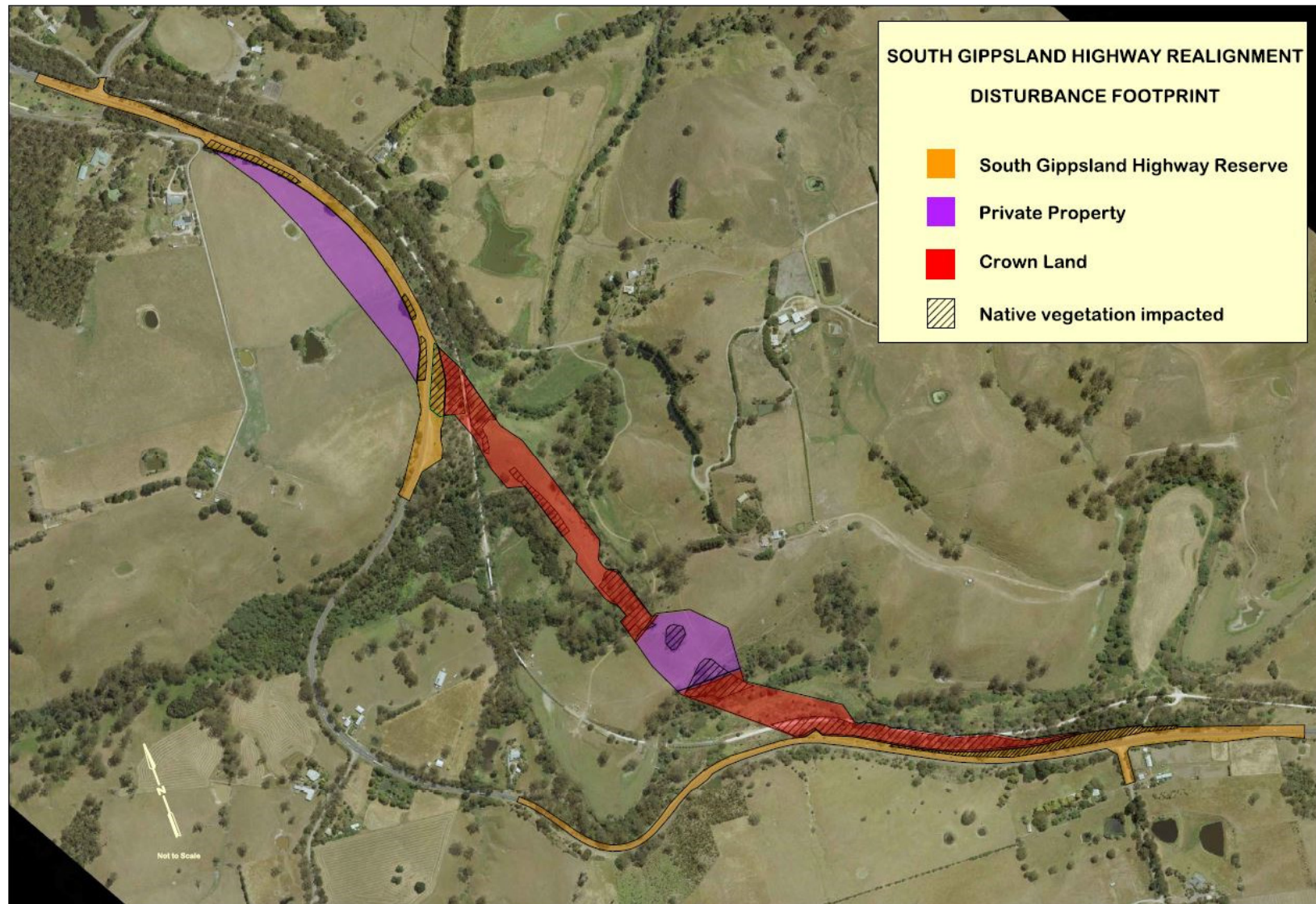


Figure 3 – South Gippsland Highway Black Spur disturbance footprint boundary

2.2 Construction Phases

2.2.1 Pre-Construction

Pre-construction activities commenced in January 2017 and included the following:

- Ecological assessments, including targeted surveys for significant species - *completed*
- Complex cultural heritage assessment including the preparation of a Cultural Heritage Management Plan – *completed*
- Hydrological/hydraulic assessment to determine flood levels - *completed*
- Extinguishing native title on Crown land - *completed*
- Road and bridge concept design - *completed*
- Geotechnical and pavement investigations - *completed*
- Landscape and architectural plans - *completed*
- Acquisition of private property and transfer of Crown Land – *possession mid to late 2018*
- Community and stakeholder consultation – *on-going*

The Project has also been through an Expression of Interest process to shortlist tenderers due to the complex constructability of the Project.

2.2.2 Construction

Construction is planned to commence in early 2019 and is expected to take three years to complete. The construction works will include:

- Clearing and grubbing of vegetation, including tree removal and stripping and stockpiling of topsoil;
- Establishment of an ancillary works area, including construction of temporary access roads, site office, workshops and stockpiles;
- Excavation of formation construction works including disposal of all waste and excavated material. Construction will include deep cuttings up to 20 metres in depth;
- Construction of retaining walls;
- Construction of verges and table drains;
- Installation of drainage pipes and pits;
- Construction of kerb and channel;
- Construction of two new bridges over the Tarwin River West Branch;
- Construction of new full depth granular pavement between Old Koonwarra-Meenyan Road and Minns Road;
- Construction of a new intersection for Caithness Road, including turn lanes and street lighting;
- Upgrade of Minns Road intersection including turn lanes and street lighting;
- Construction of a highway underpass east of the new Caithness Road intersection for the Great Southern Rail Trail;
- Realignment of the Great Southern Rail Trail under the new river bridge at the Minns Road end;
- Supply and installation of steel beam guard fence, wire rope safety barrier and concrete barrier;
- Preparation and application of sprayed seal and asphalt surfacing;

- Closure of access to the old section of highway to through traffic east of Caithness Road while retaining access for local residents; and
- Landscaping the road reserve within the new alignment and redundant highway including topsoiling, seeding and planting.

A Construction Environmental Management Strategy (CEMS) will be developed by the contractor to provide an overview of the environmental management processes that will be used during the various phases of work under the construction contract and the procedures to protect the environment. This will include:

- Purpose and objective of the strategy;
- Schedule of environmental elements affected by the work including proposed mitigation measures and timeframes;
- Processes and responsibilities for review and update of the CEMS;
- Development, implementation and auditing of the Construction Environmental Management Plans (CEMP's);
- Reporting and investigation of environmental incidents or complaints;
- Assessment of the adequacy of the implementation of controls and procedures;
- Emergency response;
- Statutory approvals and permits;
- Site induction and training; and
- Subcontractor compliance.

The CEMS is the overarching parent document from which individual Construction Environmental Plans (CEMPs) are prepared.

The CEMP's detail the proposals / actions to be undertaken by the contractor and the controls to be implemented for the management of individual stages of work (defined by work activity and / or location) that impact on the environment and as further described in section 5.1.2.

The CEMS and CEMP's will be reviewed by VicRoads and endorsed by an independent environmental auditor and the South Gippsland Shire Council prior to works commencing on the stage of works the CEMP relates to.

VicRoads has standard contract requirements for works with major environmental management considerations (Section 1200 and Section 177), which will be applied due to the complexity of the work and the number of environmental issues to address. Additionally, several site-specific conditions have also been developed to further address site constraints and considerations, including the delineation of No-Go zones by VicRoads prior to the commencement of construction.

2.3 Operational Requirements

At completion of the Project, the highway will be declared as public road and operate as a two-way road with a posted speed limit of 100km/h. The highway carriageway, infrastructure and road reserve will be maintained in accordance with the Victorian *Road Management Act 2004* under a maintenance alliance contract managed by VicRoads Eastern Region.

Future maintenance activities will include routine inspection and maintenance of the road pavement, bridges, culverts, pedestrian underpass, retaining walls, safety barriers and roadside vegetation. These activities may include repair of damaged assets, including signage and barriers, resurfacing, line marking, weed spraying and emergency response.

The section from the existing Caithness Road intersection to the new highway alignment will be declared as local road and will be maintained by the South Gippsland Shire Council.

The Great Southern Rail Trail will continue to be maintained by the Committee of Management, except for the pedestrian underpass, which will remain a VicRoads asset.

Operational requirements are to be undertaken for the life of the assets.

2.4 Surrounding Land Uses

The land uses immediately surrounding the Project area include the South Gippsland Highway and local roads, farmland for cattle grazing and the Great Southern Rail Trail, which is used as a recreational cycling, walking and horse riding trail.

The Project area is in the municipality of South Gippsland Shire Council and is subject to zoning for Road, Farming, Public Park and Recreation (Great Southern Rail Trail) and Public Conservation and Resources (Tarwin River) under the South Gippsland Planning Scheme. The Project area is additionally covered by two Environmental Significance Overlays – ESO2 (Special water supply catchment area), ESO5 (Areas subject to erosion) and LSIO - Land Subject to Inundation Overlay.

Consultation with the South Gippsland Shire Council has not identified any known future developments proposed for the land surrounding the Project area.

2.5 Feasible Alternatives to the Project

Concept development commenced in the early 2000's and identified two alignment options. Each option impacted significantly on private property, services, native vegetation, the Koonwarra Fossil Bed and the Tarwin River West Branch and Black Spur Creek (see *Table 2* and *Figure 5*).

The third option was suggested to VicRoads by community members at an early public meeting and was in response to concerns regarding severance of properties, noise and amenity and environmental impact associated with the original two options. This option (the Project) markedly reduced or eliminated the impact of the original two options and had a high level of community support and was approved for construction in June 2001.

Table 2 - Realignment Options Investigated

Asset	Option 1	Option 2	Option 3 (The Project)
Route Length (current SGH - 3.4km)	3.01km	3.02km	2.3km
Land Acquisition	20Ha	27Ha	4Ha
Properties affected	4	7	2
Houses	Possibly 1	Possibly 2	0
Dams	4	6	1

Asset	Option 1	Option 2	Option 3 (The Project)
Services	Power, NBN, Telephone, Water and Sewer	Power, NBN, Telephone, Water and Sewer	NBN pole
Koonwarra Fossil Bed	Medium Impact	High Impact	Low Impact
Strzelecki Gum Habitat	High Impact	Medium Impact	Medium Impact
Australian Grayling	High Impact Tarwin River West Branch diversion & Black Spur Creek crossing	Low Impact Black Spur Creek crossing	Low Impact Tarwin River West Branch crossings
Business & Tourism	No Change	No Change	Change
Noise Impact	Medium	Medium	Low
Benefit Cost Ratio (as of 2001)	2.9 - 2.4	1.8 - 1.7	3.2 - 2.9

From the Project's inception in the early 2000's there have been 41 recorded crashes on the South Gippsland Highway between Old Koonwarra-Meenyan Road and Minns Road. This section, known as the Koonwarra Bends, is a 3.4 kilometre steep and winding alignment with an abrupt and dangerous reduction in road standard (VicRoads, 2016).

Over the last 5 to 10 years, there have been numerous road safety improvement projects to try and reduce the high crash rate within this section, including installation of safety barriers and signage to increase driver awareness and improve behaviour, as shown in *Figure 4* (VicRoads, 2016).

There is very limited opportunity to make any further improvements to road safety along the Koonwarra Bends due to the steep terrain and narrow lane and shoulder widths and as such, the high occurrence of crashes will continue.

The option of taking no action was not considered to be a feasible alternative.



Figure 4 - Existing Road Safety Treatments

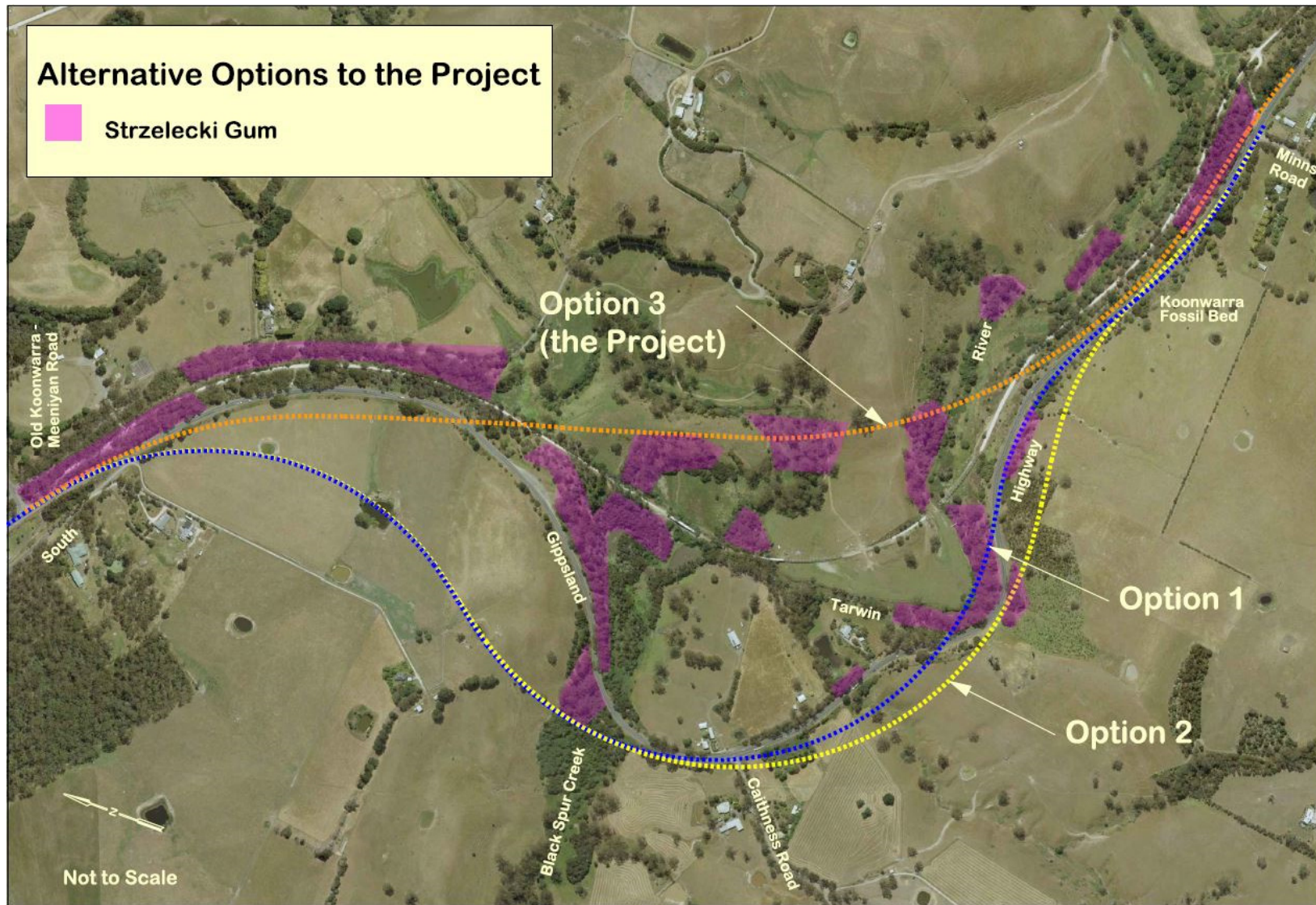


Figure 5 - Realignment options & estimated location of Strzelecki Gum habitat

3 Description of the Environment and MNES

3.1 Strzelecki Gum

Strzelecki Gum (*Eucalyptus strzelecki*) is a medium to tall forest swamp gum, with smooth white bark and red-brown mottling on the trunk, with rough, fissured bark persisting on the lower trunk of mature trees (Carter, 2006). Adult leaves are variable but primarily lanceolate, alternate and glossy green and new growth is lightly or conspicuously waxy. The tree can grow up to 30 metres in height and commonly occurs in floodplains, along river or drainage lines, as well as foothills and drier areas with preferred soils that are grey, deep and fertile (Rule, 1992).

Strzelecki Gum occurs in the South and West Gippsland regions of Victoria extending north to Neerim South, south to Foster, west to the east coast of Westernport Bay and east to Yarram (Rule, 1992). There is little historical data on the distribution of the species prior to European settlement, however it is likely to have been far more prevalent in the landscape and in continuous populations than occur today (Carter, 2006). The current population of Strzelecki Gum is estimated to be between 5000 - 15,000 plants at up to 50 locations (Carter, 2006), however work completed by Baw Baw Shire Council (Baw Baw Shire Council, 2008) counted and mapped over 10,000 Strzelecki Gums in West Gippsland alone. It is therefore likely that the numbers estimated in the Recovery Plan are well below the actual number of Strzelecki Gum individuals remaining.

The National Recovery Plan (Carter, 2006) identifies several key threats to the long-term viability of the species including:

- Grazing;
- Weed invasion;
- Lack of recruitment;
- Tree removal;
- Fire;
- Changes to hydrology;
- Increased nutrient levels
- Loss of genetic diversity; and
- Climate change.

A number of these threats result in a lack of recruitment for the species and many remnant trees are old, senescing paddock trees. Research studies in recent times have therefore focused on recruitment of the species to obtain a better understanding of requirements (Moxham and Dorrough, 2008, Schinagl *et al.*, 2013) which provide additional detail regarding these threats. Competition from ground layer vegetation and grazing was identified as a limiting factor to recruitment and establishment of the species for paddock trees in agricultural landscapes (Moxham and Dorrough, 2008). Conversely, Schinagl *et al.*, (2013) focused on high quality remnant patches of native vegetation with recruitment observed at all study locations. The two studies combine to suggest that habitat degradation and fragmentation caused by the threats described above inhibit the ability of the species to produce adequate recruitment.

3.1.1 Assessment of environmental values and impacts

Resources used to identify and determine impacts to Strzelecki Gum, included the following:

- Review of databases
 - The Victorian Biodiversity Atlas (DELWP, 2017a) for previously recorded locations of Strzelecki Gum within a 5 kilometres radius of the Project area;
 - Atlas of Living Australia (Atlas of Living Australia, 2017);
 - DELWP's Native Vegetation Information Management System (NVIM) tool to provide modelled vegetation condition and native vegetation extent (DELWP, 2017c);
 - DELWP's NaturePrint (DELWP, 2017b), to provide modelled habitat for significant species and Ecological Vegetation Class (EVC) data; and
 - Protected Matters Search Tool (PMST) to determine matters of national environmental significance within a 5 kilometres radius of the Project area (DoEE, 2017).
- Scientific literature
 - Species description for Strzelecki Gum (Rule, 1992);
 - National Recovery Plan (Carter, 2006);
 - Department of the Environment, *Eucalyptus strzelecki* Species Profile and Threats Database (DoEE, 2018)
 - *Flora and Fauna Guarantee Act 1988* Action Statement (DSE, 2008); and
 - Species specific studies (Moxham and Dorrough, 2008; Schinagl *et al.*, 2013; Baw Baw Shire Council, 2008).
- Field Survey
 - To determine the extent of native vegetation proposed to be impacted and to accurately determine locations of Strzelecki Gum within and adjacent to the Project area, field assessments were undertaken in April and June of 2017 (Bowler *et al.*, 2017) (*Appendix 1*);
 - An additional survey was undertaken on publicly accessible land within two kilometres of the Project area in August 2017, to record the location and estimate the number of Strzelecki Gum, which provided additional information for the context of the population within the Project area (Bowler, 2017); and
 - Survey data from proposed works associated with the South Gippsland Highway Safe Roads Improvement Project (SSRIP) occurring in the vicinity of the Project area recorded the location and number of Strzelecki Gum within the road reserve between Leongatha and Meeniyan (Imbery, 2018. unpub. report).

Section 11 provides additional detail regarding these documents.

3.1.2 Population and habitat

Database Searches

Database searches resulted in 3,793 Strzelecki Gum records throughout Victoria being identified, with 12 (0.3%) of these records occurring within the Project area. This total included 1,928 from the Atlas of Living Australia (ALA) and 1,865 from the Victorian Biodiversity Atlas (VBA) records. These records do not consistently include the number of individuals at each location, however the VBA alone provides a total count of over 8,700 individuals (DELWP, 2017a).

Strzelecki Gum records are largely located within West Gippsland, specifically the Baw Baw Shire Council municipality. Some of these records may be duplicates, with ALA and VBA records being present in the same area. Records from the VBA are more reputable due to expert review prior to their inclusion in the dataset. Six VBA records and six ALA records occur within the Project area. The location of all Strzelecki Gum records, compiled from both database searches, can be seen in *Figure 6*.

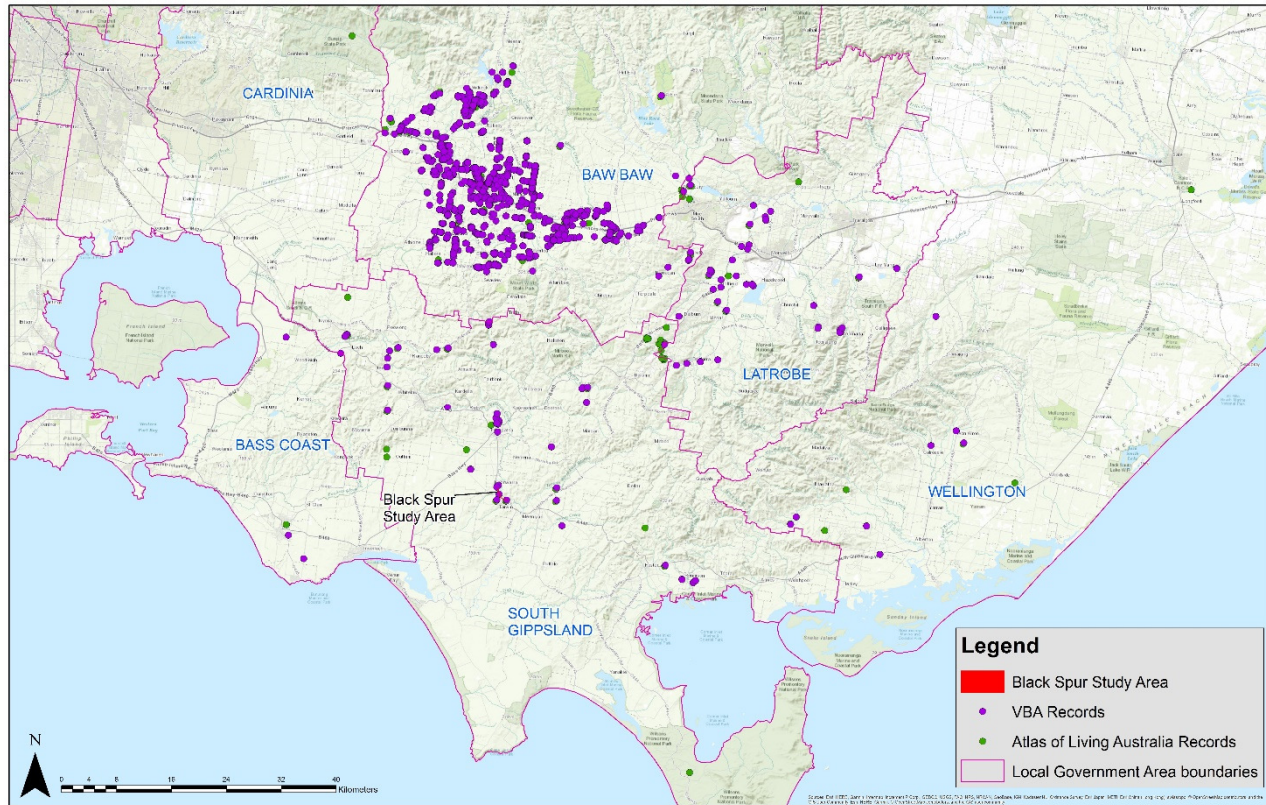


Figure 6 - Strzelecki Gum Distribution from database searches.

Based on the Strzelecki Gum database records, scattered distribution of the species occurs throughout South Gippsland Shire (where the Project area is located), Latrobe City and a small amount of records for the Wellington and Bass Coast Shires. A concentration of records north of Mount Worth State Park within the Baw Baw Shire Council is likely attributed to more intensive survey effort in this area (such as Baw Baw Shire Council, 2008).

It is very likely that the current distribution and concentration of records for the species as shown by the VBA records (*Figure 6*) is due to inconsistent survey effort and that actual numbers / distribution would place it as being far more prevalent with a greater extent (particularly around areas like Poowong, Latrobe Valley and along the Tarwin River).

Field Surveys

Targeted field survey for Strzelecki Gum was undertaken within and 10 metres adjacent to the Project area (the survey area) as shown in *Figure 8*, with 884 individuals identified. The individual size class categorisation for large trees was based on the diameter at breast height (dbh) for large trees in each assigned EVC as per the following:

- Very Large - 1.5 times;

- Large - 1 to 1.5 times;
- Medium - 0.75 to 1 times;
- Small - 0.25 to 0.75 times; and
- Very small - 0 to 0.25 times.

Strzelecki Gums found within the survey area were broken into the following size classes:

- 15 very large old trees;
- 41 large old trees;
- 43 medium old trees;
- 269 small trees; and
- 516 very small trees.



Figure 7 - Cleared farmland and Strzelecki Gums adjacent to the Tarwin River West Branch

A field assessment of the distribution and abundance of Strzelecki Gum on land within two kilometres of the Project area was also completed. This was primarily limited to public land including roadsides, rail trails and waterway corridors, due to difficulties in obtaining land owner consent.

The investigation estimated 2,307 individuals of predominantly reproductively mature Strzelecki Gums from 86 different locations, with the majority of these points being roadsides (which also represents a large portion of the public land in this area) (*Figure 9*).

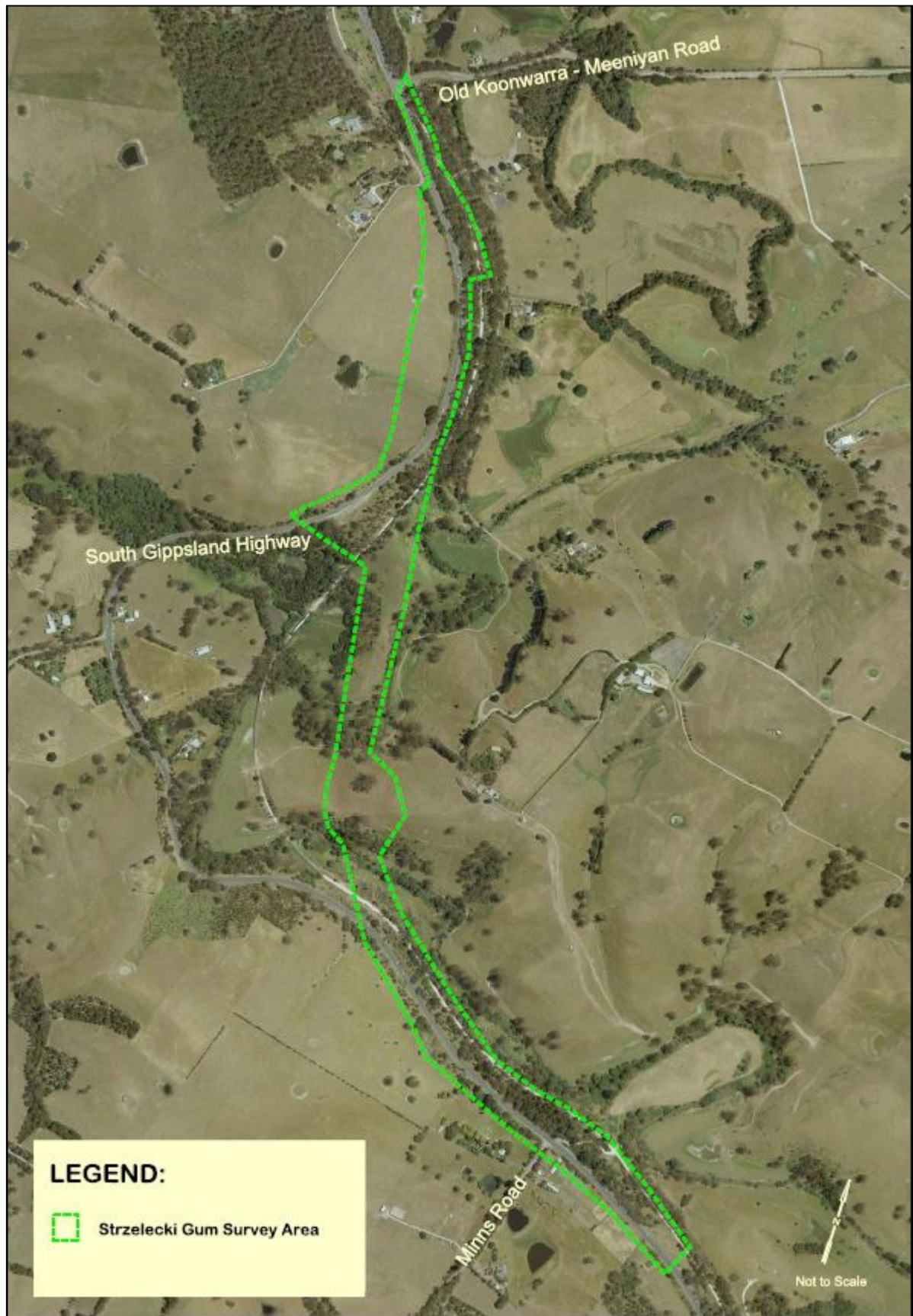


Figure 8 - Targeted field survey for Strzelecki Gum (the survey area)

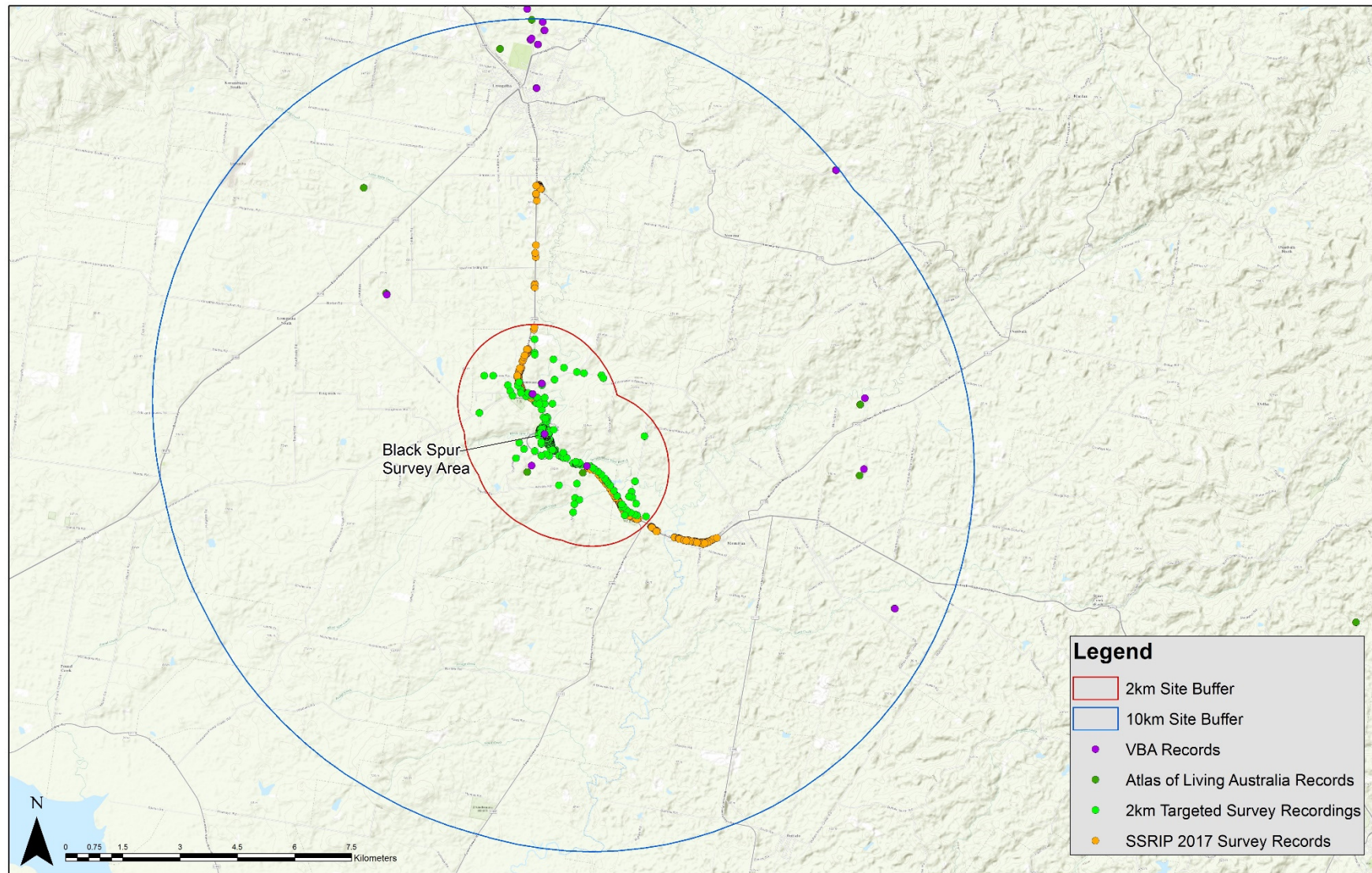


Figure 9 - Strzelecki Gum distribution from survey effort and database records within 2 & 10 kilometres

Additional survey data from proposed works associated with the South Gippsland Highway Safe System Road Infrastructure Program (SSRIP) occurring near the Project area recorded the location and number of Strzelecki Gum (Imbery, 2018. unpub. report) (*Figure 9*). The species was found extensively between Minns Road (directly south of the Project area) and Brendan Street (Meeniyan), surrounding the Koonwarra township, a dense roadside population on Carmody Road (1.5 kilometres south of Leongatha) and sparsely scattered in the road reserve between Koonwarra and Leongatha. Approximately 875 individuals were recorded between Meeniyan and Leongatha, which were mapped as part of the field work for this Project undertaken in August 2017. Some of those recorded will be duplicates with Bowler (2017), due to the work undertaken as part of this Project.

These results suggest that Strzelecki Gum abundance surrounding the Project area is comparable to that seen in the Baw Baw Shire (*Figure 6*) and that lack of survey effort in the southern extent of its range is likely the cause for its apparent paucity.

Scientific Literature

The National Recovery Plan identifies important populations necessary for the long-term survival of the species. They are important due to containing a high number of individuals, not being in a linear arrangement, have observed recruitment, or opportunities exist for restoration and conservation management (Carter, 2006).

Two important populations occur within the vicinity of the Project area, including:

- Roadsides (Shire) Koonwarra-Tarwin River Crossing (115 individuals, including 42 suckers or immature individuals); and
- Riversides (council jurisdiction) Koonwarra - Tarwin River Crossing.

It is unclear where the boundaries of these two populations occur (or if they are contiguous). It is likely they are to the north of the Project area on Old Koonwarra-Meenyan Road which will not be impacted by the action. However, this is not definitive, and individuals identified within the Project area may form some continuation, albeit in a fragmented landscape, interspersed with farmland and paddock trees.

The SPRAT profile (DoEE, 2017) identifies the 15 hectare Koonwarra Fish Bed Geological Reserve, approximately three kilometres southeast from Koonwarra township as a population of unidentified size where Strzelecki Gum occur in a reserve. The Koonwarra Fish beds are to the south of the Project area and not impacted by the proposed action, however it should be noted that advice from Museum Victoria is that the actual fossil location is at the eastern end of the Project area near Minns Road and it is unclear why the reserve has been placed in areas away from the known fossil site.

3.1.3 Adequacy of survey

Vegetation assessment and identification of Strzelecki Gum occurred in April and May of 2017, with the entire survey area traversed on foot (Bowler *et al.*, 2017). This investigation was led by a senior ecologist, Mr Harley Schinagl, with over 10 years' experience in the ecology and distribution of Strzelecki Gum in Gippsland, including the publication of research into factors affecting the recruitment of the species (Schinagl *et al.*, 2013).

Due to the large number of Strzelecki Gum individuals identified in the survey area; each tree was precisely recorded with survey equipment to accurately determine the potential impacts on the species in June 2017. This included all size classes from <1cm dbh through to very large trees of >180cm dbh. Each tree was ground surveyed horizontally to Map Grid of Australia (MGA) Zone 55 and vertically to Australian Height Datum (AHD) () with +/-5% point accuracy and recorded dbh and canopy spread.

The surrounding two kilometre survey of public land was undertaken in July 2017. All wooded remnant vegetation on public land within two kilometres of the Project area was inspected for the presence of Strzelecki Gums. When possible, this was done on foot, although most of the vegetation was situated on roadsides and was surveyed from the vehicle. Strzelecki Gums were identified by two consultants trained in the identification of the species. Locations were recorded by GPS for an area containing Strzelecki Gums, with numbers estimated rather than each individual surveyed and recorded.

SSRIP survey effort (Imbery, 2018) was undertaken in August 2017 and involved the walking of roadsides for 15 kilometres from Meeniyan to Leongatha (excluding the Black Spur section) and recording location and numbers of Strzelecki Gum found within the road reserve. Again, this was completed by ecologists trained in the identification of the species.

The three field assessments were undertaken in April-May, July and August and so it is possible that some of the identifying features of Strzelecki Gum may not have been present, particularly the glaucous new growth likely to be visible in the Spring. The method of survey may also have placed a limitation on its accuracy in regard to numbers recorded and location, however this is only relevant for the two kilometre survey surrounding the Project area which included vehicle survey rather than on foot.

3.2 Australian Grayling

Australian Grayling (*Prototroctes maraena*) is a small to medium-sized, slender, silvery fish with soft-rayed fins lacking any spines growing commonly to between 17-19 cm, but up to 33cm. A sexually dimorphic fish, most of its life is spent in freshwater, however, at least some of its larval and juvenile stage is spent in coastal seas (Backhouse *et al.*, 2008).

The species is most commonly associated with cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones. In the Tarwin River system, they have also been associated with muddy-bottomed, heavily silted habitat (Jackson, 1980).

Spawning occurs in freshwater environments in late summer through to early winter and is generally triggered by an increase in the volume and flow rate of streams, possibly combined with a decrease in water temperature (Backhouse *et al.*, 2008). The exact timing is dependent on location and annual conditions. Upon hatching larvae are swept downstream into estuarine areas where they disperse in the marine environment until approximately six months of age. Juveniles then migrate back into freshwater, where they are believed to remain for the remainder of their lifecycle (Backhouse *et al.*, 2008). It is believed that most adults die after their second year, usually after only having spawned for a single season, with a small percentage of the population living for four to five years (Backhouse *et al.*, 2008).

The species is known from coastal rivers and creeks with permanent or intermittent connection to the sea, south and east of the Great Dividing Range (McDowall, 1996).

Key threats to Australian Grayling include (DoEE, 2018; Backhouse *et al.*, 2008).

- Habitat destruction and degradation;
- Barriers to fish movement/migration;
- River regulation;
- Poor water quality;
- Siltation;
- Introduced fish;
- Climate change;
- Disease; and
- Recreational fishing.

3.2.1 Assessment of environmental values and impacts

Resources used to identify and determine impacts to Strzelecki Gum, included the following:

1. Review of Databases
 - The Victorian Biodiversity Atlas (DELWP, 2018) for previously recorded locations of Australian Grayling for the Tarwin River catchment.
 - WaterWatch temperature data on the Tarwin River (DELWP, 2018a)
2. Scientific Literature
 - National Recovery Plan (Backhouse *et al.*, 2008);
 - Department of the Environment, *Australian Grayling* Species Profile and Threats Database (DoEE, 2018);
 - Species specific studies (Ecology Australia, 2000).
3. Field Survey
 - Targeted Australian Grayling Survey for the Project (Jenkin, 2018) (*Appendix 2*);
4. Expert Opinion
 - Commutations with fish specialists at Department of Environment, Land, Water and Planning's (DELWP) Arthur Rylah Institute (ARI).

3.2.2 Population and habitat

Database Searches

Database searches resulted in 816 Australian Grayling records throughout Victoria being identified, with 25 (3.1%) of these records being in the Tarwin River West Branch catchment and from between 1972 to 2018. The VBA (DELWP, 2018) indicated the highest concentration of records occurred upstream of the Project area between Koorooman and Allambee South, followed by the area between Koonwarra and Meeniyah (*Figure 10*).

Whilst the specific seasonal timing of Australian Grayling spawning in the Tarwin River and its tributaries was not identified, water temperature records taken as part of the Victorian WaterWatch program between 2014-2016 indicate the Tarwin River West branch experiences a regular seasonal water temperature drop in about April each year (Jenkin, 2018), which provides a more specific timeframe for spawning in the Tarwin River.

Field Survey

The targeted Australian Grayling survey was undertaken over three days and two nights on 25th to 27th April 2018. Sampling was undertaken at eight sites, including seven on the Tarwin River West Branch and one on the Tarwin River, just downstream of its confluence with the West Branch. Two additional sites were visited in Black Spur Creek, although they were dry and not able to be sampled. The eight sampling sites were selected based on the presence of habitat characteristics that would potentially suit Australian Grayling and stream access (Jenkin, 2018).

The targeted survey recorded three Australian Grayling. Two were caught at sites within the Project area and one in the Tarwin River downstream of the confluence with the Tarwin River West Branch (Jenkin, 2018). The two upstream specimens were young of the previous year (89mm, 5.9 and 7.0g, <1-year-old) and were caught utilising bank electrofishing and the specimen in the Tarwin River was assessed as a two-year-old (144mm, 34.6g, circa 2-year-old) and caught via boat electrofishing (Jenkin, 2018).

Habitat in the immediate vicinity of the proposed new bridge locations included the range of requirements needed to support a resident population (e.g. alternating pools and riffles, instream snags, good water quality, etc.). The large number of historical upstream records, 2-year old specimen recorded downstream and 1-year old specimens recorded in the Project area during this survey also indicated that Australian Grayling must at times, migrate through the Project area (Jenkin, 2018).

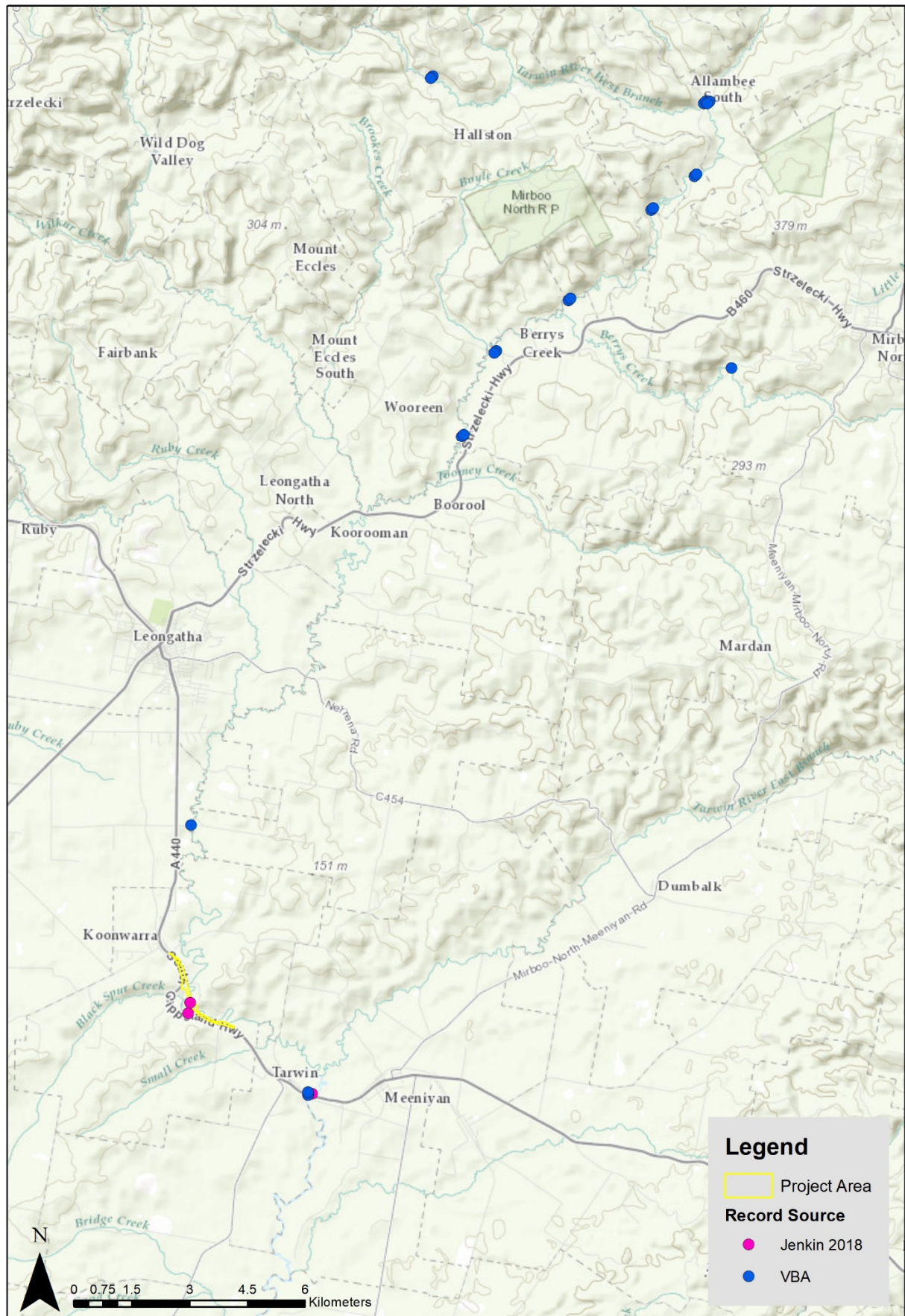


Figure 10 -Records of Australian Grayling within 25kms of the Project Area (Source: (DELWP, 2018; Jenkin, 2018))

Scientific Literature

The National Recovery Plan identifies important populations necessary for the long-term survival of the species. The Tarwin River is listed as an 'important river for Australian Grayling' (Backhouse *et al.*, 2008).

The species SPRAT profile identifies that in Victoria in the 1980s, Australian Grayling had been most frequently collected in the Tambo, Barwon, Mitchell and Tarwin River systems and research into the Australian Grayling has indicated the species undergoes large, annual fluctuations in population numbers, depending on prevailing conditions and is capable of explosive population increases when conditions are favourable (DoEE, 2018).

Discussion with researchers from DELWP's Arthur Rylah Institute (ARI) noted there was an established population in the Tarwin River West Branch, which they have been researching for several years. They also indicated that Black Spur Creek was unlikely to be a commonly used waterway by the species.

3.2.3 Adequacy of survey

Targeted Australian Grayling surveys occurred in late April 2018, during the known spawning season of the species and the methods used aligned with the Australian Grayling survey protocols outlined in the *Survey Guidelines for Australia's Threatened Fish* (DSEWPC, 2004), including boat, bank and backpack electrofishers. The survey methodology for the targeted survey (i.e. methods and effort) was reviewed and confirmed as being appropriate (T. Raadik 2018, *pers com*, 6th and 24th April, 2018).

Whilst electrofishing is the preferred capture method for Australian Grayling, at some sites, where electrofishing was not able to be deployed, overnight fyke nets and bait traps were set and dip-netting was undertaken. The deployment of overnight traps in this situation was again confirmed by DELWP as being suitable (T. Raadik 2018, *pers com*, 6th and 24th April, 2018).

4 Relevant Impacts

The Project area largely comprises cleared pastoral land with fragmented pockets of highly modified native vegetation within roadsides and rail trail, and along the river / creek frontages and ridge escarpments.

The vegetation is linked to larger patches of Riparian Scrub and Forest that are connected by the Tarwin River West Branch, Black Spur Creek and other smaller drainage lines that feed into the Tarwin River West Branch.

In March 2017, VicRoads engaged Indigenous Design to undertake a vegetation quality and biodiversity assessment to address the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017) and to investigate the existence or potential for any protected species or communities under the Victorian *Flora and Fauna Guarantee Act, 1988* (FFG) and the EPBC Act within the Project area (Bowler *et al.*, 2017).

The assessment and further targeted surveys identified that the Project area contained the nationally vulnerable Strzelecki Gum (Bowler *et al.*, 2017) and that the reaches of the Tarwin River West Branch

at, and surrounding the Project area, provides suitable habitat for the nationally vulnerable Australian Grayling (Jenkin, 2018). The species is likely to use the Tarwin River West Branch on either a permanent basis or periodically during migration.

4.1 Strzelecki Gum

4.1.1 The direct and indirect loss of habitat

The construction footprint has been overlaid with the locations of Strzelecki Gum to determine the number of trees proposed to be impacted by the Project. A total of 164 Strzelecki Gum are proposed to be directly impacted by the Project, with the following breakdown:

- 4 very large old trees;
- 6 large old trees;
- 8 medium old trees;
- 37 small trees; and
- 109 very small trees.

Strzelecki Gum indirectly impacted by the Project includes those trees that are deemed lost with estimated greater than 10% of the Tree Retention Zone (TRZ) likely to be affected by construction works. This follows technical advice from the Victorian Government regarding the protection of trees during construction in line with Australian Standard AS 4970-2009 (DSE, 2011). Whilst it is highly likely that these trees will be retained on site, their long-term viability cannot be guaranteed, and they are therefore conservatively included as indirectly impacted. Seventeen individual Strzelecki Gum are deemed lost (>10% impact to TRZ), with the following breakdown:

- 6 very large old trees;
- 3 large old trees,
- 1 medium old tree;
- 4 small trees; and
- 3 very small trees.

In summary, **181** trees from 884 identified within the Project area are proposed to be impacted, with an area of approximately two hectares. A total of 4.76 hectares of remnant native vegetation is proposed to be removed for the Project. (Note: the number of trees impacted has increased by one very small recruit that is growing along the South Gippsland Highway in isolation and was overlooked in the original impact assessment).



Figure 11 - Riparian Forest EVC looking south across Tarwin River West Branch floodplain showing Strzelecki Gum proposed to be removed

4.1.2 Risk of introduction and spread of weeds and pathogens

Five weeds declared noxious under the *Catchment and Land Protection Act 1994* (CaLP Act) were identified with the Project area during field assessments (*Table 3*).

Table 3 - Declared noxious weeds proclaimed under the *Catchment and Land Protection Act 1994*

Scientific Name	Common Name	Classification
<i>Cirsium arvense</i>	Perennial Thistle	Regionally Controlled
<i>Cirsium vulgare</i>	Spear Thistle	Regionally controlled
<i>Crataegus monogyna</i>	Hawthorn	Regionally Controlled
<i>Jacobaea vulgaris</i>	Ragwort	Regionally Controlled
<i>Rubus fruticosus</i> spp. Agg.	Blackberry	Regionally controlled

Weed invasion is a major threat to the species with Moxham and Dorrough (2008), identifying the lack of recruitment in Strzelecki Gum in agricultural landscapes as primarily due to the coverage of exotic grass species.

Weed control activities have commenced within and adjacent to the Project area and in the Great Southern Rail Trail. This has included the control of Ragwort, Blackberry and Spear Thistles. These activities will continue to be undertaken by VicRoads during the Spring and include:

- A continuation of the weed control program targeting those species above; and
- Maintenance of the rail trail Old Koonwarra - Meeniyar and Minns Roads for the duration of the construction.

While there are no known listed pathogens affecting Strzelecki Gum, vehicle hygiene will be a requirement of the CEMP.

The approved CEMP which will be developed by the successful contractor (see *Section 2.2.2*), will outline actions to prevent the introduction and / or spread of weeds and pathogens into the Project area. To address the potential introduction and / or spread of weeds and pathogens, the following will be employed:

- All machinery, plant and vehicles will be free of dirt and vegetative material prior to entry and upon leaving site, with identified cleaning areas;
- Weed control for the above five species shall occur pre, during and post construction and as a response to their identification through fortnightly monitoring of the site; and
- Use of vehicle and machinery hygiene log books.

4.1.3 Risk of increased nutrient runoff and/or nutrient uptake

As part of VicRoads legal responsibilities, the Project must protect waterways from current and future contamination, including total suspended solids, total nitrogen and total phosphorus.

This will be achieved by applying Water Sensitive Road Design principles to the detailed drainage design in the Construction Contract and will include water quality treatment measures to collect and treat run-off from all pavement areas to the performance criteria requirements of the State Environmental Protection Policy (Waters of Victoria) 2004 and the Australian Runoff Quality Guidelines prior to discharging into the surrounding drainage networks and waterways.

The treatment objectives applicable to the Project are a 45% retention of the typical annual urban load of Total Phosphorus and Total Nitrogen.

Expected treatment measures may include:

- Maintenance of existing highway drainage conditions and natural flow patterns;
- Inclusion of grassed or vegetated swale drains; and
- Construction of sedimentation basins.

Sedimentation and erosion control measures to prevent the movement of nutrients within the construction zone will be addressed specifically in the approved CEMP as described in *Section 5.1.2*.

4.1.4 Increased risk of fire

Fire has been identified as a threat due to the wet environment in which Strzelecki Gum grows, however the impacts to the species itself were unknown in the Recovery Plan (Carter, 2006). Since this time, Strzelecki Gum has been shown to have a positive response to fire (Schinagl *et al.*, 2013), with areas recently burnt (within the past 5 years) shown to have up to 15 times the number of recruits than unburnt, though this study did not investigate fire severity, suggesting that high intensity fires may still prove detrimental to remnant trees and the recruitment cycle. The significance of this threat to the species is therefore likely to require further study and revision.

The existing highway alignment through the Koonwarra Bends has narrow sealed shoulders and heavily grassed verges and due to the high incidence of road crashes, the risk of grass fires resulting from vehicle crashes is considered high.

The realignment of the highway will significantly reduce the number and frequency of road crashes and therefore the inherent risk of fire. The road shoulders will also be covered with a sprayed bituminous seal or asphalt surface, reducing fuel loads and have a minimum clearance of three metres to grassed and vegetated verges. This will provide an increased buffer area and minimise the risk of grass fires being ignited from contact with hot vehicle or plant exhaust pipes.

4.1.5 Direct or indirect loss of habitat due to soil erosion, movement and edge effects

Indirect loss to Strzelecki Gum that occur in the vicinity of the construction boundary and impacts to the TRZ has been discussed. Trees are deemed lost if an estimated greater than 10% of the TRZ is impacted by construction activities and they are included in the indirect impact losses (DSE, 2011). Changes to the road design to include battering / retaining wall works to prevent impacts to retained vegetation have been included as part of the avoidance process VicRoads have undertaken during the planning stages of this Project.

The CEMP will address the movement of soil and erosion through the following:

- Installation and maintenance of erosion and sedimentation controls;
- Minimising the amount of exposed erodible surfaces during construction;
- Temporary or permanent revegetation as work proceeds;
- Prompt covering of exposed surfaces; and
- Monitoring of water quality and rainfall to ensure water quality does not deteriorate, including Turbidity, Electrical Conductivity, pH, Dissolved Oxygen and Temperature.

To prevent the disturbance of additional habitat or individual Strzelecki Gums, No-Go zones will be fenced along the construction boundary. This will ensure no greater than 10% of the TRZ of retained trees will be impacted. Fences will have signage identifying the area as “No-Go Zone - No Unauthorised Access” and will be retained in place for the duration of construction activities. Further detail regarding the location and description of these zones can be found in *Section 5.1.2* and are shown in *Figure 15 (a-c)*.

4.1.6 Unknown, unpredictable or irreversible impacts

The targeted Strzelecki Gum survey has resulted in an accurate determination of the location of individual trees, and therefore there is a high degree of certainty that all direct impacts to Strzelecki Gum as part of the construction have been identified and accounted for. These impacts are considered irreversible.

Any unknown or unpredictable impacts whilst not expected, will be managed through the mitigation measures identified and the development and implementation of the CEMP.

4.1.7 A local and regional scale analysis of the likely impacts

For the purposes of this analysis, the local scale is defined as within two kilometres of the Project area with the regional scale defined as within ten kilometres of the Project area.

Local

Strzelecki Gums within the local area are not considered isolated populations as they are connected via corridors of vegetation along road and river reserves, and remnant trees on private property (*Figure 12*).

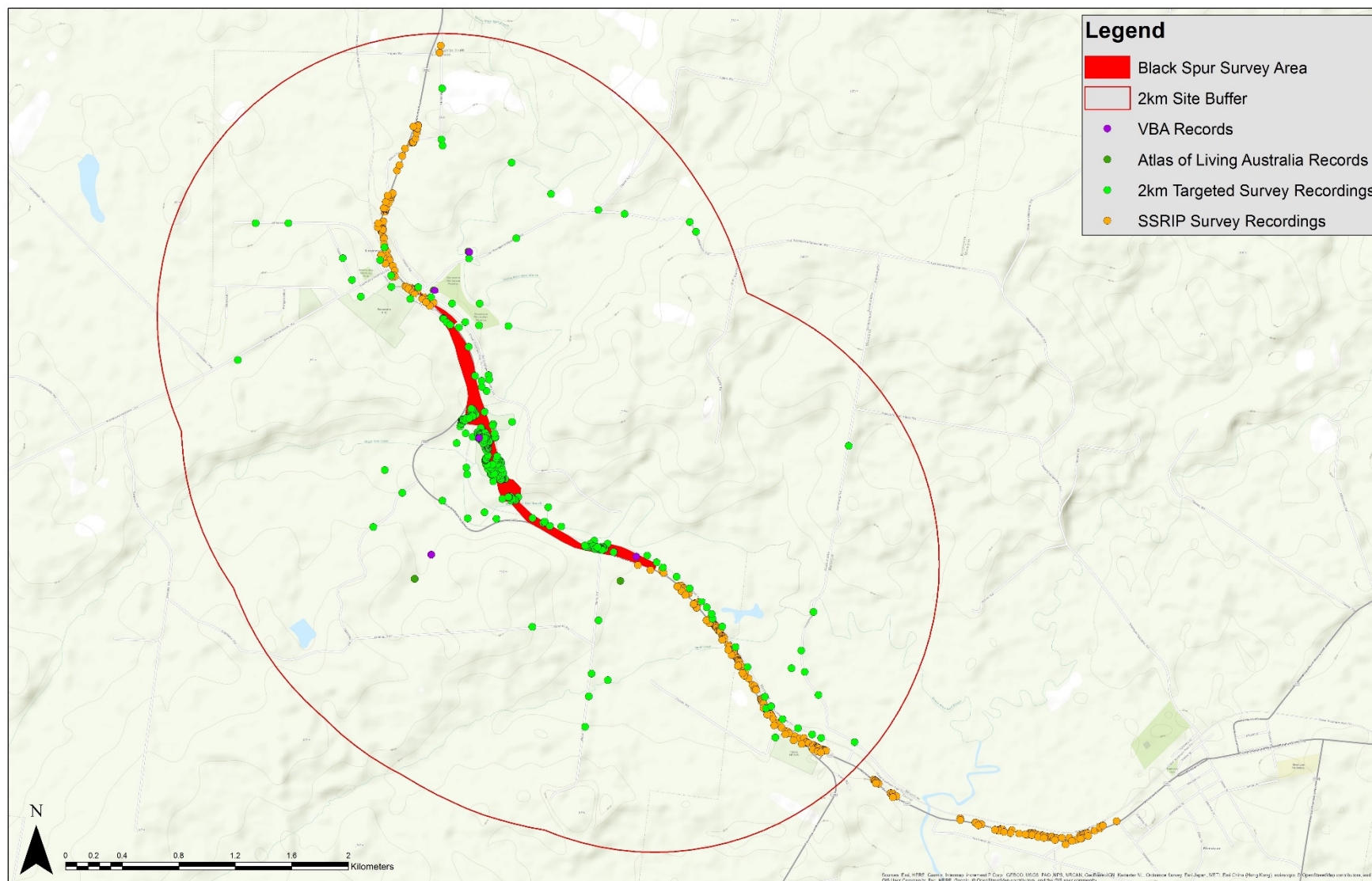


Figure 12 - Summary of Strzelecki Gum survey data within 2km of the Project

Whilst some of the proposed removal of Strzelecki Gum will occur within public reserves (public purposes reserve) for the Rail Trail, the quality of the habitat in which they occur is low. This is expected given that they occur in previously disturbed and cleared land, with the majority having re-established (primarily on the railway line) from areas that were previously cleared. Additionally, a large proportion of the trees (i.e. 153 of the 181 trees or 85%) affected by the proposal are within or below the 'small' size class. Site observations on the 22nd August 2017 of an area containing many (95) first year recruits (less than 1cm in stem diameter) indicated that a number had died from recent frosts and other agricultural activities since surveys had been completed (D. McLees, personal communication, August 22, 2017).

Only 28 Strzelecki Gums of a size greater than 'medium' size class are proposed to be impacted either directly (18 in total) or indirectly (10 in total).

While the proposed action will result in the loss of 181 individuals and two hectares of habitat, Strzelecki Gums and habitat that will be avoided will be protected by the establishment of No-Go zones, with fencing and exclusion areas identified as part of contract conditions. In addition, a proposed Landscape Plan (see *Section 5.1.2*) to be implemented during and post construction includes the planting of an estimated 4,000 Strzelecki Gum seedlings that have been germinated from seed collected from mature trees proposed to be removed (i.e. local provenance). VicRoads will also look to translocate all viable first year recruits impacted by the project (97 in total) within landscaping areas. Therefore, there is a high degree of confidence that the Strzelecki Gum population in the Project area and local area will remain viable in the long-term.



Figure 13 - Strzelecki Gum recruit impacted by the proposal

Regional

At a regional level, investigations undertaken as part of this Project have estimated 4,066 individual Strzelecki Gums on publicly accessible areas (primarily roadsides) (Bowler T., 2017 and Unpublished data) (see *Figure 9*). Given there is an estimated 5,000-15,000 remaining Strzelecki Gum within its entire range (Carter, 2006), as suggested by (Schinagl *et al.*, 2013) there is a high likelihood that there are more Strzelecki Gums across the species range than previously thought. The distribution of Strzelecki Gum within this region, when compared with those in the VBA provides additional evidence for the increase in knowledge of distribution and numbers following targeted survey effort, such as occurred in Baw Baw Shire (Baw Baw Shire Council, 2008). VBA record points can also underrepresent the numbers present, with separate location points for each individual tree unlikely and estimates of numbers at each point far more common.

The 2 kilometre targeted survey concluded that the Black Spur, Koonwarra site is located near the southern limit of the species, with Strzelecki Gums being more abundant north and north-east of the Project area, particularly surrounding Morwell and Warragul (Bowler T. , 2017a). However, the low number of VBA records surrounding the Project area have been shown to be an underrepresentation of the species' population distribution, based on more recent survey data. Additionally, field observations indicated that individuals occur in the wider area around the Stony Creek confluence with the Tarwin River (B. Imbery pers. comm. 24/05/2018) which is located over seven kilometres to the south of the Project area.

The proposed removal of 181 trees equates to 4% of the known numbers of Strzelecki Gum within a 10-kilometre radius, and 1% of the upper estimate of the entire population of the species (15,000).

The long-term viability of Strzelecki Gum regionally is therefore considered high in the context that databases currently underrepresent the population and distribution of the species.

4.2 Australian Grayling

4.2.1 The direct and indirect loss of habitat

Habitat in the immediate vicinity of the proposed new bridge locations includes the range of requirements needed to support a resident population of Australian Grayling (e.g. alternating pools and riffles, instream snags, good water quality etc.). The large number of historical upstream records, 2-year old specimen recorded downstream, and 1-year old specimens recorded in the Project area during the 2018 survey, provides evidence to suggest that Australian Grayling migrates through the Project area (Jenkin, 2018).

The proposed South Gippsland Highway realignment will cross the Tarwin River West Branch at two locations. The current design includes the construction of two permanent bridges and temporary crossings (single span). Placement of the permanent bridge piers will require no earthworks or structures and no vegetation removal directly in the river channel. Some earthworks and mitigation structures (i.e. sediment fencing and bunding) may be required near the top of the channel.

The assessment of potential impacts and mitigation measures are based on the understanding that no works will occur in the main river channel or its banks and that no direct 'instream' impacts are anticipated to Australian Grayling and / or their habitat. Potential impacts can only occur through indirect means due to works in the wider floodplain. The potential indirect impacts that have been identified for the Project are outlined below (*Table 4*).

Table 4 - Potential indirect impacts of the Project on Australian Grayling

Impact	Impact Description
Timing of construction may impact breeding / spawning of threatened species	<p>As no works or structures are proposed for in the channel, no significant impacts are expected to occur that would then impact upon fish behaviour or passage.</p> <p>In the instance of any channel-side works that may cause fish to scare, the fish would likely depart the area for the period of the disturbance to continue their breeding/spawning/migration activity elsewhere up/downstream.</p> <p>As Australian Grayling larvae are light sensitive, preferring shade / sheltered habitats, any earth / structural works that occur between dusk to dawn, under artificial lighting, may impact upon fish migration.</p>
Sedimentation of river during construction and post works	<p>Sedimentation/siltation, and subsequently reduced water quality are recognised as key threats to Australian Grayling (DoEE, 2018; Backhouse <i>et al.</i>, 2008)</p> <p>Sediment could be discharged into the river during earthworks in the floodplain such as vegetation removal and installation / construction of piers, piles, earthworks, etc.</p> <p>Higher rainfall and flow events during works (i.e. that raise above the channel and into the floodplain), have the potential to disturb Project sediments further afield and impact upon surface water quality in areas of Australian Grayling habitat both at and downstream of the Project area.</p>
Removal of riparian vegetation	<p>Although no riparian vegetation clearing will occur in the channel, clearing may need to occur in the floodplain. Removal of floodplain riparian vegetation (where present) may result in a reduction in aquatic habitat quality (reduced cover / shading) and may contribute to the cumulative reduction in the river's overall condition.</p>
Unmanaged disturbance to river banks	<p>Although works are not proposed to occur in the channel, works at the top of the channel, may encroach on the upper river bank (e.g. work buffer zones, fencing, etc.). If not appropriately protected / fenced, these works have the potential to result in unmanaged disturbance to the river bank.</p>
Contamination of waterway	<p>Reduced water quality is recognised as a key threat to Australian Grayling (DoEE, 2018; Backhouse, <i>et al.</i>, 2008)</p> <p>Spills of fuels, oils and other construction-related contaminants are possible during works and have the potential to impact water and habitat quality in the river and its downstream receiving waterways.</p>
Reduced downstream water quality	<p>Construction poses a risk to water quality through the removal of vegetation, suspension of sediments or the release of pollutants into the waterways. This has the potential to impact both immediate and downstream aquatic habitat areas and downstream receiving waterways.</p> <p>The operational phase of the Project (i.e. post construction) also presents possible threats to water quality through erosion while the site is re-established and / or due to vehicle / road use related pollutants once in operation (e.g. oils / fuels in storm water, litter, etc.).</p>

Impact	Impact Description
Alteration to 'natural' flow/hydrological regime	<p>As no works or structures are proposed for in the channel, no impacts are expected to occur that alter the river's natural flow during normal flow scenarios (i.e. flow within the main river channel).</p> <p>Depending on timing and flows at the time of work, the Project may temporarily impact on the natural 'flooding' flow of the waterway through the Project area during higher flow events (e.g. those flow events where water levels rise to inundate the floodplain). The installation of bunding, cofferdams and other floodplain structures may prevent natural flows and / or cause the flows to take another path.</p>
Incursion by weeds	<p>A wide range of common weed species are present in the Project area including blackberry and willow.</p> <p>Works in the Project area and / or insufficient / inappropriate rehabilitation of works areas have the potential to allow further inclusion of weeds if not managed appropriately.</p>

4.2.2 Unknown, unpredictable or irreversible impacts

The potential impact(s) posed by the Project to Australian Grayling and associated habitat are well understood and defined (see *Table 4*). It is considered unlikely there will be significant impact(s) that would be unknown or unpredictable. However, should any unknown or unpredictable impact(s) occur, they will be managed through the mitigation measures identified and the development and implementation of the Project's CEMP, including the following CEMP investigation and action 'steps':

- Identify the cause / source of the impact;
- Implement emergency measures to stop the cause / source;
- Report to relevant authority;
- Commence an appropriate monitoring regime to measure the extent and severity of impact; and
- Determine remediation /action measures (If any) with relevant stakeholders / authority.

None of the impacts identified in *Table 4* are considered irreversible. Impacts to water quality (i.e. sedimentation or contamination) are likely to dissipate with time and distance downstream (i.e. dilution and degradation), with the primary mitigation measure being to identify and stop the source or cause. Impacts to hydrology and flows are likely to be temporary only, returning to normal after the removal of the obstructing structure or rain event. Impacts relating to vegetation and weed incursion will be reversible through revegetation and weed / land management practices, that will be outlined in the CEMP.

4.2.3 A local and regional scale analysis of the likely impacts.

Key 'threats' to Australian Grayling include habitat disruption and degradation, introduced species, the complex nature of their lifecycle and high fecundity, and disease (DoEE, 2018). Key 'threatening processes' to the species include barriers to movement, river regulation, poor water quality, siltation, the impact of introduced fish, climate change and disease (Backhouse *et al* 2008).

Of these threats and key threatening processes, only the siltation and reduced water quality pose any considerable risk to Australian Grayling from the project.

Given no works will occur in the main river and measures will be implemented to manage and mitigate impacts from works in the floodplain, the project is unlikely to result in habitat disruption or degradation or pose a barrier to fish movement or regulate river flows. Similarly, the project is highly unlikely to result in the introduction of new pest species or disease.

As identified in *Table 4*, works over the river have the potential to result in fish scaring, which could impact fish behaviours in the immediate area of the disturbance. However, Australian Grayling are a highly mobile species that undertake large distance migrations between freshwater and estuarine / marine river reaches as part of their annual lifecycles. Being highly mobile, the species is readily able to depart areas of disturbance and return / recruit back into the area once the disturbance has ended.

Table 4 also identifies the risk of impact from sedimentation and spill, both of which could reduce water and habitat quality. Significant spills will be readily mitigated through the prevention of fuels, oils, etc. being stored within the floodplain. Should significant rain or flood events occur that result in the deposition of silt and sediments into the river, the impact is likely to be short-term, for the duration of the individual rain / flood event and it is expected the impact would dissipate downstream. Although any sediment contributed into the stream is acknowledged as contributing to a cumulative impact, the amount potentially discharged from the Project site, factoring in the proposed sedimentation controls, is unlikely to be significant in the overall catchment-wide deposition of silt / sediment into the river during larger flood events.

In consideration of the above points, at a local scale, any possible impacts are likely to be insignificant and temporary in nature, and therefore unlikely to result in any local impact(s) of significant consequence to the species or their habitat.

Regionally the species is distributed in coastal rivers throughout South Gippsland, with the Tarwin River West Branch population representing an important population (Backhouse *et al.*, 2008). However, given that the identified potential impacts can be mitigated and it is unlikely there are any significant unknown, unpredictable or irreversible impact(s), the Project is highly unlikely to result in any regional impact to the species.

5 Proposed Avoidance and Mitigation Measures

VicRoads has undertaken measures to avoid and reduce impact on Strzelecki Gum and Australian Grayling and their habitat during the planning stages of the Project. This has included the realignment of the highway through private grazing land and Crown land and modifying the design to reduce the width of the road and extent of earthworks. This effort to undertake measures to reduce and avoid impacts will continue throughout the pre-construction and construction stages as detailed below.

5.1 Strzelecki Gum

5.1.1 Avoidance Measures

The early concept design (see *Section 2.5* and *Table 2*) of the approved Project alignment was based on road design standards and statutory requirements from the early 2000's and as such, the Project was required to be reviewed and updated to reflect current design standards and statutory

obligations. Flora and fauna investigations from 2001 identified fifteen Strzelecki Gum within the Project area, with approximately sixty nearby.

Pre-construction planning of Option 3 (the Project) commenced in 2016 and targeted identification and survey for Strzelecki Gum identified 884 individual Strzelecki Gum within the survey area (including a 10 metre buffer). The approved road alignment impacted 348 trees.

The first design review of the Project in 2017, incorporated kerb and channel and a retaining wall to the road design adjacent to the Black Spur Creek Wetlands and avoided impacts to nine Strzelecki Gum.

A further review of the eastern end of the alignment near Minns Road was then undertaken to avoid and reduce the impact to a large number of Strzelecki Gum in this area. The design shifted the alignment approximately ten metres to the south and elevated the longitudinal grade line by approximately five metres and included a retaining wall. This design reduced the number of Strzelecki Gum proposed to be impacted near Minns Road by 14 trees.

The next stage of the re-design focussed on the trees within the road / rail reserve at the western tie-in at Old Koonwarra-Meenyan Road. The radius of the horizontal curve in this area was increased and the shoulder / verge area width reduced. This resulted in avoidance of a further 144 Strzelecki Gum (*Figure 14*).



Figure 14 - Strzelecki Gums to be avoided within the Project area (Great Southern Rail Trail)

Total re-design of the Project alignment has resulted in avoidance of 167 Strzelecki Gum. A summary of the avoidance measures undertaken through re-design is shown in *Table 5*.

Table 5 - Summary of Avoidance Measures for the Project

Project Design Reviews	Measure	Strzelecki Gum Removed (direct or indirect)	Strzelecki Gum Retention
First	Retaining walls and kerb and channel	339	545
Second	Geometric design and retaining walls	325	559
Final	Geometric design change at western end	181	703

5.1.2 Mitigation Measures

VicRoads will have responsibility for mitigation measures to be implemented for this Project during all stages pre, post and during construction. Several specific measures have been developed, along with the application of the VicRoads Section 1200 – Environment Protection and Section 177 - Environmental Management (Major) standard conditions. The following sections detail the relevant mitigation measures proposed.

Construction Environmental Management Plan

The development of a CEMP by the appointed construction contractor and revegetation of the impact area through the implementation of a Landscape Plan, detail the actions to be undertaken and controls to be implemented for the management of individual stages of work.

Each CEMP will incorporate the following:

- (i) Address the area or activity that the CEMP is established for and the environmental objectives;
- (ii) Identify work activities and assess the potential impacts and risks to onsite and offsite environmental receptors;
- (iii) Details of control measures to address identified environmental risks, including:
 - design measures and construction techniques to be implemented
 - drawings that show the location and extent of environmental controls, modifications to existing control devices, effects on permanent works, and monitoring locations
 - specific procedures to address identified environmental risks
 - emergency response plans and reporting requirements
 - resources, roles, responsibility and authority of staff involved in the approval, implementation and onsite review and maintenance of the CEMP
- (iv) Details of implementation of control measures, including:
 - duration of activity/risk, and timeframes for implementation and removal of control measures
 - frequency and responsibilities for inspection and maintenance of controls including proactive reviews
 - process for reviewing the effectiveness of the control measures including arrangements for implementing changes
 - details of how control measures shall be removed

- (v) Details of procedures and monitoring measures to manage all identified environmental elements to avoid or mitigate impacts, including inspection and monitoring requirements;
- (vi) Details of approvals, licences and permits necessary and their associated conditions to meet statutory requirements;
- (vii) Documentation associated with the Environmental Management Plan(s), including:
 - records of implementation of the environmental control measures, and monitoring of environmental elements;
 - a checklist to demonstrate that specified requirements have been addressed in the Environmental Management Plan.

These Plans are required to be developed using the general and specific conditions of the projects contract which will be independently audited by a VicRoads pre-qualified environmental auditor prior to submission and implementation. They will also require review and endorsement from the South Gippsland Shire Council as part planning permit conditions associated with the Project.

Specific CEMP's are required for bridgeworks in the vicinity of the Tarwin River West Branch and construction, maintenance and removal of access roads in ancillary works area.

No Go Zones

As outlined above, No Go zones for the protection of Strzelecki Gum, Australian Grayling and cultural heritage values have been specified by VicRoads and include restrictions on construction activities including permanent and temporary works, access tracks and hard standing areas (*Figure 15a-c*). The fencing of No Go zones will be installed a minimum of one metre beyond the boundary of habitat to be protected, to ensure no greater than 10% of TRZ are impacted on retained trees and prevent disturbance of any additional habitat or individual Strzelecki Gums.

The fencing will be constructed of star pickets at six metre spacing with three rows of flagging on wire support and will include signage identifying the area as "No-Go Zone - No Unauthorised Access". The No Go zone fence will be erected prior to the commencement of construction works, approved by both South Gippsland Shire Council and DELWP, retained in place for the duration of construction activities and then removed.

An arboricultural assessment and monitoring of tree health for those trees deemed lost due to TRZ impacts within No-Go zones will be included as part of the CEMP. Arborist recommendations will be implemented by the contractor to attempt to ensure the trees long-term viability. This may include pruning and limitations of works in the immediate vicinity.

Landscape Plan

VicRoads has developed a Landscape Plan in consultation with the Nerrena Landcare Group, that aims to mitigate and minimise the visual and physical impact of the Project on the local ecosystem and adjacent landowners. The plan proposes context sensitive solutions that are specific to the landscape character, local activities and enhances the experience of rail trail users by respecting environmental and historically significant sites.

The design intent is to:

- Reinstall vegetation upon completion of works to assist in the prevention of erosion/sedimentation;
- Assist in improving the condition of the newly constructed road reserve and increase vegetation cover in the immediate vicinity of the river crossings, likely providing a decrease in sedimentation and nutrient loads in surface water as the plantings develop.
- Protect and retain existing indigenous trees where possible;
- Revegetate areas to reflect local Ecological Vegetation Classes, plant additional Strzelecki Gum and reconnect wildlife habitat corridors;
- Enhance the road, land and rail trail; and
- Protect the Tarwin River West Branch from road runoff impacts.

The Landscape Plan has been incorporated into the construction contract and will be implemented and maintained by the contractor during construction and for two years after completion of the Project.

VicRoads will undertake seed collection for plantings to be used in the landscaping works, including Strzelecki Gum, from trees and vegetation to be removed for the Project and within the immediate vicinity, along with translocating any viable recruits impacted by the Project. This will ensure genetic diversity is maintained and local provenance ensured.

5.1.3 Mitigation Summary

A summary of the mitigation measures for Strzelecki Gum is outlined in *Table 6* which includes:

- The timing of the measure (pre, post or during construction);
- The environmental objectives the measure will achieve;
- The statutory basis; and
- Monitoring of effectiveness.

Table 6 - Summary of Strzelecki Gum mitigation measures proposed

Impact	Mitigation Measure	Outcome	Statutory / Policy Basis	Monitoring / Compliance
Pre-Construction				
Removal of Strzelecki Gums and habitat	<ol style="list-style-type: none"> 1. Completion of survey to locate and record diameter at breast height of all Strzelecki Gum within the Project area 2. Road design amendments to minimise the construction footprint 	<ol style="list-style-type: none"> 1. Accurate knowledge of the location (survey quality) of all Strzelecki Gums and number required for removal 2. Lodgement of records with the VBA to increase understanding of extent of species 3. The removal of a maximum number of 181 Strzelecki Gums 	<i>EPBC Act Flora and Fauna Guarantee Act 1988 Planning and Environment Act 1987</i>	<ol style="list-style-type: none"> 1. South Gippsland Shire Planning Permit 2002/250/B conditions. 2. DELWP FFG protected flora permit conditions.
Indirect impacts to Strzelecki Gums and habitat	<ol style="list-style-type: none"> 1. Tree retention zones applied to all Strzelecki Gums adjacent to the works area to determine if >10% will be impacted by the proposed works 2. Establishment of No-Go zone fencing 3. Hydrology modelling to be completed and project design to avoid hydrology changes 4. Implement Water Sensitive Road Design principles to detailed design 	<ol style="list-style-type: none"> 1. Accurate knowledge of TRZ indirect impacts to Strzelecki Gum and the number assessed as “deemed lost” but retained in-situ 2. The removal of a maximum number of 181 Strzelecki Gums 3. Maintain natural hydrology and water quality 4. Hydraulic and hydrological flood modelling undertaken to ensure no increase upstream flooding during a 1 in 100-year rain event 	<i>Planning and Environment Act 1987 AS 4970-2009 (Tree Protection) Water Act 1989 State Environment Protection Policy (Waters of Victoria) (EPA, 2003)</i>	<ol style="list-style-type: none"> 1. South Gippsland Shire Planning Permit 2002/250/B conditions. 2. DELWP FFG protected flora permit conditions 3. Works on waterways permit - West Gippsland CMA.
Impact to Strzelecki Gum and habitat beyond approved number	<ol style="list-style-type: none"> 1. Development of a CEMP 2. Establishment of No-Go zones fencing 3. Training for all construction staff prior to commencement of works on the environmental issues and risks of the Project 4. Environmental protection awareness workshop for staff involved in the CEMP development, implementation or maintenance of control measures 	<ol style="list-style-type: none"> 1. Protection of retained native vegetation and Strzelecki Gum 2. Staff awareness of environmental constraints of the Project 	<i>Planning and Environment Act 1987 Flora and Fauna Guarantee Act 1988</i>	<ol style="list-style-type: none"> 1. Endorsement of CEMP by South Gippsland Shire Planning Permit 2002/250/B. 2. Contract Hold Point for CEMP approval. 3. Contract clause 1200.03 (CEMP) compliance assessment by site supervisor.
Construction				
Removal of Strzelecki Gum and habitat beyond approved construction area	<ol style="list-style-type: none"> 1. Implementation of CEMP and monitoring of compliance with contract conditions 2. Location of all associated construction infrastructure i.e. stockpiles, access roads, etc. will be contained within the identified works area 3. Marking of native vegetation to be removed 4. Erection of No-Go zone fencing and signage 5. Qualified arborist to assess TRZ impacted trees to provide guidance on undertaking works to prevent decline in the health of the tree where possible 	<ol style="list-style-type: none"> 1. Protection of retained native vegetation and Strzelecki Gum 2. Physical boundary clearly identified on-ground for construction limit of works 3. High probability that Strzelecki Gum identified as indirectly lost through >10% TRZ impacts will be retained in-situ and health decline prevented. 	<i>EPBC Act Flora and Fauna Guarantee Act 1988 Planning and Environment Act 1987 Wildlife Act 1975</i>	<ol style="list-style-type: none"> 1. Contract clause 1200.03 (CEMP) compliance assessment by site supervisor. 2. Contract clause 1200.12 (Flora and Fauna) compliance assessment by site supervisor. 3. Contract Hold Point for onsite inspection with DELWP to confirm and clearly identify trees and habitat to be removed and approve No-Go zone fencing. 4. Inspections daily where construction activities are occurring in vicinity of retained native

Impact	Mitigation Measure	Outcome	Statutory / Policy Basis	Monitoring / Compliance
				vegetation, or at least every 7 days at other times.
Risk of spread of weeds/pathogens	<ol style="list-style-type: none"> 1. Undertake targeted weed spraying / removal of identified high threat weeds throughout the construction area, including retained native vegetation. 2. Imported top soil to meet AS 44195.4 - no noxious weeds, noxious seed or <i>Phytophthora cinnamomi</i>. 3. Vehicle and plant wash down areas to be identified for cleaning and removal of soil and organic matter before and after leaving site. 4. Vehicles and plant entering or leaving site are to be free of soil and organic matter. 5. Works area to be reinstated/revegetated as soon as practicable upon completion of works. 	<ol style="list-style-type: none"> 1. Improvement in condition of retained Strzelecki Gum habitat. 2. Removal of high threat weeds within the Project area. 3. Prevention of spread of new or existing weeds due to construction activities. 	<i>Catchment & Land Protection Act 1994</i> <i>Road Management Act 2004</i> Strzelecki Gum Recovery Plan (Carter, 2006) AS 4419 5.4 (Soils)	<ol style="list-style-type: none"> 1. Contract clause 1200.14 (Weeds, Pests & Disease) compliance assessment by site supervisor. 2. Use of vehicle hygiene log book. 3. Pest and weed management procedures to be implemented, considering pest animals, plants, fungi and other pathogens.
Risk of increased nutrient runoff	<ol style="list-style-type: none"> 1. Implementation of Water Sensitive Road Design principles. 2. Maintain existing highway drainage during and post construction. 3. Inclusion of grassed or vegetated swale drains along new road formation. 4. Construction of retarding basins to collect surface water during construction. 	<ol style="list-style-type: none"> 1. Prevention of increased nutrients having a detrimental impact on retained native vegetation and Strzelecki Gums. 2. Collection of nutrients away from significant environmental areas. 3. Water treatment design objectives of 45% retention of the typical annual urban load of total phosphorus and nitrogen. 	State Environment Protection Policy (Waters of Victoria) (EPA, 2003) VicRoads - Integrated Water Management Guidelines Australian Runoff Quality Guidelines	<ol style="list-style-type: none"> 1. Contract clause 1200.04 (Water) compliance assessment by site supervisor. 2. Monitoring and reporting of water quality in the Tarwin River West Branch both upstream and downstream. 3. Monitoring of rainfall using a portable weather station on site.
Increased risk of fire	<ol style="list-style-type: none"> 1. All staff made aware of high fire danger days and works that are prohibited during these times not undertaken. 2. Fire suppression equipment to be available and staff trained in its use. 3. New road shoulders to be sprayed with bituminous seal and have 3 metre clearance to vegetated / grassed areas. 	<ol style="list-style-type: none"> 1. Reduction in potential for construction operations to cause a fire. 2. Reduced risk of fire from vehicle crashes. 	<i>CFA Act 1958</i> CFA regulations (2004)	<ol style="list-style-type: none"> 1. Surveillance and monitoring by VicRoads. 2. Permit under section 40 to use fire on a day of Total Fire ban.
Risk of altered hydrology	<ol style="list-style-type: none"> 1. Contract clause specifying that works are to be constructed so as not to adversely affect any property by reducing drainage outfall or increasing risk of flooding. 2. The Contractor shall maintain existing flow patterns and not re-direct, concentrate or divert drainage flows except with written consent from the responsible drainage authority and other affected parties. 	<ol style="list-style-type: none"> 1. No alteration to existing drainage or flooding conditions. 2. No indirect impact to retained Strzelecki Gums or habitat. 	<i>Water Act 1989</i> State Environment Protection Policy (Waters of Victoria) (EPA, 2003)	<ol style="list-style-type: none"> 1. Contract Clause 3030.07(h) Construction Requirements compliance assessment by Site Supervisor and VicRoads Surveillance. 2. Works on Waterways permit required from the West Gippsland Catchment Management Authority. 3. Inspections daily where construction activities are occurring in vicinity of retained native vegetation, or at least every 7 days at other times.

Impact	Mitigation Measure	Outcome	Statutory / Policy Basis	Monitoring / Compliance
Direct or indirect loss or disturbance to Strzelecki Gum habitat due to soil erosion / movement or other edge effects	<ol style="list-style-type: none"> 1.Minimising the amount or area of exposed or erodible surfaces during construction. 2.Reinstate/revegetate of the works area as works proceed as per the landscape plan. 3.Prompt covering of exposed surfaces to stop sedimentation/runoff. 4.Installation of sediment and erosion controls in line with EPA best practice. 5.Inclusion of retaining walls / batters as barriers to retained vegetation. 6.Erection of No-Go zone fencing and signage, with a 1 metre buffer from retained native vegetation. 	<ol style="list-style-type: none"> 1. Prevention of soil movement into areas of retained vegetation. 2. Prevention of erosion during and post construction. 3. Physical boundary clearly identified on-ground for construction works. 	State Environment Protection Policy (Waters of Victoria) (EPA, 2003)	<ol style="list-style-type: none"> 1. Regular contractor inspection and assessment of effectiveness of controls. 2. Contract Hold point for sedimentation design plan approval. 3. Contract clause 1200.08 (Erosion and Sediment Controls) compliance assessment by site supervisor. 4. Monitoring and reporting of water quality in the Tarwin River West Branch both upstream and downstream. 5. Monitoring of rainfall using a portable weather station on site.
Post Construction				
Degradation of retained Strzelecki Gum habitat through indirect impacts associated with rehabilitation of the site	<ol style="list-style-type: none"> 1.Any imported top soil, re-use of stockpiled top soil in landscaping works. 2.Implementation of VicRoads developed landscape plan including planting, direct seeding and weed control activities. 3.Identification of defects. 	<ol style="list-style-type: none"> 1. No new weeds or pathogens introduced to Project area. 2. Re instatement of vegetation cover across the Project area. 3. Improvement in the quality of retained native vegetation. 	<i>Planning & Environment Act 1987</i> Strzelecki Gum Recovery Plan (Carter, 2006)	<ol style="list-style-type: none"> 1. Joint inspection 3 months post construction. 2. Contractor to replace missing, dead or dying plants and manage any new weed incursions.



Figure 15a - Location of Strzelecki Gums and No Go Zones (Northern extent)

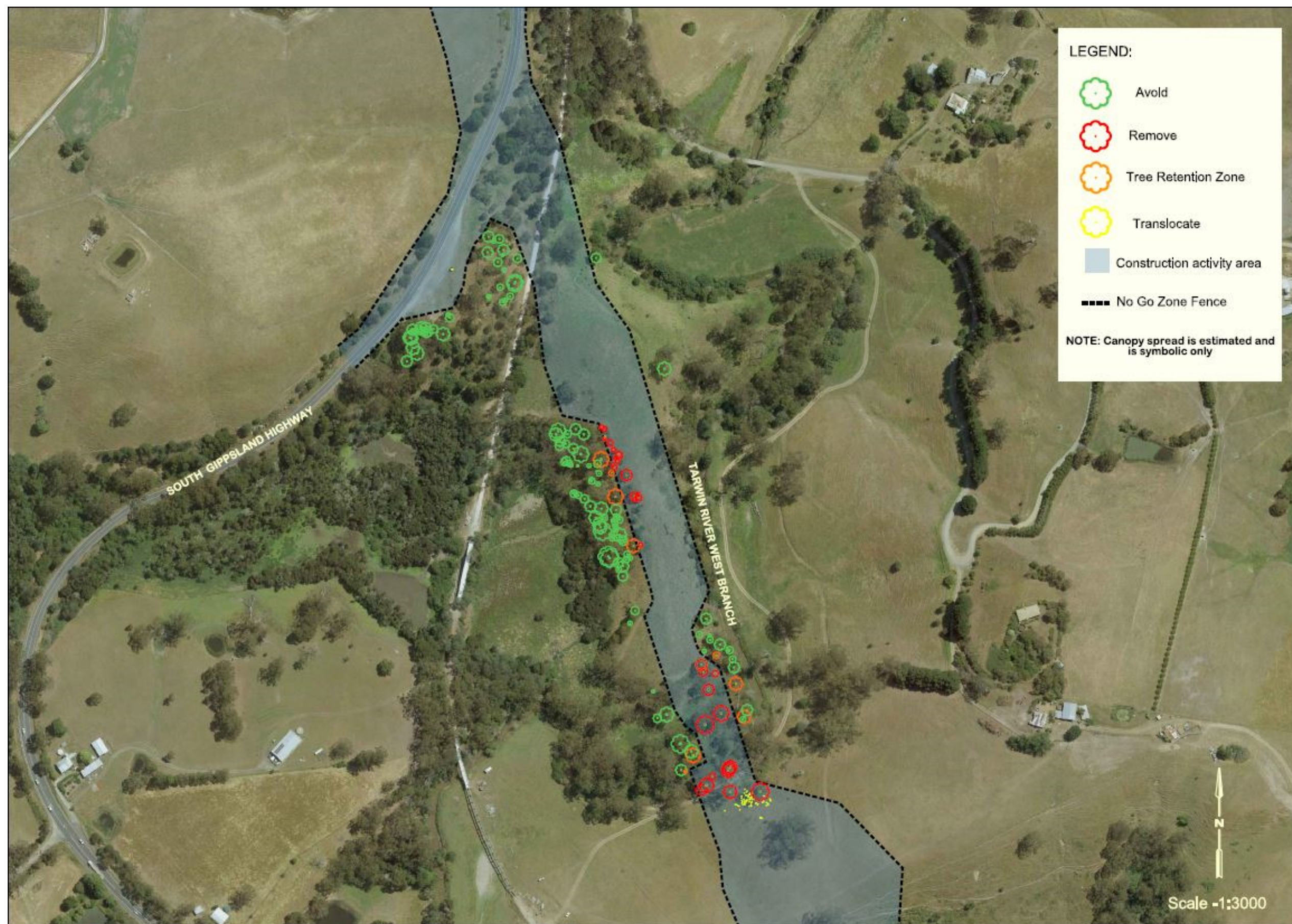


Figure 15b - Location of Strzelecki Gums and No Go Zones (Central extent)



Figure 15c - Location of Strzelecki Gums and No Go Zones (Southern extent)

5.2 Australian Grayling

5.2.1 Avoidance Measures

The Project requires construction of two permanent bridge structures over the Tarwin River West Branch, each approximately 130 metres in length and 15 metres in height. The bridge piers are to be constructed on the Tarwin River West Branch floodplain and not directly within the river, which avoids introducing any barrier to Australian Grayling migration.

Hydraulic modelling undertaken as part of pre-construction works has demonstrated that both bridges will not increase upstream flooding during a 1 in 100-year rain event and will therefore not alter normal river flows. Modelling also determined that flow velocities were generally less than 1.5 metres per second near the bridge piers and therefore it would be unlikely that either bridge would contribute to erosion of the river banks and increase sedimentation within the river.

5.2.2 Mitigation Measures

No direct in-stream impacts are anticipated to Australian Grayling and / or their habitat and potential impacts are therefore indirect in nature. Several specific mitigation measures have been developed in Jenkin 2018 to reduce these possible indirect impacts relating to sediments / erosion, unmanaged impacts to the river channel and the sites reinstatement. These measures align with the SPRAT profile (DoEE, 2018) and will be incorporated into the CEMP. Further detail is provided below for these identified indirect impacts.

Works within the Tarwin River West Branch Floodplain

At least one temporary bridge structure over the Tarwin River West Branch and associated haul roads are likely to be constructed to facilitate access for permanent bridge works and to access the major road cutting between the two permanent bridges. This will be retained in position until works are completed.

Works occurring on the Tarwin River West Branch floodplain will include No Go Zone fencing of the Project area to protect aquatic and river habitat (*Figure 15*). Exclusion zones will be established at five metres from the top of the river bank for all non-structure specific works, for example, material stockpiles, access tracks or plant and machinery parking, to prevent damage to river side vegetation and habitat.

For structure works required at the top of the bank (i.e. installation of bridge piers), exclusion zone fencing will be established to retain the largest buffer practical, but no closer to the river than the top of the river bank.

The exclusion zone fencing will be constructed of star pickets at six metre spacing with a single row of flagging on wire support. The exclusion zone fence will be erected prior to the commencement of any works on the flood plain and be retained in place for the duration of construction activities and then removed.

To further mitigate any impact to the river banks, water quality, Australian Grayling and their habitat, any ground disturbing works on the floodplain (such as earthworks, construction of haul roads and hard stand areas and installation of the temporary bridge structure) will occur during the typically drier time of the year (i.e. December to March).

All disturbed areas within the floodplain will be graded, topsoiled and revegetated to mitigate the risk of erosion and sedimentation at the completion of works. A specific CEMP will be developed for this aspect of the works and will be endorsed by an independent environmental auditor and reviewed by VicRoads (refer *Section 2.2.2*).

Works impacting on waterways will also require a Works on a Waterway Permit, issued by the West Gippsland Catchment Management Authority (WGCMA).

Sedimentation/Erosion

The following mitigation measures will be implemented for the Project to prevent erosion and sedimentation impacts:

- Water quality testing will be undertaken at monitoring sites within the Tarwin River West Branch pre-construction, during construction activities and following completion of the Project. This testing will determine if any deviation to the water quality can be determined when comparing to the baseline data collected pre-construction. Testing will be in accordance with the approved CEMP and Jenkin (2018) and include the following:
 - (i) Locations
 - in waterways upstream and downstream of the limits of the Site; and
 - at appropriate locations in waterways within the Site including immediately upstream and downstream of each point source (or flow) entering along the length of waterways within the Site.
 - (ii) Timing
 - immediately prior to works commencing;
 - weekly;
 - for each rain events as follows:
 - within one hour of commencement of the rain event during working hours,
 - every 4 hours for periods of continuous rain during working hours, and
 - within 12 hours of a rain event, outside working hours.
- The Staging of construction will be undertaken so that any ground disturbance works in the floodplain or near the river are undertaken and completed outside of the key breeding / spawning and migration periods for Australian Grayling and during the historically lower rainfall time of the year.
- Aquatic and river habitat should be protected (i.e. 5m buffer from river channel) through minimising the construction footprint and installing No-Go zone and exclusion fencing. The exception to this will be for structure-related works near the top of the river bank and the installation / removal of the temporary access bridge, where exclusion fencing may encroach on the river bank and additional erosion and sedimentation controls, such as placement of geotextile fabric, bunding and rock beaching must be installed and a specific CEMP developed for this aspect of the works.
- Measures will be implemented to contain and filter any onsite surface water before release to the river, along with treatment of pre-filter stormwater runoff and / or spills to prevent the risk of contributing pollutants to the river.
- Identification of emergency measures to protect earthworks and works areas from inundation and / or protocols of site closure for predicted higher rainfall and river flow events.

- All soil, spoil, top dressing, fuel / oil and machinery will be stored above the 1 in 100 -year flood level (i.e. outside of the floodplain) and in a suitably bunded and protected location.
- The contractor's CEMP will include provision for emergency response/s in the event of an incident that impacts water quality or aquatic habitat (e.g. a spill of sediment release).

Unmanaged Impacts to the River Channel

If not appropriately protected / fenced, works have the potential to result in unmanaged disturbance to the river bank. To mitigate this risk, no vegetation removal is to occur within the main river channel and earthworks should not occur within five metres of the channel to allow a buffer and space for the installation of No-Go zones and exclusion fencing.

The exception to the five metre exclusion zone will be for structure-related works that will occur near the top of the river bank (i.e. piers) and the installation of the temporary access bridge. These will require minor works within the five metre exclusion zone and/or on the river bank. The continued use of No-Go Zone fencing and erosion / sedimentation controls and undertaking these works during the drier time of the year will mitigate the impact to Australian Grayling and their habitat.

Project Area Reinstatement

The Project area will be reinstated with vegetation immediately after completion of temporary or permanent works to ensure water quality and erosion and sedimentation risks are adequately controlled and for the temporary structure, erosion and sediment controls to be in place to minimise the amount of erodible surfaces during construction. As outlined in the proposed Landscape Plan, revegetation will assist in improving the condition of the newly constructed road reserve and increase vegetation cover in the immediate vicinity of the river crossings. This is also likely to provide a decrease in sedimentation and nutrient loads within the river as the plantings develop.

Monitoring of any floodplain rehabilitation works will be undertaken for a minimum of two years post completion of construction, including Project area reinstatement to ensure floodplain and works area(s) revegetation is successful and erosion is not occurring. Monitoring will include assessment of revegetation and weeds, erosion and river bank stability.

5.2.3 Mitigation Summary

A summary of mitigation measures for Australian Grayling are outlined below (*Table 7*).

Table 7 - Summary of Australian Grayling mitigation measures proposed

Impact	Mitigation Measure	Outcome	Statutory / Policy Basis	Monitoring / Compliance
Pre-Construction				
Impacts to Australian Grayling or habitat	<ol style="list-style-type: none"> 1. No works to occur within the river channel. 2. Design the Project and associated works area to have the smallest footprint possible. 3. Hydrology modelling to be completed and Project design to avoid hydrology changes. 4. Implement Water Sensitive Road Design principles to detailed design. 5. Bridge design to include systems to prevent direct discharge or treat/pre-filter stormwater run-off. 6. Collect weekly baseline water quality data for 1 month prior to work commencement. 7. Develop CEMP for the Project. 	<ol style="list-style-type: none"> 1. No indirect impacts to Australian Grayling or their habitat. 2. Project designed to avoid impacts to river, river channel and channel vegetation. 3. Maintain natural hydrology and water quality. 4. Hydraulic and hydrological flood modelling undertaken to ensure no increase upstream flooding during a 1 in 100-year rain event 	<p>EPBC Act <i>Planning and Environment Act 1987</i> <i>Water Act 1989</i></p> <p>State Environment Protection Policy (Waters of Victoria) (EPA, 2003)</p>	<ol style="list-style-type: none"> 1. Baseline water quality monitoring pre-construction as per Jenkin 2018. 2. Works on waterways permit - West Gippsland CMA. 3. VicRoads approval to drainage design.
Construction				
Indirect impacts to Australian Grayling or habitat through disturbance to river bank vegetation	<ol style="list-style-type: none"> 1. Implementation of CEMP and monitoring of compliance with contract conditions. 2. Contractor induction to include awareness training of environmental / Australian Grayling issues. 3. Erection of No-Go Zone and exclusion fencing and signage to prevent disturbance to river bank. 4. Any earthworks within five metres of the river channel requires a task specific CEMP that includes establishment of additional No-Go zones and exclusion fencing. 	<ol style="list-style-type: none"> 1. Protection of retained native vegetation on river bank 2. Physical boundary clearly identified on-ground for construction limit of works. 3. Contractor/site personnel awareness of environmental constraints of the Project. 	<p>EPBC Act 2000 <i>Planning & Environment Act 1987</i></p>	<ol style="list-style-type: none"> 1. Contract clause 1200.03 (CEMP) compliance assessment by site supervisor. 2. Contract clause 1200.12 (Flora & Fauna) compliance assessment by site supervisor. 3. Contract Hold Point for onsite inspection with DELWP to approve No-Go zone fencing. 4. Inspections daily where construction activities are occurring in vicinity of retained native vegetation, or at least every 7 days at other times.
Impact breeding / spawning of Australian Grayling	<ol style="list-style-type: none"> 1. Stage construction so that any ground disturbance works in the floodplain are undertaken and completed outside of the key breeding/spawning and migration periods. 	<ol style="list-style-type: none"> 1. No indirect impact(s) on the breeding/spawning activities of the species 	<p>Australian Grayling Recovery Plan (Backhouse, <i>et al.</i>, 2008)</p>	<ol style="list-style-type: none"> 1. Review of Contractor's Construction Program and monthly review of progress. 2. VicRoads surveillance.
Contamination or reduced water quality	<ol style="list-style-type: none"> 1. Implementation of Water Sensitive Road Design principles. 2. Maintain existing highway drainage during and post construction. 3. Contain and filter any onsite surface water before release to the river, along with treatment of pre-filter stormwater runoff and/or spills to prevent the risk of contributing pollutants to the river. 4. All soil, spoil, top dressing, fuel/oil and machinery are to be stored above the 1:100-year flood level (i.e. outside of 	<ol style="list-style-type: none"> 1. Prevention of contamination or reduction in water quality leading to a detrimental impact on Australian Grayling. 	<p>State Environment Protection Policy (Waters of Victoria) (EPA, 2003)</p> <p>VicRoads - Integrated Water Management Guidelines</p> <p>Australian Runoff Quality Guidelines</p>	<ol style="list-style-type: none"> 1. Contract clause 1200.04 (Water) compliance assessment by site supervisor. 2. Monitoring and reporting of water quality in the Tarwin River West Branch both upstream and downstream as detailed in the CEMP. 3. Monitoring of rainfall using portable weather station on site as detailed in the CEMP.

Impact	Mitigation Measure	Outcome	Statutory / Policy Basis	Monitoring / Compliance
	the floodplain) and in a suitably bunded and protected location. 5. CEMP to include provision for emergency response/s in the event of an incident that impacts water quality or aquatic habitat.			
Alteration to hydrology	1. Contract clause specifying that works are to be constructed so as not to adversely affect any property by reducing drainage outfall or increasing risk of flooding. 2. The Contractor shall maintain existing flow patterns and not re-direct, concentrate or divert drainage flows except with written consent from the responsible drainage authority and other affected parties.	1. No alteration to existing drainage or flooding conditions.	<i>Water Act 1989</i> State Environment Protection Policy (Waters of Victoria) (EPA, 2003)	1. Contract Clause 3030.07(h) Construction Requirements compliance assessment by Site Supervisor and VicRoads Surveillance. 2. Works on Waterways permit required from the West Gippsland Catchment Management Authority.
Sedimentation of the river	1.Minimising the amount or area of exposed or erodible surfaces during construction. 2.Reinstate/revegetate the works area as works proceed as per the landscape plan. 3.Prompt covering of exposed surfaces to stop sedimentation/runoff. 4.Installation of sediment and erosion controls in line with EPA best practice for permanent and temporary structures. 5.Identification of emergency measures to protect earthworks and works areas from inundation and/or protocols of site closure for predicted higher rainfall and river flow events. 6.CEMP to include provision for emergency response/s in the event of an incident that impacts water quality or aquatic habitat 7.Erection of No-Go zone and exclusion fencing	1. Prevention of soil movement into riparian and aquatic environment or retained vegetation. 2. Prevention of sediment laden water entering the river and reducing water quality. 3. Prevention of erosion during and post construction. 4. Physical boundary clearly identified on-ground for construction works.	State Environment Protection Policy (Waters of Victoria) (EPA, 2003)	1. Regular contractor inspection and assessment of effectiveness of controls. 2. Contract Hold point for sedimentation design plan approval. 3. Contract clause 1200.08 (Erosion and Sediment Controls) compliance assessment by site supervisor. 4. Monitoring and reporting of water quality in the Tarwin River West Branch both upstream and downstream as detailed in the CEMP. 5. Monitoring of rainfall using a portable weather station on site as detailed in the CEMP.
Post Construction				
Degradation of Australian Grayling habitat through indirect impacts associated with rehabilitation of the Project area	1. Any imported top soil, re-use of stockpiled top soil in landscaping works 2.Implementation of VicRoads developed landscape plan including planting, direct seeding and weed control activities 3.Identification of defects	1. No new weeds or pathogens introduced to Project area. 2. Re instatement of vegetation cover across the work site	<i>Planning and Environment Act 1987</i>	1. Joint inspection 3 months post construction. 2. Contractor to replace missing, dead or dying plants and manage any new weed incursions.

5.3 Management, research and monitoring programs to support adaptive management

Tables 6 & 7 outline the on-going management of environmental aspects of the Project and monitoring required as part of mitigation strategies. This will be included as part of the approved CEMP and can be summarised as follows:

- Site environmental co-ordinator who will be on site each day;
- Monitoring of site controls such as stockpiling, bunding, sedimentation controls, No-Go zone and exclusion fencing;
- Water quality monitoring; and
- Weather monitoring.

Should monitoring identify an issue with a mitigation strategy of the Project, the following steps are to be undertaken to determine what mitigation and management actions are required to be implemented:

- Identify the cause of the incident;
- Report to the relevant authority;
- Commence an appropriate monitoring regime to measure the extent and severity of impact; and
- Determine remediation / action measures (If any) with relevant stakeholders / authority.

The last rapid survey for Strzelecki Gum (Baw Baw Shire Council, 2008) was completed soon after the drafting of the National Recovery Plan (Carter, 2006) and FFG Action Statement (DSE, 2008) over ten years ago. As such there is little information regarding the current distribution or status of extant populations or management actions required at specific locations to ensure survival of this species.

VicRoads will develop and contribute to a population survey of Strzelecki Gum across its known range to acquire baseline population data, document known habitat and collect floristic and environmental information relevant to community ecology and condition. This work will determine the current ecological requirements and population status of the species and increase the number of database records. This Project is expected to commence in late 2018 and be completed by ecologists from the Arthur Rylah Institute (ARI).

It is expected that this research project and learnings from the implementation of mitigation activities for this proposal will assist in developing adaptive management strategies for future projects to minimise impacts to Strzelecki Gum.

5.4 Effectiveness and achievability of measures proposed

The extent of works and Project area have been considered and identified by VicRoads as part of pre-planning investigations, which considers the construction requirements to be able to construct the road, including access, stockpiles, machinery movement, parking, etc. The Project footprint will be part of the contract conditions and no works are to be undertaken outside of this area. All areas adjacent to retained native vegetation or the Tarwin River West Branch will be fenced to identify No-Go zones.

The use of standard contract conditions including the CEMP process as part of contract conditions has been used on numerous large-scale projects by VicRoads. Contract clauses ensure compliance and VicRoads will undertake monitoring and auditing of the works undertaken by the contractor so that mitigation measures proposed will be effective and achievable.

6 Residual Impacts and Proposed Offsets

With the successful implementation of the avoidance and mitigation measures proposed for the project, 181 Strzelecki Gum (164 directly impacted and 17 indirectly) are still proposed to be impacted by the project.

Avoidance and mitigation measures undertaken for Australian Grayling will remove any residual significant impact to the species, and therefore no offsets are required or proposed for this species.

6.1 Strzelecki Gum

Several offset sites have been investigated to determine the most suitable for the residual impacts to Strzelecki Gum. These include two freehold properties on the northern edge of the Strzelecki Ranges and the Latrobe Valley and one site located on Crown Land immediately adjacent to the Project area. Information regarding the presence of Strzelecki Gums, habitat, vegetation quality and threats have been obtained for each site and used as a basis for offset calculations and to determine the optimal environmental outcome for the species.

Based on environmental benefit, locality to the Project area and size and scale, a site at Black Spur Creek wetlands which includes river frontage to the Tarwin River West Branch has been selected to compensate for the residual impacts to Strzelecki Gum from this Project. The objective for the offset will be to increase the number and size of habitat for Strzelecki Gum within the local area.

6.1.1 Description of site

The offset site is located immediately adjacent to the Project area and is approximately 8.68 hectares in size. It includes a patch of remnant native vegetation within and adjacent to the Rail Trail, along with the Black Spur Creek wetlands and the banks of the Tarwin River West Branch. A degraded area of 1.2 hectares is included and proposed for use in Strzelecki Gum revegetation.

Strzelecki Gum is dominant on the slopes surrounding the wetlands and along the margins of the Tarwin River West Branch. Numbers have been accurately surveyed within the offset site, with 232 recorded. These range in size from very small recruits through to very large mature trees.

Native vegetation on the floodplain within the northern segment of the site have a largely intact canopy and shrub layer and a mixed ground layer. Native sedges and grasses are prevalent but are intermixed with high threat weeds including *Ranunculus repens* (Creeping Buttercup), *Rubus fruticosus* spp. agg. (Blackberry) and *Cirsium vulgare* (Spear Thistle). *Tradescantia fluminensis* (Wandering Trad) occurs on the floodplain adjacent to the wetlands in the south eastern corner of the site.

The slopes to the adjacent north and east of the wetlands hold an intact native over storey with a range of Strzelecki Gum trees present across a range of size classes. This area has been excluded from

grazing with reasonable recruitment of the species evident as a result. The understorey is mixed with clusters of native grasses and sedges interspersed with exotic grasses such as *Agrostis capillaris* (Browntop-bent), *Holcus lanatus* (Yorkshire Fog) and the high threat weeds *Myosotis arvensis* (Forget-me-not) and *Jacobaea vulgaris* (Ragwort).

River frontage areas have a mixed understorey with sections of intact riparian vegetation in the central east and south and more degraded sections in the north and south west. Beneath the canopy the more intact sections host scatterings of native shrubs including *Acacia melanoxylon* (Blackwood), *Melaleuca ericifolia* (Swamp Paperbark) and Strzelecki Gum saplings above a grassy / sedgy native ground layer. The most common weed, albeit in low overall numbers, within these more intact sections is the shrubby weed *Solanum pseudocapsicum* (Madeira Winter-cherry). The more degraded sections hold infestations of *Salix* spp. (Willows) in the northern section, Blackberry in the southern section and Wandering Trad is dominant across the ground layer of the south-western section.

The degraded areas of the site, identified for revegetation, generally contain few woody species. The ground layer is dominated by exotic grasses, with the occasional scattering of native tussocks or sedges such as Sword Tussock-grass (*Poa ensiformis*). Kikuyu (*Cenchrus clandestinus*), Yorkshire Fog and Browntop-bent are common weed species within these degraded sections. Other high threat weeds present include Spear Thistle and Ragwort.

The site is Crown Land partially managed by a DELWP appointed volunteer committee of management, and the land is temporarily reserved under the *Crown Land (Reserves) Act 1978*, as Public Purposes Reserve (Rail Trail) and Public Purposes Reserve (River frontage).

The EPBC Environmental Offsets Policy (DSEWPC, 2012) identifies the offset mechanism principles for offsets on public land. These are:

- Should be legally secured for conservation purposes for at least the duration of the impact;
- Should be statutorily defined and resourced;
- Any change in management status should require Ministerial or statutory approval.

A licence agreement between VicRoads and the Great Southern Rail Trail Committee of Management under Section 17B of the *Crown Land (Reserves) Act (1978)* will be used to allow for VicRoads to become the land manager of the selected offset site for a 10-year period. VicRoads will therefore be responsible for the management and implementation of the OMP. To permanently secure this area, a Crown Land Offset Memorandum of Understanding (MOU) will be signed by the Crown land manager and DELWP Secretary and included as an encumbrance on the Crown Land Register.

The use of a Section 17B licence to secure offsets on Crown Land has been used for the Energy Australia's Yallourn Coal Field Realignment (2008/4454) Project. The licence agreement secured offsets for losses associated with impacts on Strzelecki Gum on Crown Land river frontage (Public Purposes Reserve). This offset was approved by DoEE in 2015.

The offset site was visited on the 26th April and 26th July 2018 and *Figures 16 - 19* provide a pictorial summary of the site. The proposed boundaries and location of current Strzelecki Gums are shown in *Figure 20*. An offset management plan (OMP) for the site has been prepared and is provided in *Appendix 4*.



Figure 16 - Remnant large old Strzelecki Gums within the proposed offset site



Figure 17 - Remnant patch of native vegetation containing Strzelecki Gums within the proposed offset site



Figure 18 - Available areas for revegetation activities within the offset site.



Figure 19 - Blackberry infestation within riparian habitat of the offset site.

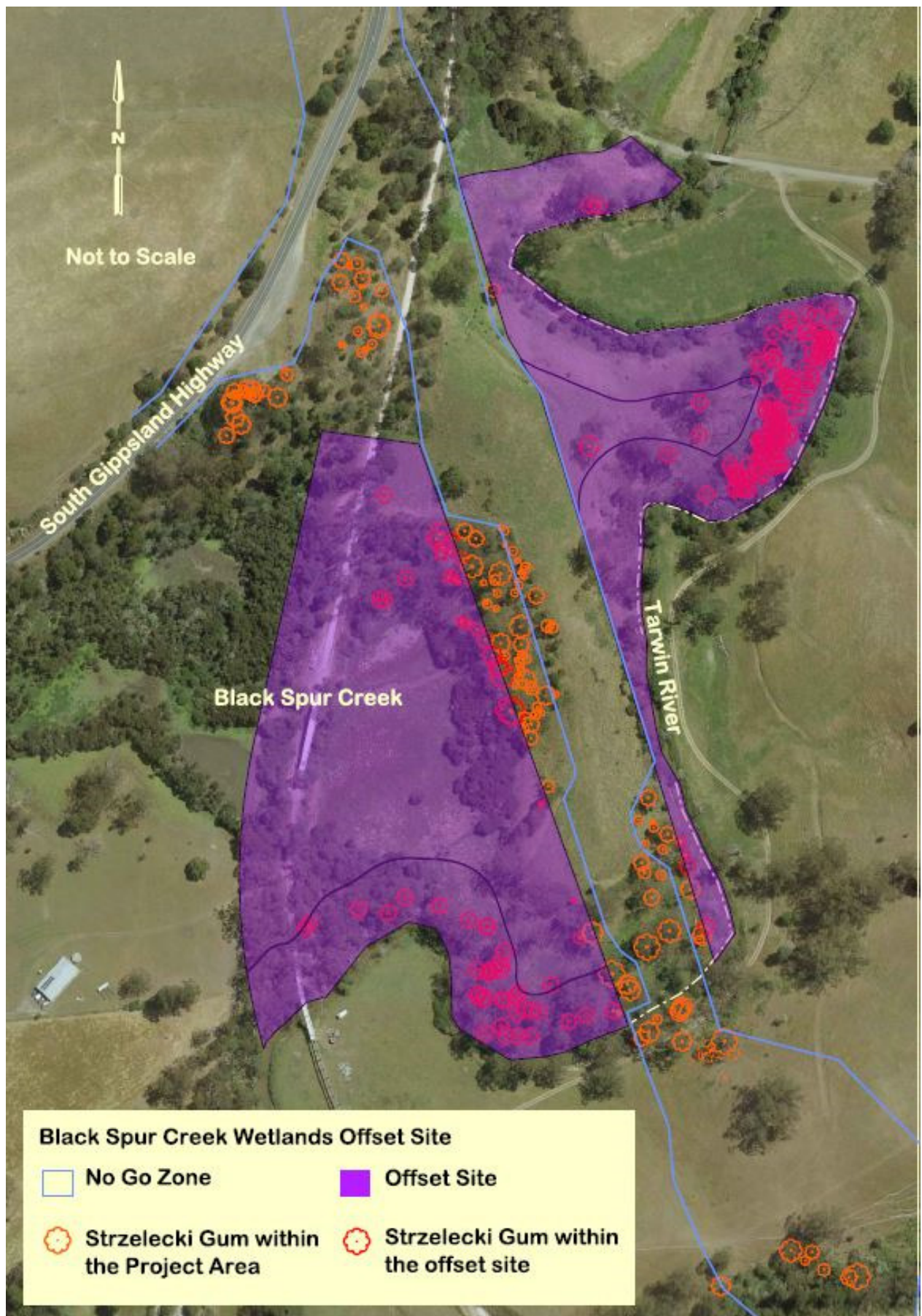


Figure 20 - Proposed Black Spur Creek wetlands offset site

6.2 Assessment of offset suitability

The DoEE Offset Policy (DSEWPC, 2012) provides principles for suitable offsets to compensate for residual impacts. An assessment of the Black Spur Creek wetlands site against these principles is provided below.

1. *Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action.*

The Project will result in the loss of 181 Strzelecki Gums. The proposed offset is located at Black Spur Creek wetlands, which is immediately adjacent to the Project area and contains 232 Strzelecki Gums that are contiguous with the local population.

The existing quality of the offset site is comparable and, in some instances, may be of better quality than that proposed to be removed by the Project. The site will be actively managed over a 10 year period to increase the area of available habitat and the number of Strzelecki gums it contains.

Environmental / conservation outcomes with locating the offset at Black Spur Creek include:

- Site is immediately adjacent to Strzelecki Gums proposed to be removed by the Project;
- Continuation and consolidation of population and habitat within the Projects local area;
- Provision of resources for the management of Strzelecki Gum specific threats currently occurring on site;
- Additional support to a volunteer committee of management to manage rare or threatened species;
- Removal of high threat weeds such as Willow, Blackberry and Kikuyu which can impact on the recruitment of Strzelecki Gum and compete for resources;
- Supplementary planting to re-create habitat, compete with weed species and connect remnant habitat and trees and
- Increased community awareness and ownership of the conservation of the species.

2. *Be built around direct offsets but may include compensatory measures.*

Direct offsets are proposed to offset all of the impact on Strzelecki Gum. Based on the EPBC Offset Assessment Guide calculator, the site mitigates 124% of the impact, which exceeds the 90% direct offset requirement (*Appendix 3*).

3. *Be in proportion to the level of statutory protection that applies to the protected matter.*

The offset calculator has been used to determine the offset requirements to compensate for the proposed impacts to Strzelecki Gum (*Section 6.2.1*) which considers the conservation status of the species. The offset site will exceed the requirement for a direct offset (*Appendix 3*).

4. *Be of a size and scale proportionate to the residual impacts on the protected matter.*

The residual impacts to the protected matter is 181 trees. The offset calculator (*Appendix 3*) has been used to determine the offset requirements to compensate for the proposed impacts which will include the protection of 232 Strzelecki Gums and the revegetation of degraded areas of the site. This will increase the number and area of habitat available for Strzelecki Gums, through the

removal a number of high risk threats identified in the National Recovery Plan (Carter, 2006), such as grazing and weed cover, through the implementation of the OMP.

5. *Effectively account for and manage the risks of the offset not succeeding.*

The use of direct offsets presents lower risk to the species survival at a local level and result in a conservation gain that can be more easily measured and monitored. The development of the OMP will identify the required actions and timing for the implementation of the offsets at Black Spur Creek wetlands. This will include the identification and implementation of monitoring and additional compensatory measures if offset targets are not being achieved.

The offset management plan (*Appendix 4*) addresses the following:

- 10 years of implementation;
- Fencing requirements;
- Revegetation requirements;
- Pest animal monitoring and control;
- Pest plant monitoring and control; and
- Reporting and compliance.

The offset assessment guide calculator also takes this risk into account through the confidence in the result at 80% (see *Section 6.2.1* for further justification).

6. *Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs.*

The primary objective of the Crown Land reservation status of the offset site is for public use of the land for recreational purposes. The role of the Committee of Management which is appointed over part of the offset site is to manage, improve, maintain and control the Crown land reserve for the benefit of the people of Victoria (DELWP, 2016). The reservation status of both areas of the proposed offset site is not specifically for conservation purposes and does not include management for the conservation of rare or threatened species such as Strzelecki Gum.

Additionality for the management of the proposed offset site will be achieved through the following:

- Provide the resources (expertise, budgets and personnel) to manage the environmental values of the sites (being the presence of Strzelecki Gum);
- Manage the site for the specific threats identified to the recovery of Strzelecki Gum;
- Set management goals to achieve improvement in condition and recruitment;
- Include yearly monitoring to determine the on-going success or threats to the site;
- Undertake supplementary planting to increase the number of Strzelecki Gums and assist in Strzelecki Gum establishment and recruitment;
- Ensure fencing, signage or other on-site protection are installed; and
- Provide for protection for the duration of the impact (10 years).

7. *Be efficient, effective, timely, transparent, scientifically robust and reasonable.*

The management of the site will be in accordance with the developed OMP. The OMP will utilise Indigenous Designs' knowledge of the revegetation requirements for Strzelecki Gum, through over

15 years of revegetation activities using this species within the Morwell river floodplain. Sensitive weed control of high threat species will be undertaken to assist in the promotion of natural recruitment and reduce this threat to the existing population, a key threat identified in the National recovery Plan (Carter, 2006).

8. *Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.*

The Section 17B licence agreement with the Rail Trail Committee of Management and MOU between VicRoads and the DELWP Secretary will enforce the implementation of the OMP, along with permit conditions from South Gippsland Shire Council (*Planning and Environment Act 1987*) and conditions from the EPBC approval process.

The OMP has set objectives, targets, monitoring and reporting requirements for the site (*Appendix 4*). This will be reported as per any specific EPBC Act approval condition and as part of the MOU agreement.

6.2.1 Offset Calculator Justification

The offset calculator has been used to determine that the retention and management of 232 Strzelecki Gums within the site, along with revegetation of degraded areas will mitigate 124% of the impact of the removal of 181 Strzelecki Gums (*Appendix 3*).

Proposed Offset

The proposed offset site is 8.68 hectares, within the Black Spur Creek wetlands and adjacent to the Tarwin River West Branch, immediately adjacent to the Project area.

Time Horizon

The implementation of the offset plan and Section 17B Licence security arrangement will be in place for 10 years.

Start Value

All Strzelecki Gum within the offset site have been spatially located and had their DBH recorded to determine the current number and size of Strzelecki Gum within the offset site. This was either completed as part of the precisely recorded survey undertaken in June 2017 and during a site visit by Indigenous Design in July 2018.

The breakdown of the 232 trees recorded is as follows (based on EVC benchmarks):

- 20 very large old trees;
- 35 large old trees;
- 26 medium old trees;
- 100 small trees; and
- 51 very small trees.

This number does not include any dead trees or trees that are possibly a *Eucalypts viminalis* (Manna Gum) / Strzelecki Gum hybrid.

Future Value without offset

A reduction of 50% in the number of very small trees currently recorded at the site (26), due to high weed coverage and potential for grazing has been applied.

Future Value with offset

Weed control activities and prevention of grazing within the site are likely to result in an increase in natural recruitment surrounding mature Strzelecki Gums. Schinagl *et. al* (2013) provides figures for newly recruited Strzelecki Gums as constituting 11% of the population number (Schinagl, *et. al.*, 2013). An additional 26 recruits have been added to the current numbers recorded.

A proportion of the site is either devoid of native vegetation or contains large amounts of weed species (approximately 1.2 hectares), with the potential to undertake plantings of Strzelecki Gum to re-create habitat and an associated EVC. Schinagl *et. al* (2013) provides data for the average density of canopy height Strzelecki Gums within remnant vegetation, which was found to be approximately 90 trees per hectare for a Swampy Riparian Woodland EVC (Schinagl, *et. al.*, 2013). Canopy height Strzelecki Gums were also found to make up an average 46% of the total number of Strzelecki Gums within a population (Schinagl, *et. al.*, 2013). Based on these figures 196 Strzelecki Gums occur within a 1 hectare area of Swampy Riparian Woodland, or 235 trees can be accommodated within the 1.2 hectares available for revegetation activities.

Confidence in Result

Confidence in the result has been estimated as 80%, with a high degree of certainty that the offset measures can compensate for the residual impact of the action within the 10 year period, due to the following:

1. *Conservation outcomes are achievable for the site within the 10 year period.*

Indigenous Design has been involved in the collection of seed, propagation and revegetation of Strzelecki Gum over the past 15 years. This includes a number of projects along the Morwell River and associated wetlands and offset plantings for both Hazelwood Power and Energy Australia. Since 1999, Indigenous Design has planted in excess of 25,000 Strzelecki Gums in the Latrobe Valley area. Revegetation data collected from more recent revegetation projects has shown that the height of Strzelecki Gums averages 2.2 metres after 2 years post planting; 4.8 metres after 4 years and 9 metres (*Figure 21*) after 6 years (Indigenous Design, unpublished data, August 2018). Once a plant exceeds 5 metres in height, it becomes largely self sufficient and likely to be vulnerable only to unpredictable natural events.



Figure 21 - 6-year-old Strzelecki Gum

Revegetation efforts by the local Landcare Group of Strzelecki Gum immediately adjacent to the Black Spur Creek offset site in 1998 have also proven to be largely successful, further supporting the reduced risk in revegetation efforts as part of any proposed offsets (*Figure 22*).



Figure 22 - 1998 Landcare Strzelecki Gum plantings adjacent to the Project Area

The Black Spur area was, up until the cessation of the operating railway line, devoid of much of its native vegetation, primarily due to agricultural activities and the requirement to keep the railway line clear of vegetation. A comparison of historical imagery from 1975, 2001 and 2015 shows the changes in vegetation cover since the decommissioning of the rail line (*Figure 23*). Strzelecki Gum constitutes a large number of the regenerated vegetation within the northern and southern extent of the Project area, providing further support that the growing conditions of the site are excellent for this species.

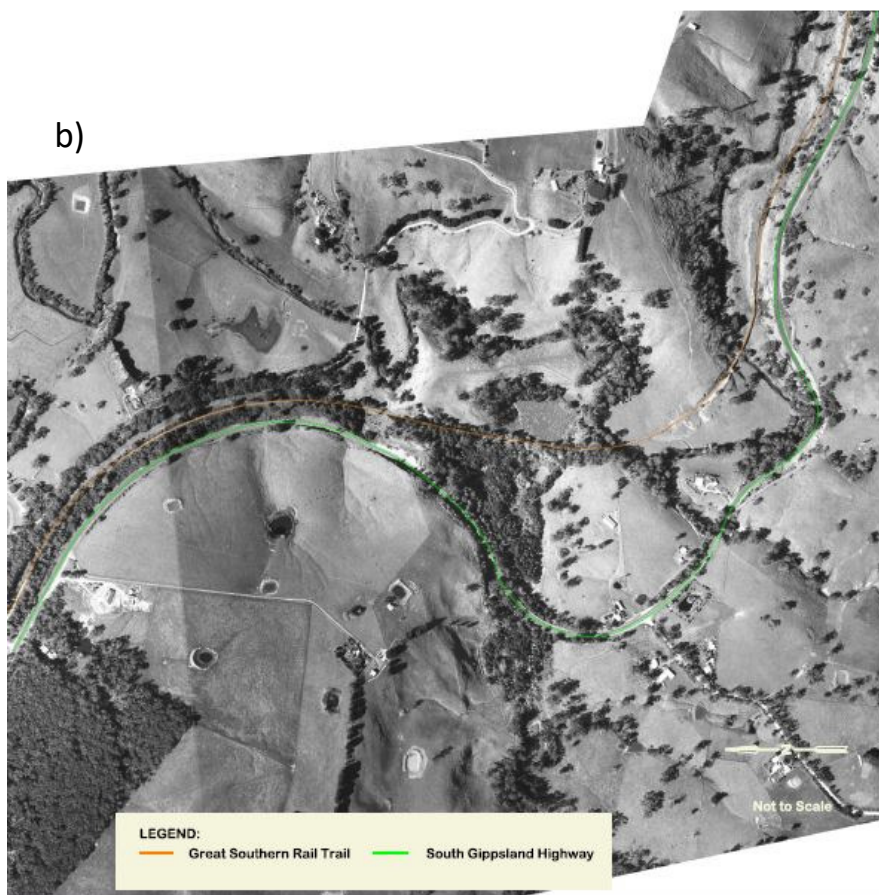
The OMP details targets for weed control coverage within the 10 year implementation period. These include:

1. Within revegetation areas:

- Herbaceous/ High Threat weeds will be controlled (no increase in baseline cover) in conjunction with revegetation plantings; and
- CALP weeds Ragwort, Spear Thistle & all Woody weeds can be eliminated (to less than 1%) comfortably by Year 5.

2. Within remnant patches:

- Herbaceous and High Threat grassy weeds will be 'controlled' (no increase in baseline cover);
- Wandering Trad can be eliminated to less than 1% by the end of Year 5;
- CALP weeds Ragwort, Spear Thistle & all Woody weeds can be eliminated (to less than 1%) by Year 5.



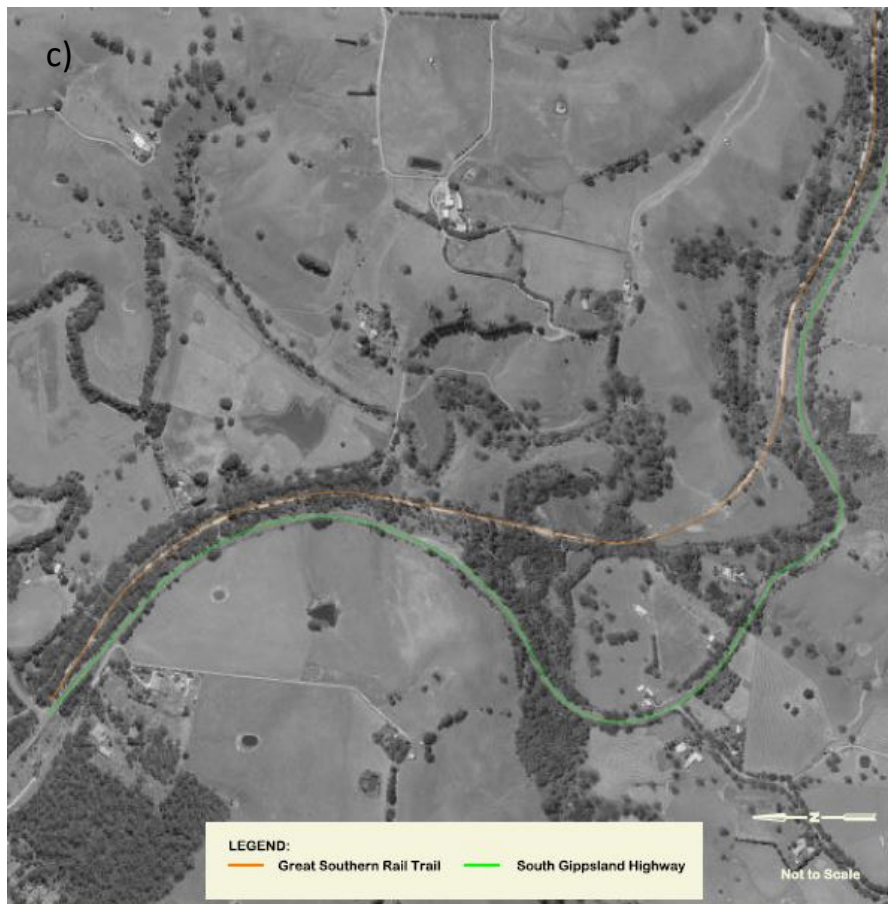


Figure 23 - Comparison of aerial photography showing increase in cover in native vegetation (a) 1975; (b). 2001; (c). 2015

3. *Unexpected or unpredictable impacts from herbivore grazing, fire, flood and frost.*

The success of revegetation plantings from previously mentioned projects has been impacted by natural events, which are difficult or unable to be controlled. Events such as fire, frost and flood are unable to be foreseen and therefore mitigated against entirely. However, strategies such as the use of core flute tree guards will provide some protection against frost damage and rabbit browsing and the use of wallaby guards will assist in prevention of browsing by both native (kangaroos and wallabies) and introduced (deer) herbivores. If deer or rabbit numbers are posing a threat to the site, a plan for their control will also be implemented.

The OMP will also include monitoring of revegetation success and replanting of any losses will be undertaken to meet identified targets.

4. *VicRoads track record in implementing their offset responsibilities.*

VicRoads currently manage a number of state and federal offset sites within Gippsland, such as the Princes Highway East, Traralgon East to Kilmany (2010/5640). VicRoads have the available staff and resources to allocate to these sites to ensure offsets are implemented and achieved.

5. *Management and Security*

The use of a 17B licence agreement for management responsibility and the MOU for security will ensure active management occurs over a 10 year period. The OMP details the targets the offset site will achieve within this 10 years of active management, including:

- Plant survival;
- Woody, herbaceous and grass weed control targets;
- Pest animal management;
- Exclusion of grazing; and
- Fencing requirements.

7 Other Approvals and Conditions

The Project shall be undertaken in accordance with environmental objectives and measures outlined in the relevant State and Federal legislation, including approvals, licences and permits and their associated conditions.

A description of the statutory approvals obtained, or which apply to the Project are provided in *Table 9*.

Monitoring, review and enforcement to ensure that approval conditions are being met will be the responsibility of VicRoads and the Construction Contractor and will be incorporated into the Contract specification for inclusion in the Contractor's Environmental Management Plan.

Table 9 – Statutory Approvals

Legislation	Permit/Approval Number	Issuing Authority	Conditions
<i>Planning and Environment Act, 1987</i>	Planning Scheme Amendment No C8 for public acquisition overlay	South Gippsland Shire Council	Nil.
<i>Planning and Environment Act, 1987</i>	Planning Permit 2002/250/B for roadworks and removal of native and non-native vegetation	South Gippsland Shire Council	Vegetation for removal to be marked and checked for fauna, preparation of revegetation plan/offset measures including legal security and 10-year management schedule, construction controls and submission of an environmental management plan.
<i>Planning and Environment Act, 1987</i>	Planning Permit 2002/250/B	South Gippsland Shire Council	1.267 General Biodiversity Equivalence Units required to offset removal of native vegetation.
<i>Flora and Fauna Guarantee Act, 1988</i>	Permit required to take or destroy seventeen species of identified native vegetation, including Strzelecki Gum.	DELWP	Expected to include rapid population survey of Strzelecki Gum and development and implementation of a conservation management plan for Crown land adjacent to the Project.

Legislation	Permit/Approval Number	Issuing Authority	Conditions
<i>Water Act, 1989</i>	Works on Waterways permit required	WGCMA	Expected to include preparation of a site management plan, revegetation, discharge and sedimentation controls.
<i>Aboriginal Heritage Act, 2006</i>	CHMP14990	Aboriginal Victoria	Historical research and modelling, salvage of up to 212m ² and installation of No-Go zones.
<i>Native Title Act, 1993</i>	Native Title extinguished on 6 July 2017	DELWP	Continue to consult with the native title applicant with regards to protection of cultural heritage.
<i>Heritage Act, 1995</i>	Application for consent to disturb (H8020/0024) and consent to damage a site	Heritage Victoria	Includes historical research and reporting and conservation of historical artefacts.
<i>Transport Integration Act, 2010</i>	Consent to use Crown land for transport purposes	DELWP	Nil.

Additionally, consideration for the projects construction is also required for the following legislation:

Catchment and Land Protection Act 1994

In accordance with Section 20 of the CaLP Act, landholders and managers have a responsibility to take all reasonable steps to:

- Avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner;
- Eradicate regionally prohibited weeds;
- Prevent the growth and spread of regionally controlled weeds on their land; and
- Prevent the spread of, and as far as possible, eradicate established pest animals.

Five weeds declared noxious under the *Catchment and Land Protection Act 1994* (CaLP Act) were identified within the Project area during assessments (*Table 3*). All five weeds are categorised within the West Gippsland Catchment Management Authority region as 'Regionally Controlled' (DELWP, 2017d).

Weed management will be undertaken for the duration of the project and as part of the CEMP (if these species are present) to control these species.

Wildlife Act 1987

The *Wildlife Act 1975* provides the primary legislation for the protection and management of wildlife, the purposes of this Act are:

- to establish procedures in order to promote the protection and conservation of wildlife, the prevention of taxa of wildlife from becoming extinct and the sustainable use of and access to wildlife; and
- to prohibit and regulate the conduct of persons engaged in activities concerning or related to wildlife.

Persons engaged to remove, salvage, hold or relocate any native fauna species during proposed construction works must obtain a permit under the Act to undertake such works and ensure these works are undertaken in accordance with the requirements of the Act.

Fauna translocation during vegetation removal (if required) is included as part of the CEMP and South Gippsland Shire planning permit..

8 Social and Economic

Realigning the South Gippsland Highway at the Koonwarra bends will provide important economic and social benefits to the Gippsland region and to Victoria by supporting Victorian, Gippsland and Local Government policies and programs to develop regional Victoria.

The following benefits are anticipated from improving the alignment of the South Gippsland Highway at Black Spur:

- Enhanced business activity resulting from:
 - reduced freight costs because of reduced labour, fuel, repairs and maintenance costs;
 - improved access to ports at Melbourne, Hastings and Barry's Beach;
 - improved connections between manufacturers in South Gippsland and Melbourne and primary producers throughout South Gippsland; and
 - improved connection between markets in Melbourne and suppliers throughout South Gippsland.
- Enhanced social environment in South Gippsland resulting from:
 - improved road safety;
 - greater reliability and reduced travel times for motorists using the South Gippsland Highway; and
 - greater connectivity between different parts of South Gippsland.
- A more viable tourism sector resulting from:
 - improved access to tourist destinations in South Gippsland;
 - provision of direct access between Melbourne and Wilson's Promontory, one of Victoria's premier tourist locations, as well as to many smaller South Gippsland coastal villages, Parks and attractions; and
 - increased tourism during non-season periods in a region that is subject to periodic population peaks in holiday times.

The Project will also play a key role in supporting two regional strategies for the development of Gippsland detailed below.

Gippsland Freight Infrastructure Master Plan 2014

The Plan aims to support the Gippsland Freight Strategy and manage the development of a long-term vision for improved regional access to markets. The plan refers to the South Gippsland Highway where it aims to provide:

- More efficient and safer access to domestic and international markets in Melbourne, the Ports of Melbourne and Hastings;
- More efficient access of inputs to industry in South Gippsland;
- More resilient strategic transport network providing an alternative to the Princes Highway.

The Gippsland Regional Strategic Plan, 2015-2020

The Gippsland Regional Plan (GRP) is a long-term strategic plan for improving economic, social and environmental outcomes for the Gippsland region and its community. It is a long-term strategic plan that aims to respond to the most significant challenges and opportunities that the Gippsland region is expected to face over the next 10 to 20 years. The development and implementation of the GRP brings together all levels of Government and business, as well as a wide range of agencies and community organisations.

The Plan directly refers to South Gippsland Highway upgrade projects that would benefit freight along the route including a high priority for the realignment of the road at Black Spur, Koonwarra.

8.1 Community Consultation

VicRoads undertook extensive community, public and stakeholder consultation during the early Project development stages and during the Planning Scheme Amendment process in the early 2000's. Consultation took the form of:

- Print media (information updates, newspapers);
- Public displays;
- Community meetings;
- Phone calls;
- Formal letters; and
- Face to face communication.

Community engagement recommenced in September 2015 with a drop-in session arranged to inform and update the community on the progress of the Project and included consultation with key stakeholders and affected landowners. Consultation included stakeholder meetings, letters, public information sessions, information bulletins, newspaper articles and electronic updates via VicRoads website.

Stakeholders include:

- South Gippsland Shire Council,
- Department of Environment, Land, Water and Planning,
- West Gippsland Catchment Management Authority,
- Museum Victoria,
- Geological Survey of Victoria,
- Geological Society of Australia,

- Bunurong Land Council
- Gunaikurnai Land and Waters Aboriginal Corporation
- Boonwurrung Foundation
- Aboriginal Victoria
- Affected landholders,
- Local community,
- Road users including freight companies,
- The Great Southern Rail Trail Committee of Management and;
- The Nerrena Landcare Group.

Overall, the Project is well supported by the local and broader community and stakeholders and will deliver significant safety improvements for all road users by reducing the current occurrence of road crashes, providing a more comfortable and efficient road environment and improving travel reliability with a 100km/h road standard.

Additionally, the realignment will have little impact in terms of dislocation, severance, accessibility or reduction in local amenity, which is important for the protection of the South Gippsland natural environment and tourist attractions.

8.2 Project Benefits

The benefits arising from the realignment of the South Gippsland Highway at Black Spur are increased economic activity and tourism and improved safety.

The South Gippsland Region is well placed to benefit from a more efficient transport system with a strong economic base including:

- Production of \$3,933.46 million per year
- Employment of 10,817 people,
- Ranking 6th against 27 other Victorian regional and rural areas in exports and in the proportion of its output that is exported.

This is a sound base from which to grow in response to the opportunities presented by the China Free Trade and Trans Pacific Partnership Agreements. Realising these opportunities however, requires efficient infrastructure. Presently, the road infrastructure does not provide that level of efficiency because of the Koonwarra Bends.

A Benefit Cost Ratio (BCR) of 1.2 has been calculated for this Project and the financial outcomes are summarised in *Table 10*.

Table 10 - Summary of benefits generated by the Project

Benefit Type	Realignment of the South Gippsland Highway
Vehicle operating costs	Costs reduced by \$19.43 million
Travel time costs	Costs reduced by \$31.60 million
Crashes	Costs reduced by \$3.44 million

Vehicle emission costs	Costs reduced by \$0.56 million
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The overall benefit of the Project is a reduction in operating, travel time, crash and emission costs of \$48.15 million dollars.

The Project is also subject to the Victorian Government's Major Projects Skills Guarantee (Skills Guarantee) which requires the Contractor to utilise Victorian registered apprentices, trainees or engineering cadets for at least 10 per cent of the Project's total estimated labour hours.

In addition, the Project is also subject to the Victorian Industry Participation Policy (VIPPP) which seeks to maximise opportunities for Australian, New Zealand and Victorian suppliers (local suppliers) to compete for government business on a number of contestable items such as design and consultancy services, asphalt, bridge and structural components, barriers and signage.

9 Environmental Record

9.1 Details of Proceedings

VicRoads has a history of responsible environmental management in sensitive areas and protection of important species and vegetation.

Some regional examples include management of the Sale Common RAMSAR wetland and Dwarf Galaxias south of Sale during the realignment of the South Gippsland Highway (2009/4959), management of the Giant Gippsland Earthworm during upgrade works on the South Gippsland Highway between Loch and Bena (2001/243), management of Colquhoun Grevillea and Giant Burrowing Frog on the Bruthen-Nowa Nowa Road (2001/194), and management of Gippsland Red-gum Grassy Woodland as part of the duplication of the Princes Highway between Fulham and Sale (2010/5332).

The Victorian Roads Corporation (VicRoads) has initiated and completed a significant number of both major and minor road projects across the State, all of which have the potential for environmental impact. In any one year, it is estimated that approximately 200 projects are completed of which, five projects per year on average are referred for approval under the EPBC Act.

Although not established under the Corporation Act 2000, VicRoads publicly reports its environmental performance in the Annual Report. In recent years, the environmental incident reporting system was upgraded to automatically track and escalate issues as appropriate. Since January 2010, there have only been [3] significant environmental incidents reported (significant is defined as Level 4 and Level 5 incidents) of which only one related to EPBC Act issues and resulted from contractor non-compliance with VicRoads specifications and requirements.

Details are as follows:

- The incident occurred on 6 December 2010:
- VicRoads notified the Department of the Environment on 8 December 2010.
- The incident was investigated by VicRoads and corrective action taken.

- In addition, to the best of our knowledge, neither VicRoads or its directors have been refused a licence, permit or authority under any environment protection legislation or had any such licence, permit or authority suspended, revoked or withdrawn in Australia or elsewhere been prosecuted for an offence under any environment protection legislation either in Australia or elsewhere been found guilty of an indictable environmental offence either in Australia or elsewhere.
- A search of EPA Victoria's prosecutions database as at 5 June 2015, [<http://www.epa.vic.gov.au/our-work/compliance-and-enforcement/epa-sanctions/prosecutions>] in relation to enforcement of the Environment Protection Act 1970 and the Pollution of Waters by Oil and Noxious Substances Act 1986, has indicated no prosecutions involving VicRoads.

VicRoads has been involved in EPBC compliance audits as noted below.

EPBC 2005/1990 – Construction of Bayles Bridge

Approval conditions attached to a Project by VicRoads to replace the Bayles Bridge in Victoria were audited on 25 to 26 October 2006. The conditions related to the protection of Growling Grass Frog (*Litoria raniformis*), Southern Brown Bandicoot (*Isodon obesulus*) and Dwarf Galaxias (*Galaxiella pusilla*).

The audit identified compliance with eight of the 12 conditions of approval. Two instances of non-compliance were found, these related to the implementation of an offset strategy and bridge construction material. Five elements of the conditions were found to be partially compliant. These related to construction methods and materials, water quality testing, and reporting to the Department. A formal warning was issued to VicRoads and recommendations for rectification of the compliance issues made. The non-compliances have been addressed to the satisfaction of the Department in accordance with the Department's Compliance and Enforcement Policy.

EPBC 2008/4486 – Geelong Ring Road – Section 4A, Victoria

A compliance audit of the Geelong Ring Road – Section 4A, Victoria, was conducted by the Department on 21 August 2012.

There are seven particular manner requirements set out in the decision notification. VicRoads demonstrated compliance with requirements 2, 5, 6 and 7 relating to best practice erosion, siltation and sediment controls being implemented; controls to manage a one in two Year Average Recurrence Interval event being implemented and maintained; construction activities that could potentially impact on the breeding of the Yarra Pygmy Perch and the Growling Grass Frog not being undertaken during September and October in associated habitat; and the construction area being fenced off to ensure that areas outside of the construction area are not impacted.

Non-compliance was found with elements of requirements 1, 3 and 4 relating to the implementation of the Project Environment Protection Strategy and water quality monitoring requirements for the Project. The non-compliances have been addressed to the satisfaction of the Department in accordance with the Department's Compliance and Enforcement Policy.

EPBC 2010/5741 – Western Highway Project Section 2: Beaufort to Ararat, Victoria

VicRoads self-reported an alleged breach of conditions attached to EPBC 2010/5741 to the Department the day following the potential impact to an area less than 0.1 hectare of Grassy Eucalypt Woodland of the Victorian Volcanic Plain (GEWVVP).

Condition 5 of the approval required VicRoads to implement the Threatened Species Management Plan approved by the Department. The Plan required No-Go zones to be installed at the section of the site where unapproved works were undertaken. Vegetation located outside the No-Go zone, that had been marked and agreed to be cleared by VicRoads and its Contractor was fallen and stored in the No-Go zone by a subcontractor.

An audit by the Department determined that although condition 5 of EPBC 2010/5741 had been contravened, no matters of national environmental significance were impacted in this instance. No further action was taken by the Department at that time.

10 Ecologically Sustainable Development

The National Strategy for Ecologically Sustainable Development (1992) provides broad strategic directions and framework for governments to facilitate the development of ecologically sustainable development. This Strategy is supported by the objectives and principles of the Victorian *Transport Integration Act, 2010* and is the basis for VicRoads *Sustainability and Climate Change Policy, 2014* which outlines VicRoads responsibilities to provide an integrated and sustainable transport system that contributes to an inclusive, prosperous and environmentally responsible State (VicRoads, 2014).

Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.

The realignment of the South Gippsland Highway at Black Spur has been developed with an aim to facilitate effective and efficient transport access for road users, reducing crash rates, avoiding, mitigating and offsetting environmental impacts and by improving access for social and economic opportunities as a major arterial road for the region.

The Project has been developed to minimise its impact on the surrounding environment and to enhance and protect the unique environmental and social features within and adjacent to the Project area into the future. These features include Strzelecki Gum, the Tarwin River West Branch, Black Spur Creek Wetlands, the Great Southern Rail Trail, cultural heritage and the Koonwarra fossil bed.

If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

Environmental assessments have been completed which include both the sites ecology and cultural heritage. These assessments have provided a good understanding of the Projects impact, with measures to prevent environmental degradation informed by survey accurate mapping of Strzelecki Gum within the Project area, targeted field survey for Australian Grayling and on advice from flora and fauna specialists to reduce uncertainty.

The principle of inter-generational equity -that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The Black Spur Creek Wetland offset site will protect, conserve and improve the natural environment for future generations, with the active management of the site for a period of 10 years and an MOU included as an encumbrance on the Crown Land Register. This encumbrance will require VicRoads to manage the site in accordance with an approved Management Plan to ensure an on-going and viable local population of Strzelecki Gum.

The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.

The design of the highway realignment has been heavily influenced to avoid and minimise the number of Strzelecki Gum impacted, to prevent direct impacts to and protect habitat for Australian Grayling along the Tarwin River West Branch.

The implementation of the CEMP will ensure mitigation activities are undertaken to protect habitat, prevent direct impacts to Australian Grayling and manage other key threats to both Australian Grayling and Strzelecki Gum. The natural environment of the Project area will also be enhanced through landscape plantings, and the selection of the offset site which is 8.68 hectare in size immediately adjacent to the Project area. These measures will increase the number and area of habitat for the local Strzelecki Gum population, ensuring biodiversity will be conserved and substantially enhanced within and adjacent to the Project area.

Improved valuation, pricing and incentive mechanisms should be promoted.

This principle is not considered relevant to the Project.

11 Conclusion

The primary objective of the realignment of the South Gippsland Highway at Black Spur is to reduce road trauma resulting from the steep and winding alignment of the Koonwarra Bends and safeguard future generations of road users. The realignment of the highway through private grazing land and Crown land, modifying the design to reduce the width of the road and extent of earthworks through the incorporation of geometric design, narrowed road width, retaining walls and kerb and channel has resulted in the avoidance and reduction of impacts on Strzelecki Gum and Australian Grayling and their habitat during the planning stages of the Project.

The impact of the Project on Strzelecki Gum has been reduced to the removal of 181, from a potential 884 found within the Project Area.

No direct in-stream impacts are anticipated to Australian Grayling and / or their habitat and potential impacts are therefore indirect in nature. Several specific mitigation measures have been developed to reduce possible indirect impacts to Australian Grayling and these remove any residual significant impact to the species.

Mitigation measures for both Strzelecki Gum and Australian Grayling developed for the Project are to be included as part of the CEMP, which requires endorsement by an independent environmental auditor and the South Gippsland Shire Council prior to works commencing. These measures include No-Go zones, exclusion zones and landscaping works, along with monitoring and reporting requirements.

Offsets for the removal of Strzelecki Gum are proposed to be undertaken within an 8.68 hectare site at the Black Spur Creek Wetlands, immediately adjacent to the Project area. This site meets the requirements of the EPBC Environmental Offsets Policy and will be secured with an MOU agreement. Activities to be implemented as part of the offset management plan such as revegetation, weed management and exclusion of grazing, will support natural regeneration and provide connectivity between stands of retained Strzelecki Gum within the Project area and Offset site. This will further ensure the protection and enhancement of Strzelecki Gum at a local level through the removal of key threats to the species.

No offsets are required or proposed for Australian Grayling.

The controlled action of realigning the South Gippsland Highway at Black Spur should be approved under the EPBC Act, with impacts to Strzelecki Gum and Australian Grayling adequately addressed through avoidance and mitigation measures, the implementation of the CEMP and residual impacts offset at Black Spur Creek Wetlands. The following conditions are proposed be applied to the approval:

Condition 1: The approval holder must not remove more than 181 Strzelecki Gums.

Condition 2: The approval holder must ensure construction remains within the designated Project area and no construction is undertaken within the No-Go zone.

Condition 3: Any works within the exclusion zone, or within 5 metres of the bank of the Tarwin River West Branch, are to be controlled through the development of a specific CEMP for this activity.

Condition 4: For the protection of Strzelecki Gum and Australian Grayling, prior to commencement of the action, the approval holder must establish the designated No-Go zone, including signage and fencing to restrict access.

Condition 5: To compensate for the loss of 181 Strzelecki Gums, the approval holder must secure the nominated offset site as shown in *Figure 20* and implement the approved Offset Management Plan prior to the commencement of the action, or as otherwise agreed to by the Minister, and provide the Department with the offset attributed, shapefiles and textual descriptions and maps to clearly define the location and boundaries of the offset site(s).

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13 Appendices

Appendix 1 - High Risk-Based Pathway Biodiversity Assessment Report for South Gippsland Highway Realignment.

Appendix 2 - Australian Grayling Targeted Survey South Gippsland Highway Realignment Koonwarra, Victoria

Appendix 3 - Offset Assessment Guide Calculator

Appendix 4 - Offset Management Plan



INDIGENOUS DESIGN

1635 Main Rd, Research, VIC, 3095
Melbourne | Morwell | Wonthaggi

P (03) 9437 0555
E nicole@iddesign.com.au

ABN: 64 081 044 144

www.iddesign.com.au